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Managing Schools, Managing Complexity: using Viable System Modelling to develop Learning Capacity.

By

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Acknowledgments

In what follows I aim to give a realistic and rich representation of everyday life and complexity within a typical Scottish Secondary school. I try to do this by using the staff's own words as much as possible, but its important to recognise that teachers like everyone in all organisations can use especially direct language which can be open to misinterpretation. This is particularly true at times of stress and I hope to show that working in schools is far more complex and *'stressful'* than is usually assumed. Also, teachers like all people engaged in a common task develop a shorthand method of conversation in which many complex meanings are condensed into apparently crude simple statements. And because of these reasons, to protect staff and prevent others from accidentally or wilfully ascribing unintended meanings and motives, I regret that I cannot explicitly name the school or all those who helped me. Instead, I have attempted to make the school as anonymous as possible by changing as much of the identifying information as I can and none of people mentioned, staff or pupils are referred to by their real name. Nevertheless, there are groups of people I wish to thank in the hope that they can recognise themselves.

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Nomenclature and Abbreviations

ACE	A Curriculum for Excellence. Outlines the purpose and principles of design for developing a curriculum that covers the 3 - 18 age group.
ACfE	*see **ACE***.
ASD	Autistic Spectrum Disorder: A group description covering conditions from dyslexia, dyspraxia, dyscalculia, Tourette's and Asperger's syndrome etc.
ASL	Additional Support for Learning: General term to describe pupils who receive additional educational support. Includes ***ASD***, ***LAAC*** and pupils with ***SEBD***.
CAT	Cognitive Ability Tests provided by Nfer-Nelson.
CfE	Curriculum For Excellence
CHSP	Child Health Systems Project (CHSP): Used to gather health information about children on behalf of **ISD** Scotland
COSLA	Convention of Scottish Local Authorities. Umbrella group representing all Scottish local government.
CPD	Continuing Professional Development
CT	Chartered Teacher.
DMR	Devolved Management of Resources. Delegated granted by the local authority to manage their own school budgets.
DTG	Discipline Task Group. Established by the Minister for Education in 2000 to investigate and make recommendation on improving the standards of behaviour in school.
ESMT	Extended School Management Team. Includes the **SMT** and Faculty Heads **(FH)** and Principal Teachers **(PT)**.
GTC	General Teaching Council.
HAS	Human Activity Systems: Checkland's term for purposeful activities.
HMIE	Her Majesty's Inspectorate of Education. An executive agency responsible to government for the inspection and review of schools with the aim of improving quality of education and raising attainment.
INSET	In Service Training.

ISD	Information Services Division: Scotland's national organisation for health information, statistics and IT services for the National Health Service (NHS)
LAAC	Looked after and accommodated children. Children who have been taken into care by the local authority.
LTS	Learning and Teaching Scotland: A non departmental organisation sponsored by SEED to promote innovation in teaching and lead on curriculum development.
PFI	Private Finance Initiative.
PT(G)	Principal Teachers Guidance
PT(S)	Principal Teacher Subject
PSE	Personal and social education. A non-certificate course taught by Guidance Teachers.
P[1..7]	Used to identify year groups in ***Primary*** Education. **P7** broadly equivalent to age 11/12 and so on downwards to **P1** where pupils start their education at age 5/6 depending on their birth date.
SALSUS	Scottish Schools Adolescent Lifestyle Substance Use Survey conducted every two years by Child and Adolescent Research and Health Unit (**CAHRU**) University of Edinburgh
SEBD	Social and Emotional Behavioural Difficulties.
SEED	Scottish Executive Education Department - *see* ***SOED***
SEN	Special Educational Needs.
SGPA	Standard Grade Point Average. An average grade calculated from all Standard Grade exams.
SMT	School Management Team. Includes head teacher **(HT)** and assistant head teachers **(AHT)**. May also include the School Business Manager (SBM) or Bursar - *see* ***ESMT***
SOED	Scottish Office Education Department: Renamed Scottish Office Education and Industry Department (**SOEID**) in 1995. Following devolution in 1999 it became Scottish Executive Education Department (**SEED**). Currently lies within the overall responsibility of the Minister of Education and Lifelong Learning.
SOEID	Scottish Office Education and Industry Department - *see* ***SOED***
SQA	Scottish Qualifications Authority. The body in Scotland responsible for

	managing qualifications and assessment below degree level. Established in 1997.
STACs	Standard Tables And Charts. A statistical analysis of School results based on final examination performance currently prepared by ScotXed and formerly by the **HMIE Audit Unit**.
S[1..6]	Used to identify year groups in ***Secondary*** Education. **S1/S2** broadly equivalent to age 11/12 to 13/14: **S3/S4** equivalent to age 13/14 to 15/16. **S5/S6** equivalent to 15/16 to 17/18.
VSM	Viable Systems Model: A model proposed by Stafford Beer to determine the necessary and minium conditions of viability.
ODP	Organisational Defensive Patterns: behaviours followed to resist change.
MSC	Model of Systemic Control.

Abstract

Education has always been amongst the highest of government's priorities and following devolution for Scotland in 1999, the government has shown a fresh enthusiasm for educational reform. Building on a major restructuring of the teaching profession, Government is now expecting further change in the primary and secondary sectors. This thesis considers some of these changes and argues that they are increasing the amount of complexity that schools have to deal with, both in terms of the amount of change and the rate of change. How secondary schools cope with complexity is examined through the lens of the Viable Systems Model developed by Stafford Beer. From evidence derived from a lengthy case study, it is suggested that far from encouraging change, Government initiatives with an emphasis on accountability and targets, are leading to defensive routines and practices that make change less likely and less effective. This resistence comes not from staff, but is a consequence of a failure to recognise and adequately manage complexity through a top down centralised planning process. Through a structure based on recursive systems, rather than traditional hierarchical relationships, it is proposed that schools should be given much greater freedom and autonomy to manage their own affairs. This, it is argued, would allow schools to develop in line with their own needs and priorities. To enable this, a framework linking individual learning to organisational learning and development is outlined. The thesis also suggests that the structural relationship between the Schools Inspectorate used by Government to monitor school performance should be changed. Instead of bypassing local authorities the School Inspectorate should be brought more within their control increasing local accountability.

Keywords: Complexity, Systems, Viable Systems, Variety, Education, School Management., Individual and Organisational Learning.

Chapter 1: Introduction

Education has always been a high priority in government policy making. In part because it's seen as a way of fulfilling a philanthropic duty of elders looking after the next generation, where education or the acquisition of knowledge is seen as a good thing in itself. Some cynics, see promising higher standards of education or better provision of education as a vote winner with the electorate, particularly those with families. It works, they claim, by appealing to parental desires for better futures for their children. However, this hints at another reason for the high priority given to education. High standards of education and attainment have become closely associated to economic benefit for the individual and subsequently for the local community and then the state as a whole. Seen as the traditional route out of poverty, a good standard of education is perceived as a significant factor in helping individuals to gaining well-paid jobs: a high proportion of well-paid jobs lead to a prosperous community and all the ensuing economic benefits that go with that. More recently, the idea of education helping individuals to transcend class, achieve more buying power and become more prosperous has been expressed as social mobility.

Education has also become associated with national competitive advantage. The decline in manually intensive traditional industries, such as manufacturing, engineering, mining etc has been accompanied by what some (Drucker, 1969: Brinkley, 2006: Lauder et al, 2012) have characterised as the *'knowledge economy*'. This is where a higher skilled, better educated workforce is seen as a way of limiting unemployment and competing with countries that have lower production costs (Scottish Office, 1999).

Whether education has improved over the years is continually subject to debate which reaches a peak with the annual publication of exam results. Some point to the lack of challenge and knowledge required to achieve good passes (Roberston, 2004, Macleod, 2007, Horne, 2007). Others argue (English, 2004, MacLeod, 2004) that exams are just as challenging if not more so, and that improvement in exam passes is due to improvements in teaching and changes in what is actually examined. Whatever the *'truth'* of these opposing views, the repeated promises and initiatives by government to improve education over the last thirty years, suggest by implication, that much remains to be done. Devolution in Scotland in 1999 provided a fresh burst of enthusiasm for changing the educational system,

which some (Humes and Bryce, 1999) in Scotland have always seen as distinct from that in the rest of the UK, particularly in terms of breadth of the curriculum. Since 2000, three significant educational acts have been passed by the Scottish Parliament; a major building programme started to rejuvenate the school estate; a restructuring of the teaching profession instituted and new initiatives started to restructure the curriculum and promote greater inclusion.

The intended outcomes of these initiatives are expected to be significant: increasing school responsibilities, raising expectations and requiring greater organisational responsiveness and flexibility. It is appropriate therefore, to examine the effects of some of these changes on the staff and management of schools. In the main, previous educational research has essentially been restricted in focus and concentrated within three main strands.

- A concern with the process and pedagogical aspects of teaching (Pollard and James, 2006) or curriculum development (Connelly, 2003, DfID, 2007).
- A focus on particular aspects of education such as the development of educational policy (Bryce and Humes, 1999) or how regional and national policies can be implemented within the school context (Reeves et al, 2002).
- Examining particular issues in relation to education, for example discrimination by racism (Gundara, Jones & Kimberly, 1986), or sexism (Weiner, 1985). Other examples include research based on such issues as psychological development and cognition (Howe, 1984), the use of language (Sutton, 1981, Stubbs & Hillier, 1983), or on self esteem and self concept (Burns, 1986, Mearns & Thorne, 1988). Research based on viewing education as an *'acting out'* of ideology (Levitas, 1986, Gordon & Klug, 1986) can be included in the last strand. The majority of this research, based predominantly on quantitative methods, has the aim of providing prescriptive advice to school managers and teachers (Burgess et al, 2003).

Research outcomes have in the main, been orientated towards three broad audiences. Senior school managers responsible for the school as a whole with McBeath (1989) for example, attempting to identify the characteristics of a good school, or Renold and Cuttance (1992) discussing school effectiveness. Others focussed on the completion of a particular function or were limited to a particular subject area. Lowden and Powney, for example, discuss how

head teacher skills can be improved through performance review (Lowden, 1994, Lowden & Powney 1994), while Bryce et al, describes how to use various techniques for assessing skills in Science (Bryce et al, 1988, 1991) and Flint and Gordon write about the best ways of managing a Modern Languages Department (Flint & Gordon, 1993). The final audience includes those concerned with the completion of cross disciplinary management functions or cross curricular areas. Bradley, Connor & Southworth, (1994) for example, discuss how school managers can make in service training (INSET) more effective or the use of information technology (IT) across the curriculum (Tomei, 2003).

When looked at as whole, it is possible to make some general observations about the output of educational research. Much of the advice arising from educational research or embodied in government or local authority policy documents is *'free of context'*. Advice is assumed to exist independently and its usefulness is not dependant on any local contingent factors with the result that all schools are treated as a homogeneous block. For example, all schools within the former Strathclyde region had the same aims and objectives, regardless of whether they were in a prosperous middle-class suburb like Clarkston or in a depressed working-class area of Paisley. Another limitation to the usual approach to educational research is to assume that implementation of advice is non-problematic and relevant to local conditions faced by all schools. Little effort has been given to establishing a framework by which school managers can interpret the advice to decide for themselves its relevancy and guide its implementation. In general, research has tended to concentrate on the behaviour of individual cases, for example INSET or gender differences in attainment. Subsequent advice has focussed on methods to modify the behaviour of the individual case like improving the effectiveness of INSET or closing the gender gap in attainment. Again, little effort has been made to investigate systemic collective behaviours and informational processes that lead to the behaviour of the initial object of the research. In relation to the last point, educational research has principally been focussed on internal processes to the school ranging from monitoring attendance through coordinating a complex curriculum via the timetable to controlling the behaviour of a large number of disparate individuals of widespread abilities. However, little attention has been given to how schools can adapt and respond to changing local conditions or trends. Adaptive behaviour is mostly seen as the responsibility of external agencies such as local authorities or government.

In contrast, the following research looks at the management of secondary schools from a systems perspective through the examination of phenomena of complexity under the lens of Stafford Beer's Viable System Model (VSM) (Beer, 1975, 1979, 1981). In the main, the research is primarily aimed at:

- Policy makers and people who assist in the formulation of new initiatives and policies, by helping them to understand the systemic consequences or effects of their developments.
- School managers and teaching staff by providing them with an insight into systems and helping them to understand the dynamic relationships underpinning their activities.
- Interested general readers in education by helping them to reach a deeper understanding of the complexities and difficulties of teaching.

The research also aims to:

- Explore and add to the number of contexts in which the VSM has been applied and thereby add to the body of evidence that underpins its theoretical development.
- Discover whether a practical application can be developed from the analysis of school activities with the use of the VSM.

The next section develops these aims into research questions. Subsequently, there is a brief discussion on the principal changes and trends developing in Scottish education and society. The discussion is not exhaustive and only looks at trends in as far as they affect educational developments or have a major impact on the organisation and management of schools. Although separated into different sections, it is recognised that they are both highly interrelated, with changes in one affecting the other and vice versa and is included to illustrate the increasingly complex and turbulent environment in which schools have to exist. Finally there is a brief discussion about the nature of complexity and emergent properties.

1.1 Research Questions

The central theme of this thesis is the role of complexity and how schools manage this complexity considering in particular:

> *How are secondary schools configured to deal with complexity?* and
> *Can the Viable Systems Model produce any useful insights into the management of secondary schools?*

However, these questions are perhaps too general and are more clearly defined below. Each question follows a theoretical proposition implied in the two main questions above.

Schools exist in an increasingly complex and turbulent environment. Effective management and organisational performance depend on matching distinctions in this complexity with appropriate actions. Failure to manage this complexity at an individual and organisational level leads to poor performance and subsequent loss of control.

Question 1: *Can schools match with actions, at the individual and organisational level, the complexity arising from within their own respective domains?*

Schools do not have an independent existence from their staff. It is the relationship between staff that creates the organisation and its structure. In order to change and to cope with change, organisations must have the capacity to reconfigure themselves and for individuals to learn new ways of working.

Question 2: *Have schools the capacity for staff to learn new ways of working and realise their potential through new configurations and structures?*

For schools to thrive in times of continuous change, they need to be able to detect, respond and adapt to change and be able to create opportunities for themselves by modifying their environments or create new ones.

Question 3: *Have schools the capacity to make new distinctions in their environmental complexity together with the ability to influence the environment in which they are embedded?*

With increasing demands on schools and increased competition for resources, staff have to seek continual improvement in all their activities. This requires knowledge of the structures and mechanisms underlying their activities and how their activities contribute to the work of the whole school.

Question 4: *Are there mechanisms supported by appropriate structures which enable staff to determine the contribution of their activities to school aims and targets?*

Schools need structures and frameworks to guide adaptation and the implementation of change with respect to its long term goals. In view of increasing complexity, these structures need to enable participation and support autonomy and problem solving at all structural levels.

Question 5: *Are there mechanisms in place that encourage participation and allow staff to actively contribute to planning outcomes which are appropriate to their needs?*

Schools are complex multi-systems constituted from people with multiple viewpoints. Effective organisation requires the channelling of these multiple viewpoints into joint action through alignment of goals and intents. This can be achieved through a well-structured management model which reflects the complexity of the organisation.

Question 6: *Is there an implied or explicit model used in schools to bring about coordinated action and is this model adequate for managing complexity?*

Together, these research questions define the boundaries of this thesis. The methodology used in the research is explained in Chapter 3 and the overall issue of how schools are configured to deal with complexity is examined from the perspectives of organisations as

machines, organisations as culture and organisations as organisms from the perspective of management cybernetics and the VSM.

Providing some historical context to the study and the complexity that schools have to deal with. The next section examines some of the trends developing in education and society.

1.2 Educational Changes and Trends

Even before Tony Blair used the catch phrase *'Education, Education, Education'*, to describe his immediate priorities during his party's successful campaign to government in 1997, education has invariably been seen as a priority for most governments. The Education (Scotland) Act in 1872 made education for five to thirteen year olds compulsory for the first time and since then, it has been updated or revised a number of occasions. First in 1918 and more recently in 1980, 1981, 1996, 2000 and 2004. A separate Education (Scotland) Act for Higher and Further Education was passed by the Scottish Parliament in 2005. In their manifesto for the 2007 election for the Scottish Parliament, the Labour party has committed itself to the creation of a new education bill within the first hundred days of government (Scottish Labour Party Manifesto, 2007, p.26).

One of the factors that places education high on the list of government's priorities is the connection politicians and government make between education and national competitiveness. In the launch of his party's 2007 election manifesto, Jack McConnell, Scotland's First Minister argued that *"To put Scotland first, we must put education first"*. He went onto to say:

> *"For Scotland to be the best equipped, most effective and most enlightened, all of our people must be the best educated. My vision for a Scotland most able to influence and inspire over the next 20 years is a vision of a country better educated than our competitors." (J. McConnell, 10th April 2007)*

Unsurprisingly, for most in the teaching profession the commitment to education is much appreciated. However, for teachers it has led to a period of continuous change at an increasing rate across a number of areas. In 1984, the Ordinary Grade originally introduced

in 1962, was replaced by the Standard Grade as the new Scottish Certificate of Education for sixteen year olds (Scottish Office Information Directorate, 1996) with the first exams taking place in 1986. As well as representing a new course, the Standard Grade introduced new methods of assessment. For the first time, attainment in exams included an element of internal assessment conducted by teachers on pupils course work. Subjects were also taught in a different way, with a distinct emphasis on the application of knowledge. Another significant reform began in 1991 with the introduction of the 5 - 14 Development Programme or what has become to be known as simply '5 - 14'. This programme affected the whole curriculum for pupils aged 5 to 14 across Scotland. It specified what should be taught in both primary and the first two years in secondary schools; introduced new ways of assessing and reporting on pupil attainment and included a programme and method of national testing in English and Maths. As Wynne Harlen noted in his report on the progress on the implementation of '5 - 14' (Four Years of Change in Education, 1996) its introduction added considerably to teacher workload requiring: -

> *"... involved teachers in coming to grips with new vocabulary for describing the curriculum as well as some new material within it, and, for some, new concepts in record keeping, reporting and relating assessment and the curriculum."*
> *(Wynee Harlen, 1996)*

While the Scottish Office Education Department (SOED) anticipated the completion of the implementation of '5 - 14' in 1999 (SOED, 1994a), progress particularly in Secondary schools has been slow. Even in 2007 some elements remain outstanding, for example the development of national tests for Science. Against this background of '5 - 14' implementation, significant changes were also occurring for post 16 pupils. In response to the Howie Report (1992) which recommended the abandonment of the Higher Grade exam in favour of a European Baccalaureate type exam and the extension of the range of available vocational qualifications, the Scottish Office outlined its own plans in *"Higher Still - Opportunity for All"* (SOED, 1994b). With an emphasis on access and progression, it outlined a new framework of qualifications. Starting with 'Access' for the less able, pupils could begin with 'Intermediate 1', progress to 'Intermediate 2' before under taking 'Higher' or 'Advanced Higher' qualifications. Courses would be structured differently. In the 'Higher Still' structure, courses at all levels would be much more modular in design with

greater emphasis on internal assessment by teachers. Pupils would have to pass an assessment at the end of each module, which they would be allowed to take more than once, as well as a terminal exam at the end of the course to in order to attain the full qualification. The advantage of this structure would be that even though pupils perhaps failed the final exam, they would still gain academic credit for each of the modules they passed during the course, taking these forward into any application for further education. For many, *"why Standard Grade?"* was an obvious question and even the Higher Still proposals (SOED, 1994b) suggested beginning Standard Grade courses earlier. Essentially the idea was, if pupils could enter the proposed framework earlier, rather than post 16, they would have more time to progress further towards Higher and Advanced Higher qualifications. However, this would create a knock on effect to the '5 - 14' programme. Pupils starting earlier would require shortening of the '5 - 14' curriculum. At the time however, the regulations of the Scottish Qualification Authority (SQA) restricted Schools to presenting pupils for their Standard Grade exam in the fourth Year of their secondary schooling (S4). Nevertheless, despite some concerns over educational standards and *'dumbing down'* (Toby McManus, 1997), the roll out for the new qualification framework started after repeated delays in 1999. Unfortunately, the first year of exams in 2000 was a fiasco with almost 17,000 pupils receiving late and/or incorrect results. While Colin McCaig (School Exams: Leavers in Panic, 2003) saw the cause of the *'exam results crisis'* as a result of technical difficulties (inadequate number of data entry operators, too few assessors and poorly designed software), David Raffe *et al* (What Happened to the Consensus on Higher Still, 2001) described how the evidence presented to Parliamentary Committees established after the crisis: -

> *"... blamed the complex model that was developed (especially the assessment arrangements), the speed with which it was introduced and above all the alleged arrogance and unresponsiveness of the leadership ..." (Raffe, Howieson and Tinklin: 2001)*

Against this background of ongoing reform of the qualification framework, there was considerable debate about the future of the teaching profession. Teachers were becoming increasingly dissatisfied with their working conditions, complaining of poor pay, increasing workload and lack of opportunity. There was concern over the rising average age of

teachers and the difficulty of attracting and retaining new entrants in the profession. After Teachers and their employers, - Convention of Scottish Local Authorities (COSLA) - failed to reach agreement over pay, the Scottish Executive commissioned an independent inquiry in 1999 under the leadership of Prof Gavin McCrone. Produced in 2000, the McCrone Report, *"A Teaching Profession for the 21st Century"* subsequently became the basis of the *'McCrone Agreement'* in 2001 (Scottish Executive Education Department, 2001a). The *'McCrone Agreement'* completely altered the structure of the profession and revised the conditions of service. Simplifying the existing structure, flattening it through the removal of some management posts, it introduced a twin track path of progression. Teachers could advance their careers either on the management side or remain in the classroom and achieve greater professional recognition and pay by achieving Chartered Teacher (CT) status through examination. A much greater emphasis was given to professional development with continuing professional development (CPD) becoming a condition of service. Concerns over workload were acknowledged and a commitment made to reduce class contact time for teachers and make a much greater investment in support staff who would relieve teachers of work not directly related to teaching and learning. Implementation was to be phased in over a number of years reaching completion post 2006.

Proceeding in parallel with the implementation of the *'McCrone Agreement'* and the roll out of the new qualifications framework, additional changes were beginning to impact on teachers and the management of schools. After passing the Standards in Scotland's Schools etc. Act 2000, the Scottish Parliament established five national priorities for education (The Education (National Priorities) (Scotland) Order, 2000). Centred around 'Achievement and attainment for all' the remaining priorities of 'Inclusion and equality', 'Framework for learning', 'Lifelong Learning' and 'Values and citizenship' spelled out strategic outcomes against which, the effectiveness of schools would be assessed. The immediate consequences affected teachers and the management of schools, particularly at secondary level, in two main ways.

First, it began to blur boundaries by making schools the front line in tackling broader social concerns, for example equality in all its aspects (sex, race, disability), sexual and physical health (teenage pregnancy, alcohol and drug dependency), antisocial behaviour and community responsibility (vandalism, how government works, participation in elections

etc.). To some extent, schools had always included elements of these issues but usually covered them within a personal and social education (PSE) course. Now they became the responsibility for all staff. Teachers, whatever their subject would have to demonstrate how they and their subject was relevant to and how it contributed to meeting each of the national priorities, for example citizenship or equality. Second, because the national priorities formally became strategic outcomes against which schools were assessed by Her Majesty's Inspectorate of Education (HMIE), it triggered a bureaucratic expansion that led to much more formal record keeping and planning. It was no longer enough for schools to say they did things, they would have to have demonstrate that they did them *and* have evidence as proof. Furthermore, the activities would have to pass a quality threshold. An extreme example being: it was no longer sufficient to maintain that a *'show of hands'* constituted pupil consultation. Demonstrating good pupil consultation would require elections of pupil representatives convening in formal regular meetings with proceedings recorded in minutes.

The accountability of schools was further emphasised, when in May 2002 the Scottish Executive launched the *'National Debate on Education'*. Over 20,000 people took part (Munn et al, 2004a) and the ministerial response in *'Educating Excellence -The Executive's Response to the National Debate*' (SEED, 2003) promised to strengthen the role of inspection in order to raise quality and standards in Scottish education. The minister also acknowledged the workload burden and limitations of the 5 - 14 programme by agreeing to 'de-clutter' the curriculum and reduce the amount of assessment: almost at the point when implementation of the 5 - 14 programme was virtually complete. A commitment was made to allow head teachers greater autonomy, especially with respect to how they managed their own budgets and to provide scope for a more flexible curriculum. Parental involvement in children's education was to be encouraged through reform of School Boards and Parent Teacher Associations. The executive's response (SEED, 2003) made clear a commitment to improve and modernise the quality of Scotland's school estate: a commitment further elaborated in *'The 21st Century School - Building Our Future: Scotland's School Estate'* (2003) and has since led, under the Private Finance Initiative (PFI), to an extensive refurbishment and rebuilding programme of schools across Scotland.

To help implement the Scottish Executive's commitments made in response to the *National Debate on Education'*, a Curriculum Review Group was established in November 2003. It

produced in 2004 *'A Curriculum for Excellence'* (The Curriculum Review Group, 2004). Rather than lay out detailed content for a new curriculum, *'A Curriculum for Excellence'* (CfE), covering the 3 to 18 age groups, concentrates on identifying the values on which a curriculum should be based, what the purpose of the new curriculum should be and the outcomes that should be achieved alongside with a set of design principles that should be used in creating a new curriculum. Together, CfE emphasises greater personalisation, choice and opportunity for pupils to realise their potential and allows schools and teachers the flexibility in the means with how this might be achieved. CfE also returns to some of the earlier Howie (1992) recommendations by allowing for the introduction of more *'skills-for-work'* vocational type courses and creates the possibility for varying the method and place of course delivery. Some parts, for example might be delivered in school, others in college and others in a work placements. Within the national priority framework, CfE continues the trend of expanding the concept of education beyond narrow subject boundaries into a knowledge and understanding of wider social concerns by encouraging more cross subject teaching. So for example, a recently emerging social concern over healthy eating might be addressed by several subject departments like Biology, Physical Education and Home Economics. In its overall concept, CfE represents a considerable reform of the existing curriculum and presents an open-ended problem for schools and teachers of how they might proceed. There is no exemplar model showing what a *'curriculum for excellence'* should look like, and neither is there a road map showing how schools might develop such a curriculum. Furthermore, CfE created additional uncertainty for schools and teachers by indicating that they will review the assessment methods, the national qualification framework and the way the pupil achievement is recorded. The Scottish Minister for Education had already announced an intention to relax the age and stage qualification restrictions in 1999 (Scottish Office Information Directorate, News release, 8th April 1999), but it wasn't until 2004, after a report by Inter-ed (2004) that this became formalised (SEED Circular No 3, 2005). Almost immediately, many schools adjusted by dropping Standard Grade courses from their curriculum and instead entered pupils into Intermediate 1 - the first stage of the *'Higher Still'* framework - in S3. A few schools opted to do this a year earlier, at the beginning of S2 requiring pupils to make a course choice towards the end of their first year. Consequently, the intention expressed by the Curriculum Review Group in CfE (2004) to revisit the qualification framework again in the year that the *'roll out'* of the *'Higher Still'* programme was virtually complete was a concern. To an extent, the Curriculum Review

Group acknowledged the uncertainty and complexity created by the open-ended nature of a *'A Curriculum of Excellence'* (2004) by emphasising that CFE only marked the start of a process and that its development would be evolutionary in nature. Its successful development would require a partnership between Schools, Learning and Teaching Scotland (LTS) - an organisation sponsored by SEED to promote innovation and lead on curriculum development - and the Scottish Qualifications Authority (SQA). The HMIE would be the body responsible for overseeing the quality and effectiveness of its implementation.

The recommendations in CfE were accepted in full by the Scottish Executive and the Minister of Education set out the Executive's plans for change in *'Ambitious Excellent Schools - our agenda for action'* (Scottish Executive, 2004). Of particular concern was the rate of change, which the Minister wanted to increase: -

> *"Even with the sound achievements of our schools, more still needs to be done and the pace of change needs to accelerate. When you have seen excellence, you want it delivered everywhere and quickly – that is what drives our agenda." (Ambitious Excellent Schools p.3, 2004)*

Local authorities were seen by the Minister as a key driving force to bring about the changes in ACE and emphasised that schools had to meet the needs of the local community. Good leadership was seen as being critical to the success of a school and the Minister made a commitment to the creation of a leadership academy, to provide development opportunities for senior staff. Although the general focus of *'Ambitious Excellent Schools'* is on achieving outcomes rather than on process, with its support for the ideas of flexibility for schools and teachers, personalisation and choice for pupils, the Minister reiterated the central role of the HMIE in overseeing the accountability of local authorities and schools. A new round of authority and school inspections were promised with a commitment to an inspection at primary and secondary levels at least once during a child's time at school. Greater emphasis was to be given to checking the quality assurance programmes developed by schools, especially with regards school self-evaluation and improvement planning systems. The HMIE were asked to identify the features of *'Excellent Schools'* and in 2005 published these in *'How good is our school? The Journey to Excellence - Part 1: Aiming for Excellence, Part 2: Exploring Excellence'* (HMIE, 2005a). Also in 2005, the HMIE produced an

amended version of *'How Good Is Our School?'*(HMIE, 2005b) which included a six-point quality indicator scale for each of 33 quality indicators arranged in seven main groups representing the criteria against which schools would be inspected.

While strengthening the HMIE's role in inspection, the Minster also announced in *'Ambitious Excellent Schools',* the start of the *'Schools of Ambition'* programme as a means of promoting change. In this programme, schools could gain access to additional funding and obtain additional freedoms to manage their own school budgets under devolved management of resources (DMR). For schools to achieve recognition as a *'School of Ambition'*, required nomination by their local authority and pass a subsequent assessment by a core group that includes the HMIE, or almost immediately on the recommendation of the HMIE following an inspection. *'School of Ambition'* status could also be achieved with the support of private donors. A commitment was made to have 20 schools in this programme by 2007.

So far, discussion has focussed on describing the broad educational context of the research. It has noted the high political priority of education and shown how it's seen as important to the economic and competitive success of Scotland. A survey of the key educational developments over the last twenty years followed and for each one, some of the consequences for schools and teachers were highlighted. This survey revealed some emerging trends.

- An increasing rate of change requiring much more flexibility and a faster response time to implement change.
- Increasing complexity with fragmentation in the qualification framework and the developing interrelationships necessary for the implementation of the new curriculum.
- Increasing uncertainty as to future developments as schools and teachers move towards new and as yet unknown ways of working and finally increasing accountability.

As well as being effected by these externally imposed top down changes, schools have also had to cope with changes in societal attitudes and trends. Although the formation of

government policy claims to take account of these trends (*'Ambitious Excellent Schools - our agenda for action'*, Scottish Executive, 2004a), they are often felt first in a more immediate, personal and intimate way in the classroom. Some of these changes are briefly discussed in the next section.

1.3 Social Changes and Trends

Developments in education have been partially reflecting changes in social attitudes and trends. One trend that's had the greatest impact has been the general slow decline in Scotland's Population. In 2003, the Population and Migration Statistics Committee (PAMS) of the General Register Office for Scotland (GRO), projected over the following 10 years, a fall of 19% in the number of pupils attending state funded primary schools and a fall of 13% attending state secondary schools (*Demographic Trends in Scotland: A Cause for Concern?*, PAMS, 2003). Declining school rolls has clear implications for both teachers and the number of schools. Falls in the school population leads to a reduction of class sizes and if continued, reduces the viability in particular subject areas and creates surplus teachers in less popular subjects. Perversely, further declines can lead to a increased class sizes as small classes are amalgamated, creating surplus teachers even in popular or 'core' subject areas like English and Maths. If unchecked, a continued decline can threaten the economic viability of the school with subsequent closure or amalgamation with other schools. The School Estate Statistics (Scottish Office, 2004b) reported that 68% of secondary schools were operating below 90% of their capacity. A further 11% of secondary schools had a population at or below 60% of their capacity.

The concept of the traditional family unit has also changed considerably over the last twenty years. Gillian Miller in her review of household change in Scotland, records an increasing complexity and diversity in household types (Miller, 2006). The fragmentation or as she describes it, the "pluralisation" of family life is attributed to delays in marriage, an overall reduction in the marriage rate together with increases in cohabitation, illegitimacy and divorce. Consequently, the family of a married couple with their own children is statistically no longer the norm. Where families do conform to the *'ideal'* type, they are likely to be smaller with older parents, but as Miller notes, increasingly married couples with children are likely to include a parent or parents who have been married before. Other family

structures may include cohabiting adults, one of whom may not be related to any children and may even be of the same sex. Another change has been an increase in the number of lone or one parent families. Miller (2006) shows how according to the 2001 Census, the number of lone parents rose from 9.3% of all households in 1981 to 10.5% in 2001 and was expected to rise further. James Kirkup described how the number of lone parent families in Scotland increased from 140,000 in 1997 to 174,000 in 2006, and that the 24% rise in Scotland is well above the 17% increase in lone parent families for the rest of the UK (Kirkup, 2006).

While it's not necessarily the case that children within these *'newly'* emerging family structures present problems at school, Rebecca O'Neill in *'Experiments in Living: The Fatherless Family'* (O'Neill, 2002) identifies some important features. Lone mothers tend to be poorer, have more health and psychological problems and have more problems interacting with their children. Similarly, children who live without their biological fathers tend to be poorer, at higher risk of suffering health and psychological problems, are more likely to be exposed to physical, sexual and emotional abuse and experience difficulty in forming relationships with others. As teenagers, they are also more likely to exhibit overt *'anti social'* behaviours in that they have a greater tendency for under age smoking, drinking alcohol, taking drugs and offending. They are also more likely to experiment with sex earlier, experience problems with sexual health and become teenage parents. With respect to education, they re more likely to have more trouble in school, truant from school, be excluded from school, attain fewer qualifications and leave school earlier.

Changes in the family unit have been reflected by concerns over general lifestyle and health choices made by young people in Scotland. The Scottish Schools Adolescent Lifestyle Substance Use Survey (SALSUS) used by Child and Adolescent Research and Health Unit (CAHRU) in 2005 appears to indicate a slight decline between 2002 to 2004 in the numbers of 13 and 15 years olds at school who smoke, drink and use drugs (CAHRU, 2005). Other research though shows a slightly different picture, with rising trends of boys and girls involved in underage drinking. The British Medical Association (BMA) observe using other government data from the Scottish Executive Health Department, a *"… 60% increase in reported drinking by 15 year olds and more than a 100% rise in drinking by 13 year olds."* (BMA, 2006). They also argue that without government intervention the proportion of

young involved in underage drinking will increase. Paul Bradshaw in a longitudinal study of underage drinking in Edinburgh found that more children were drinking more heavily, more often (Bradshaw, 2003). For example 51% of 13 year olds admitted to drinking alcohol and this rose to 84% in 15 year olds: 25% of 4,500 involved in the study drank on a weekly basis and 49% of drinkers had drunk so much that they couldn't remember some of things they had done on at least one occasion. Toby McDonald in the "Scotland on Sunday" writes about how the number of prosecutions for underage drinking has more than doubled in the five years from 2000, rising from 85 to 199 in 2005 (McDonald, 2006). Both the BMA and Paul Bradshaw found a close relationship between underage drinking and behaviour. In particular, BMA found:

> *"Regular heavy alcohol consumption and binge drinking are associated with physical problems, antisocial behaviour, violence, accidents, suicide, injuries and road traffic accidents. They can also affect school performance and crime. Drugs and Alcohol misuse is associated with a range of mental disorders and can exacerbate existing mental health problems. Adolescents report having more risky sex when they are under the influence of alcohol; they may be less likely to use contraception and more likely to have sex early or have sex they later regret" (BMA, 2006)*

Identifying trends in drug use other than alcohol amongst the young is harder to establish due too long standing drug education programmes already in school as part of the Scottish Executive's strategy on drug misuse (Scottish Office, 1999). This may have had the effect of limiting the increase or even reversing the trend of drug use in the young. The SALSUS results of 2004 show that 35% of 15 years olds and 13% of 13 year olds admitted to using drugs. Of these, 20% of 15 year olds and 7% of 13 year olds had used drugs in the month prior to the survey. Only in the category of 15 year old boys, was there was a marginal decline in the number using drugs in the previous month; falling from 25% in 2002 to 21% in 2004 (CAHRU, 2005). While these results have changed little from 1998, when the surveys started, there is some evidence that children are being exposed to drugs at a much earlier age. Research by McIntosh et al (2003) in Glasgow and Newcastle, show that 30% of preteen (11 and 12 years) children had been exposed to illegal drugs with 4% of a 2,000 sample actually having experimented with drugs.

Scotland has for some time, had one of the highest rates of Coronary Heart Disease (CHD) in the developed world (Scottish Health Survey 2003, 2005). Causes have been attributed to high rates of smoking, deprivation and poor diet in particular. Until recently, children have been relatively unaffected and only in later life begun to show signs of CHD. However, in common with many other developed countries, Scotland has been experiencing a rising trend in childhood obesity. It has been particularly pronounced in Scotland, where according to the Scottish Information Services Division (ISD) of the National Health Services (NHS), childhood obesity has steadily risen from 2000 to double the UK average. Statistics gathered by the Child Health Systems Project (CHSP) show that in the academic year 2004/2005, more than a third of 12 year olds could be described as clinically overweight. Just over 19% of this group could be classed as obese and a fraction over 11% were severely obese (CHSP, 2006). The rise in obesity is similar in all other age groups. In 2004/2005, 20% of 3 ½ year olds had become overweight and 8% of these, obese: 4% could be classed as severely obese (CHSP, 2006). The ISD notes that there is a close relationship between weight and physical problems (back pain, diabetes) and mental health issues (low self esteem, depression) and there is a concern that these problems will become more acute as children get older, leading to higher rates of CHD, osteoarthritis, diabetes and other mental health problems.

The effect of changing family structures, lifestyle and health choices have been reflected in the steady increase in the number of incidents of indiscipline in schools. Responding to teacher concerns, the Minister for Education established a discipline task group (DTG) in 2000 to investigate and make recommendations on how behaviour in school could be improved. The result was the *"Better Behaviour - Better Learning"* (SEED, 2001b) initiative arising from the task group's recommendations (DTG, 2001). However, identifying an objective measure of discipline is problematic. As Pamela Munn et al found in their survey of discipline in Scottish Schools (Munn et al, 2004b), behaviours acceptable to one teacher may be considered unacceptable by another. Even the same behaviour, may be viewed differently by the same teacher depending on such factors as time of day. Despite the subjectivity involved, it is reasonable to use the number of school exclusions as a general barometer of standards of behaviour in school. Exclusion is the severest sanction available to schools and typically last for a few days, where the pupil is suspended from school. In some cases exclusion can also be permanent. Classed as *'removed from register'* this type

of exclusion requires a move to another school. The types of incident that can lead to exclusion are varied, but include physical assault, threatening behaviour, sexual misconduct, alcohol and drug related behaviour, theft, vandalism and persistent disruptive behaviour. One advantage to using the number of exclusions as a general indicator of behaviour is that they have to be justified to the local authority. Consequently, incidents have to be fully documented and involve a higher standard of evidence than that required for a lesser sanction. And, although not necessarily true in every case, incidents are independently investigated by a member of the School Management Team (SMT). This goes some way to reducing the degree of subjectivity involved in how some behaviours are perceived.

Even with the implementation of the *"Better Behaviour - Better Learning"* action plan (SEED, 2001b), the trend for exclusions has been steadily rising. In the 2002/2003 academic session, the number of exclusions jumped sharply when under pressure from head teachers, the target for limiting exclusions was dropped. The number of exclusions rose again by another 8% in the 2004/2005 session and again by another 2% in 2005/2006 to reach the record level of 42,990 (Scottish Executive, 2007a). The number of permanent exclusions actually fell by 3% in the 2005/2006 session, although this can be misleading as parents are often encouraged to voluntarily move their child to another school for reasons of a *'fresh start'* to avoid the *'removed from register'* action from appearing on the child's record.

While the rising number of exclusions indicate a general trend of worsening behaviour in school, they remain exceptional cases, and as such represent the tip of an iceberg. Most indiscipline in schools can be classed as low level, but as Munn's report (Munn et al, 2004b) indicated, teachers find low level indiscipline extremely disruptive, wearing and time consuming to deal with, detracting from the amount of effective teaching that can be done. As already identified, establishing trends in these kinds of behaviour is difficult because of the subjectivity involved, but as Munn notes: -

> *"The most striking findings are the increasing number of secondary teachers reporting a wide range of potentially disruptive behaviours in the classroom and around the school. Tests of statistical significance show that the increase in the number of teachers reporting most of the behaviours could not be attributed to*

chance" (Munn et al, 2004b)

Essentially, more teachers are reporting that they are experiencing more indiscipline, more often. Table 1 for example shows the kinds of behaviour reported both by primary and secondary teachers at least once in their classrooms during a one week period.
Another significant trend has been a slow but steady increase since 2000 in the number of *'looked after and accommodated children'* (LAAC). These are children whose care and accommodation have been taken over by their local authority. Children may enter into council care voluntarily with parental agreement, or forced into council care under compulsory measures decided by a children's hearing or a court. Although there is a distinction between *'looked after'* children - those where the local authority has taken over responsibility for their care, but may still be accommodated at home under authority supervision - and *'looked after and accommodated'* children - those that have been removed from home and accommodated elsewhere (foster homes, council residential units etc.) - for the remainder of this discussion, these two groups are treated as one, as in both cases, the responsibility of their education has been assumed by the authority and issues at school such as attendance, behaviour and attainment are common to each group.

Overall the number of looked after children have increased by 7% since 2000. The Children's social work statistics for the academic session 2004/2005 show a 4% increase on the previous year (Scottish Executive, 2005). For the 2005/2006 session the numbers rise

Table 1: Sample behaviours reported by secondary and primary teachers on a weekly basis

Behaviour	Secondary Teachers	Primary Teachers
Pupil on pupil physical violence	56%	63%
Pupil on teacher physical violence	8%	2%
Pupil on pupil verbal abuse	79%	63%
Pupil on teacher verbal abuse	45%	12%
Pupil on pupil racist abuse	11%	4%
Pupil on pupil sexist abuse	33%	12%

Source: Scottish Executive National Statistics (2006)

again by another 5% (Scottish Executive, 2006a). In relation to the entire school population of about 713,000, the 13,000 looked after children are not especially significant, but they become important in a number of ways.

- The Children(Scotland) Act 1995 outlines the corporate responsibilities of local authorities for their education which is exercised through the schools.
- Many of the children have additional learning needs and The Education (Additional Support for Learning) (Scotland) Act 2004 (the ASL Act), imposed additional legal responsibilities on local authorities in terms of provision of additional support to meet their needs.
- Many of these children show the most challenging behaviours and are disproportionately represented in the exclusion statistics. The average rate for exclusions for typical secondary school children is about 114 per thousand. For looked after children, the average rate is about 330 per thousand (Scottish Executive, 2007a).

Looked after children also tend to truant more and attain fewer qualifications at lower levels in comparison to others. For these reasons, looked after children have become a priority group for the Scottish Executive and in a recent report *"Looked after children & young people: we can and must do better"* (Scottish Executive, 2007b) have acknowledged that this group are extremely difficult to deal with.

Inclusion is the final change that has had a profound impact on schools and teachers. In 1978, the Warnock report (Warnock, 1978) recommended reclassifying mentally and physically handicapped children (statutory categories) as pupils with special educational needs (SEN). In educational terms, this moved the focus of attention from the child's disability to their educational needs and Mary Warnock argued that in many cases, these could be best satisfied by integration into mainstream education. In 1992, the Strathclyde Regional Council (SRC) introduced the *'Every Child is Special'* policy (SRC, 1992). This began to expand the concept of integration into one of inclusion, where the education of *'all'* pupils in mainstream education is seen as a *'right'* rather than satisfying the requirements of SEN pupils. Another difference, was that inclusion was seen as a benefit to all pupils through exposure to a greater diversity and experience. Instead of SEN pupils being taught

by specialist teachers, all teachers would have to acquire the necessary knowledge and skills to teach SEN pupils and again, by broadening the skills base of staff, this would bring benefits to all pupils. In combination, these factors were aimed at reducing barriers to learning and promoting equality which have since become part of Scotland's National Priorities for education (Scottish Executive, 2000)

For teachers, the policy of inclusion has led to a wider diversity in the range of pupils they have to teach. The term SEN covers physical impairment of various kinds, such as visually or hearing impaired and those with learning impairments ranging from those with global learning difficulties to pupils with specific learning difficulties such as dyslexia, dyscalculia or dyspraxia. It also includes pupils with behavioural, neurological and developmental difficulties, for example Asperger's syndrome, Tourette's syndrome and Attention-Deficit/Hyperactivity Disorder (ADHD). SEN also covers pupils with psychological problems like elective or elective mutism to those with issues arising from the birth mother's behaviour during pregnancy such as Fetal Alcohol Syndrome (FAS). Due to the nature of their conditions, many of these pupils are identified as being on the autistic spectrum and the number of pupils that can be classed has having some kind of autistic spectrum disorder (ASD) has been steadily growing from 2002. In the Primary sector in 2002, ASD pupils accounted for 3% of the School Role and this rose to 4% by 2005. A similar growth has occurred in the Secondary sector, with the number rising from 2.6% of the secondary school role in 2002, to 3.8% by 2005 (Scottish Executive, 2006b). Reasons for the increase include:

- Greater inclusion with more pupils moving into mainstream education.
- Earlier identification and better diagnosis of ASD conditions.

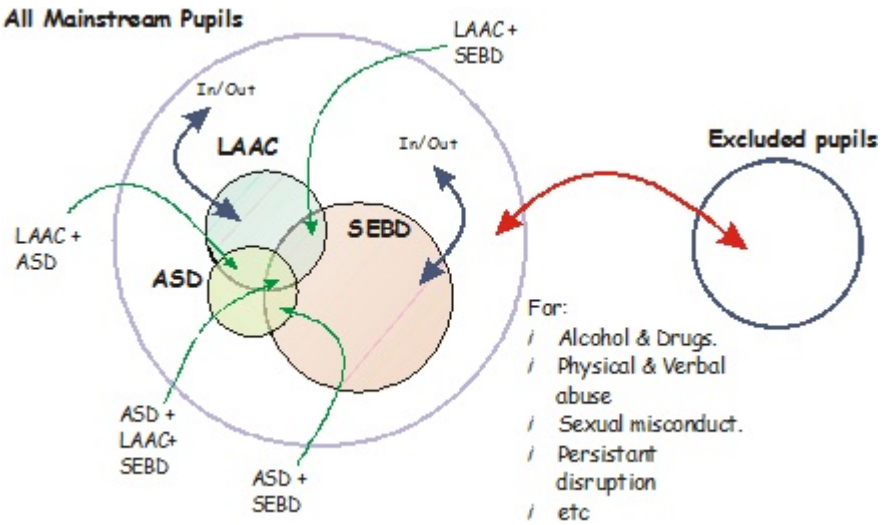
The rising numbers of ASD pupils have brought their own problems and challenges for teachers, requiring new pedagogical approaches and different skills. It has also caused a dramatic increase in record keeping. Since the 1980 Education (Scotland) Act, schools have had to, on behalf of their local authority, maintain a record of what they've done to meet the educational needs of these pupils and the bulk of the burden has fallen on the teaching and guidance staff.

ASD pupils with special educational needs represent the most easily identifiable group within the concept of inclusion. In recent years however, the idea of special educational needs has changed. With exclusion levels amongst LAAC pupils being so high and their attainment levels being so low, it was recognised that in order for these to change, LAAC pupils would benefit from additional support. The Education (Additional Support for Learning) (Scotland) Act 2004 broadened the definition of SEN into one of Additional Support for Learning (ASL). Pupils who are now eligible for ASL include those whose: -

> *"… needs can arise from any factor which causes a barrier to learning, whether that factor relates to social, emotional, cognitive, linguistic, disability, or family and care circumstances. For instance, additional support may be required for a child or young person who is being bullied; has behavioural difficulties; has learning difficulties; is a parent; has a sensory or mobility impairment; is at risk; or is bereaved" (SEED, 2004).*

Consequently, the ASL Act covers not only ASD and LAAC children, but also extends to a new group of pupils who have been identified as those with Social, Emotional and Behavioural Difficulties (SEBD). None of these groups are mutually exclusive and their relationship is shown in figure 1.

Figure 1: Pupils eligible for Additional Learning Support (ASL)



While the numbers of ASD and LAAC pupils have been gradually increasing, membership of the LAAC and SEBD groups are in a constant state of flux, depending on what's happening in their families and other aspects of their lives: children may pass into and out of care and in and out of SEBD group. For schools, expanding the number of children entitled to ASL has had significant consequences: -

- Increased the range of duties and legal responsibilities of the local authority and through them to the school.
- Increased the amount of multi-agency working involving teaching staff, social workers, child psychologists and other health and care agencies acting together to identify educational needs and deliver co-ordinated support plans.
- Granted new rights for parents entitling them to ask their local authority for a general assessment or for a particular kind of assessment (medical, psychological etc.). Parents have to be kept fully informed and can request an early review of the co-ordinated support plan. Where there is disagreement between parents and providers of additional learning support, in the majority of cases schools, the Act expects local authorities to provide for mediation and dispute resolution services. The awareness of legal obligations and possible future disputes, has placed greater emphasis on the accuracy of information and evidenced-based reporting.
- Extended the range of school's responsibility beyond that of the pupil's school career to provide a smoother transition for ASL pupils as they pass from one stage into the next. The joint teams responsible for the delivery of support plans have become responsible for a formal future needs assessment process for any pupil entitled to additional support for learning. This means identifying and planning for needs post school life with any agency that might become responsible for ASL pupils after leaving school. This must be done at least 12 months before they are expected to leave.

Overall, the underlying intention behind the ASL Act has been to try and *"... make the system fit the child, not the child to fit the system."* (The ASL Act, 2004). For schools, the general effect has been to expand the number of pupils for which they are legally accountable for on behalf of their local authorities. It has also required greater flexibility in the provision of services in order to meet their ASL needs, requiring greater personalisation

of courses, teaching methods and materials.

1.4 Complexity, Systems and Uncertainty

Stephen Hawking has declared *"Complexity will be the science of the 21st century"* (Fletcher, 2006). While a rather grand claim, it is a view shared by others. Peter Coveney and Roger Highfield, for example see that *"Comprehending the complexity of life is the biggest challenge facing modern science."* (Coveney & Highfield, 1995). But well before these claims, Stafford Beer already regarded complexity as *"the stuff of management*" (Beer, 1979) and argues that handling complexity should be the principal focus of managers.

Given these statements, together with the fact that complexity is one of the main objects of study in the research, it is appropriate to attempt to clarify what is meant by the term complexity and the conditions necessary for it to emerge. This exploration is accomplished through an examination of various definitions of the term. Some consequences for management and theories of how to manage complexity are included in the next chapter.

Defining complexity can be problematic. First, because as Stephen Wolfram (2002) describes, there is a tendency for anything that can't be understood to be described as complex. This, he writes, can say more about the cognitive abilities of the observer than of the situation being described. Second, because there are a large range of definitions, many of which define a particular type of complexity and each of which has some shortcoming when applied in a different field. On the mathematical side, for example there is "Kolmogorov Complexity" or as Gregory Chaitin describes it, "algorithmic complexity" which defines complexity in terms of the number of steps or "recipe" for the complete reproduction of a mathematical treatment. According to this definition, complexity lies on a spectrum with simple things requiring smaller algorithms to describe them and complex things, longer algorithms. Several variations of this type of complexity have emerged in the field of computing science, such as cyclomatic complexity (a description of computer program complexity) or time complexity which refers to the number of steps required to solve a problem. However, while these definitions of complexity appear useful in capturing some essence of its meaning in that complex situations can be lengthy to describe, involve many decisions and take time to solve, they begin to fail when random events occur which,

by definition, can't be accounted for in a 'compression' to an algorithm.

For scientists at the Sante Fe Institute (SFI), an independent multi-disciplinary research centre established to study complexity, complexity is defined as the midpoint between order and disorder. This definition has a certain degree of utility in that it places complexity midway between simple situations and chaotic situations and thereby implies the possibility of change or *'dynamic complexity'*, with situations moving from an ordered state to a disordered state and accounts for the possibility of randomness. However, Edmonds (1996) argues that the midpoint between order and disorder depends on the level of representation. In other words what can appear ordered or disordered at one level or scale of resolution can appear differently at another scale. Heylighen (1996) provides the example of a pattern of cracks in dried mud which can appear complex. But zoom out, to look at the mud plain as a whole, the surface appears homogeneous and the complexity decreases. Similarly, zoom in from the cracks to look at the clay particles and their arrangement is at another range of disorder and complexity increases.

Leaving aside these more technical interpretations of complexity, which have perhaps have little relevance to most peoples everyday experience of complexity, similar difficulties of only partially capturing the meaning of complexity is encountered with more commonplace dictionary definitions. The Concise Oxford English Dictionary (OED) (1995) provides a definition of complexity as something *"made up of related parts"* and the Modern Language Association (MLA) offers *"the state or quality of being complex; intricacy"*. On one hand, the OED definition is useful in indicating that complex situations are made up from a number of related parts and opens the possibility of wholes made up of parts or subsystems. On the other hand, the MLA definition is useful in hinting at the detail or intricacy that may exist in the connections between each part and emphasises the interconnectedness and interdependency between the parts or subsystems that make up the whole. Used in combination, these two definitions make it is possible to see that complex situations would have many parts, each of which is richly interconnected to other parts. In contrast, simple situations would have fewer parts and/or fewer connections. This interpretation of complexity also enables the distinction to be made between *'inherent complexity'*, a situation with many related parts, and *'detail complexity'*, the degree to which the parts are related. A modern car, for example has a high degree of inherent complexity in that it has

many related subsystems and a high degree of detail complexity in that the subsystems are highly interconnected, so that a failure of one system can bring the car or the whole system to a halt. Heylighen (1996) identifies this relationship as *'static complexity'* where a whole system together with its subsystems can be intrinsically complex and difficult to comprehend in itself, but is nevertheless capable of being understood by experts and whose behaviour given certain conditions can be predicted in advance. Returning to the example of the modern car, for non experts its internal workings and relationships between the parts may be something of a mystery. For engineers and mechanics though, these are reasonably transparent systems capable of being designed and built in a variety of configurations and should an unexpected event occur like a breakdown, capable of being repaired. This suggests that causality in static complex systems can be understood, so for example it is known that A leads to B and in the case of a breakdown in the car system, the fault traced to part D. For organisational scientists and systems theorists, this interpretation of complexity has the siren call of considerable appeal: to improve efficiency, tweak this, to improve effectiveness tweak that. The first difficulty with this interpretation is that it leaves out the dynamic complexity identified by the SFI interpretation, where systems have the ability to change from one state to another. Second, it suggests easy *'compressibility',* where complex situations can be reduced to an algorithm and with the capability of accounting for or predicting future random events. Its third limitation becomes clear when other familiar contexts are considered in which the term complexity is used.

Wine experts use complexity as the *"hallmark of quality in a wine. A complex wine is one with multiple layers and nuances of BOUQUET and flavour. Its myriad elements are perfectly balanced, completely harmonious, and eminently interesting. Such a wine is the diametric opposite of one that is simple and one-dimensional."* (The Wine Lover's Companion, 1995). Similarly, coffee makers use complexity as referring to *"the co-presence of attributes in a coffee. Acidity, body, earthiness, sweetness, etc., combine to make a coffee complex. Varietals are often blended to increase their complexity."* (Sweet Maria's Taste Terms). These definitions begin to demonstrate the concepts of *'emergence'* and *'synergy'* in that the properties of complex situations or systems can be different to the properties of the individual elements or subsystems that make up the entire system (Corning, 2002). In the case of the wine and coffee examples, the individual chemical constituents or subsystems come together to provide a flavour and smell that is completely lacking or

different to the flavour and smell of each individual element. The fact of *'life'* has been used as another example (Coveney and Highfield, 1995). Life forms are essentially chemical in nature and the property of *'life'* emerges from the complex interaction between chemicals mixed together in the right proportions and in the right conditions. These examples show that the term complexity can be used to describe situations that have properties that are greater than the sum of their parts and consequently their parts have a non linear relationship to one another. In other words, two plus one may not equal three. Two significant consequences follow on from this interpretation of complexity.

- Causality can be difficult or impossible to establish: A may lead to B, but also require C and D and the presence of F which has a relationship to G and possibly some other factor like E which remains to be identified.
- It affects the way complex situations can be studied. Because the whole system may have different properties to its subsystems, it has to be studied in its entirety (Heylighen, 1989), as opposed to the usual reductive approach used traditional scientific methods of enquiry, which relies upon breaking situations down into its constituents and attempting to describe the whole system in terms of its parts. This would rather be like studying the richness of flavour and bouquet of wine through the study of ethanol - the alcohol in wine - or explaining *'life'* in terms of the carbon element. Their effects on wine and life can only be understood at the level of the complete system.

So far, discussion has focussed on trying to establish an objective definition of complexity and through this, elaborate on some characteristics of situations showing complexity. A number of definitions have been offered, both technical and non technical and each, while adding something useful, have been shown to be deficient in someway; falling short of capturing the complete essence of complexity. In *'Complexity is Just a Word!'*, Peter Corning (2001) maintains that the difficulty with complexity is one of semantics, both by being rich in meaning and capable of capturing a great range of phenomena. He quotes Seth Lloyd of MIT who compiled 30 odd definitions of complexity, but when asked what he meant by it, replied *"I can't define it for you, but I know it when I see it."* (Corning, 2001). This is probably true of most people and better reflects a universality of experience and the ubiquity of complexity in that it appears in so many different contexts. Nevertheless for

some *'hard'* scientists, to dismiss the issues surrounding the definition of complexity as one of semantics *"is a lazy approach to science"* (Wolfram, 2002). For scientists like Wolfram, *"complexity needs to be both rigorously defined and measurable"* (Adami et al, 2000). Issues of measurement are discussed in the next Chapter, but before offering a definition of complexity used in the remainder of this thesis, a last feature of complexity needs to be made clear.

Debate has focussed on the *'objective complexity'* of any situation with the use of examples from the physical world. This kind of complexity would exist whether or not situation was studied. But as Beer (1979) and Checkland (1981) make clear, there is also *'subjective complexity'* which lies in the meaning ascribed to the situation by the observer. For example, the wine and coffee definitions of complexity are fairly complete, but it is improbable that all people tasting the same drink will experience it in the same way and therefore will ascribe a range of different meanings to it, with some seeing it a very complex and others less so. The motor car is another example and can show how meanings attributed to situations can change through time. At one point the car was seen as a great liberating invention, freeing people from their immediate surroundings, but now with the threat of global warming, it is increasingly being perceived as a means for poisoning the planet. Thus, the complete complexity of any situation is a function of both its objective complexity and its subjective complexity. With this in mind, the following definition of complexity offered by Coveney and Highfield has been adopted.

> *"Complexity is the study of the behaviour of macroscopic collections of such unity that are endowed with the potential to evolve over time." (Coveney and Highfield, 1995)*

Implied within this definition are the properties elaborated in the preceding discussions and commonly associated with complexity in that:

- Complex situations consist of many parts or systems whether they be individuals, units or items (inherent complexity).
- The parts or systems are richly connected with many interdependencies and interactions between them (detail complexity)

- Complex situations have the ability to change over time (dynamic complexity)
- Complex situations exhibit non-linearity with parts combining in novel and unpredictable ways (synergies) to produce behaviours (emergence) that can only be described at a level higher than the individual units.
- The complexity of a situation is dependent upon the viewpoint of the observer who selects the *"... collections of unity "* to be studied (situational complexity).

It is the combined effect of all these properties, but as Coveney and Highfield (1995) emphasise, it is particularly the irreversibility of time and non-linearity of complexity, that creates space for uncertainty with respect to future outcomes. Non-linearity makes it difficult to establish the causal relationships underpinning outcomes and the possibility of change over time, moving from a closed past towards an open future, makes it difficult to extrapolate future outcomes or states of systems showing complexity with any degree of certainty. This is not to say that steps can't be taken to reduce uncertainty, nor that uncertainty can't exist independently from situations showing complexity. Rather it is to say that situations showing complexity are always associated with uncertainty.

1.5 Summary

This chapter began by describing some of the reasons why education, the general area of research, occupies such a prominent position in government policy making. Not only is education seen as a good thing in itself as a way of improving subsequent generations, but also because it has become closely associated with economic strength and competitive advantage. As discussions in later sections showed, the concept of education has changed and broadened over time. Rather than just seen as method of imparting knowledge on the way to the acquisition of qualifications, education has become to be seen as a way of tackling wider social concerns, for example equality and underage drinking and drug abuse. A high standard of education has also become to be seen as part of the rights of the child and as a way of compensating for social disadvantages such poverty, family breakdown or for various kinds of disability through provision of additional support for learning. Recently, many of these aims have become wrapped up in the concept of social mobility.

As to the reasons for the research now, it was noted that there still remains considerable debate over whether education has improved over the years. Some research (Blanden et al, 2005) for example, appears to indicate that social mobility has declined in recent years. Additionally since devolution in 1999, the Scottish Parliament has shown its enthusiasm and determination to improve education through a series of legislative and policy changes. These are the latest in a long sequence of challenges and changes faced by the educational profession as the section on educational trends demonstrated. Broadly, the educational profession has seen considerable changes in what is taught and methods of assessment: moving from teaching mainly knowledge content and external examinations to including more applied aspects of subjects such as problem solving skills or information handling and continuous assessment based on internally assessed course work. With the introduction of *'Higher Still',* it has also seen an increasing fragmentation of the qualification framework: moving from a simple bi-level system with 'O' levels and Highers, later Standard Grade and Highers, to including more *'modularised'* Access, Intermediate 1 and Intermediate 2 courses, where pupils can gain academic credit for passing internally assessed modules even though they may fail the external exam. There has also been a developing trend for education to become more *'personalised',* moving from a position where teachers treated groups of pupils as reasonably homogenous blocks to one where teachers generate specific learning plans and identifying learning outcomes according to the strengths and weaknesses of each child.

Alongside the trends for increasing fragmentation and increased personalisation in what teachers actually do, teachers have had to take into account changes made in the profession of teaching. There has been a move away from a unitary view of teaching with *'all teachers together'* - independent of the role they play in organisations - to a pluralistic view, with the profession fragmenting into management or teaching sides depending upon the role played in school. This latter view centres around the idea of competence in an area underpinned by the acquisition of additional professional qualifications. With increasing emphasis on demonstrable qualities, teachers have had to learn to meet the demands for increased accountability, both at the level of the school and the individual. Some of these accountabilities relate to inclusion and how well the school and teachers deal with the increased diversity of pupils entering school, both in terms of ASL needs and social background.

A lot of educational research, the majority of which is underpinned by quantitative methodologies, tends to focus on particular areas either in relation to pedagogical or specific management issues. This research tends to treat change in a linear and non problematic way, often ignoring the effects of context and the impact of their prescriptive recommendations may have on other aspects of teaching or management. It is the contention of this thesis that the growing fragmentation, personalisation and diversity in the professional, educational and social domains are creating a situation of growing complexity. Implied within the research questions, is that failure to tackle this complexity will ultimately lead to lost stability and control as the complexity of the situation grows beyond the capacity of teachers and managers to handle it. As the discussion on the nature of complexity made clear, this requires considering that schools are part of a system that: -

- Contains many parts or embedded subsystems.
- Have parts or subsystems that are richly connected with many interdependencies and interactions between them.
- Is changing over time.
- Exhibits non-linearity with parts combining in novel and unpredictable ways to produce behaviours that can only be described at a level higher than the individual units.
- Is capable of being interpreted in different ways.

The principal methodology used in the research is the qualitative case study approach described in greater detail in Chapter 3 with the researcher as employee. While lacking breadth, the longitudinal study is aimed at capturing the rich diversity in the interactions between the parts over time and the essential dynamics of school life. Information from the research is analysed from a management cybernetic perspective with the aid of the viable systems model. The results are provided in Chapter 4. In Chapter 5, a description is given of a school wide intervention program derived from insights provided by the VSM in Chapter 4. Before then however, it is necessary to look at other perspectives on organisation and the VSM itself.

Chapter 2: Organisational Perspectives

Chapter 1 outlined the research questions and provided a definition of complexity. It provided some background to the changes taking place in the professional, educational and social domains in which schools are placed, making the contention that these changes represent a situation of growing complexity. It was suggested that managing this complexity should be the prime focus of managers and the viable systems model (VSM) was proposed, as a suitable tool for capturing and modelling this complexity.

This chapter explains the VSM and the principles underlying management cybernetics. However, the VSM has not been without its critics (Ulrich, 1981, Checkland, 1980). One of the arguments made against the VSM has been its lack of relationship to other theories. So, this chapter is broadly arranged in four parts. The first, revisits some long standing conceptions of organisation and explains how some of the principles underpinning these different models are related to those used in the formulation of the VSM. The second, revisits the concept of complexity, explaining some consequences for managers and looking at some of the different ways it might be measured. This is followed by an elaboration of the VSM itself, in association with what Espejo et al (1995) have identified as two key processes: *'Inventing the organisation'* and *'Inventing **in** the organisation*'. The last part, looks again at some of the other criticisms of the VSM and makes some suggestions as to why it yet remains to find a wider audience.

2.1 Perspectives on Organisation

In *'A Systems Map of the Universe'* Peter Checkland (1971) proposed a hierarchy of natural systems which could split into *'living'* and *'non-living'* systems. The *'living'* side, shares a common root with *'non-living'* systems, with the complexity of systems progressing from the sub atomic through atomic then molecular systems before branching into single celled organisms. These *'living'* systems then continue to rise with increasing complexity and interdependence through organs to level of the complete system, whether it's plants, animals or humans. In this model, each level contains all the systems below it. So for example, the individual human system contains several organ systems, each of which can be

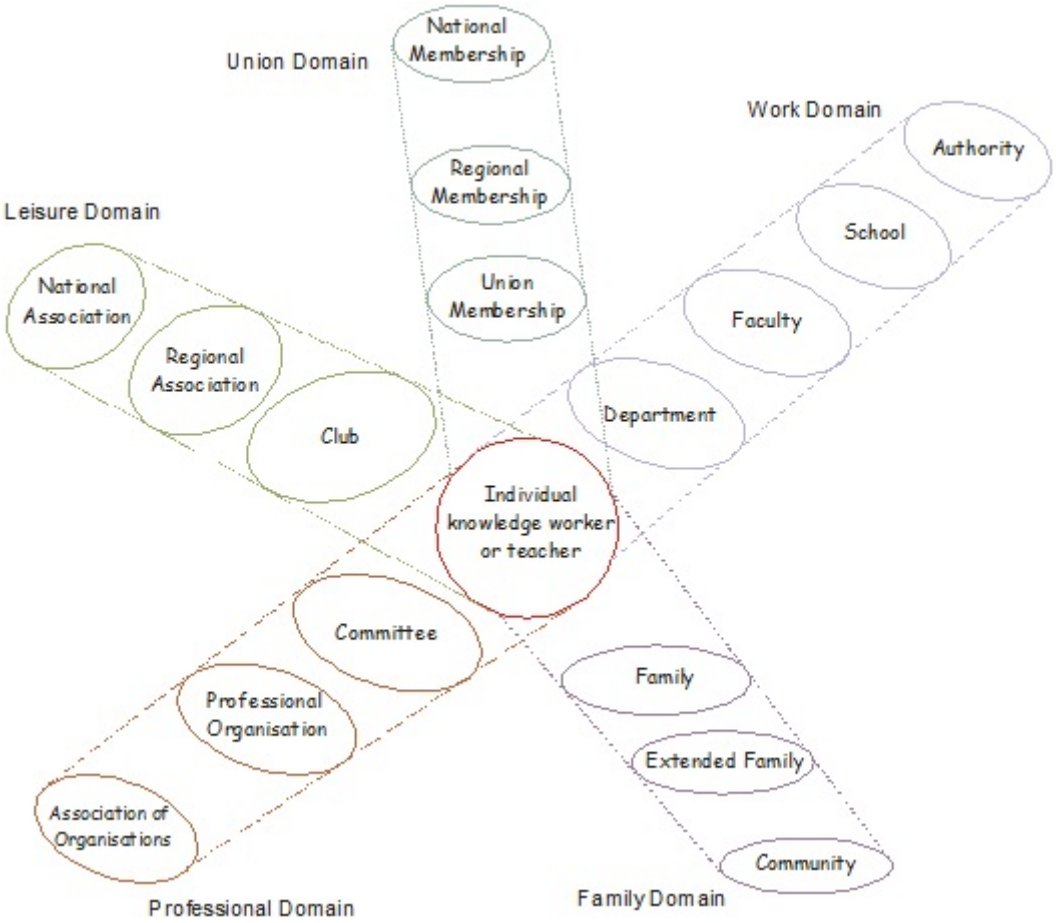
'decomposed' into its cellular systems, which can in turn be *'decomposed'* further into molecular systems and onwards through atomic systems and all the way back to sub atomic systems. While illustrating the embedded and *'systemic'* nature of systems, the model implies that any arrangement, living or non living, can be analysed in terms of its system - between systems at the same level - and systemic relationships - between one level and its embedded systems. This approach has been characterised by Boulding (1956), von Bertalanffy (1971), Checkland (1971, 1981), Mingers and White (2010) along with others as *'Systems Thinking'*.

Thinking about systems or systems thinking, is distinguished from other approaches in a number of ways, two of which are mentioned here. First, there is the need to think about wholes in a *'holistic'* manner by studying the relationships between systems and the systemic relationships within systems, in order to understand the emergent properties and behaviours of complete systems. As described earlier in chapter 1, emergent properties and behaviours are one of the characteristics of complexity. And second, by the approach taken in systems thinking. Boulding (1956) in particular emphasises the inter-disciplinary aspect of systems thinking, citing the emergence of what he called hybrid disciplines of mixed parentage that draw upon the concepts and ideas of *"... respectable and honest academic parents."* As examples of these new hybrid disciplines, Boulding offers cybernetics, information theory and even management science itself. In line with Ackoff's (1978) argument that systems thinking requires an expansionist mode of thought, Heylighen (1990) develops Boulding's inter-disciplinary approach further and proposes that thinking about complex systems requires a *'trans-disciplinary'* approach. He identifies this approach as a way of thinking *"about scientific problems which transcends the existing boundaries between the disciplines"*. In contrast, Boulding's inter-disciplinary approach is a stand that lies between disciplines, while a multi-disciplinary approach represents an aggregate of concepts and ideas from other disciplines.

Returning to Checkland's hierarchy of systems (Checkland, 1971), Checkland (1981) notes that individual human systems come together to form larger systems. He identifies these as *'Human Activity Systems'* (HAS) which are created in order to fulfil some purpose. Like Checkland, Beer (1979, 1981) also sees human activities as purposeful. Beer (1985), Espejo et al (1995) and Leonard (2009, 2010) also describe how individuals can simultaneously be

members of different human activity systems operating in different domains, and these in turn, may be parts of larger activity systems. Figure 2 provides an example of some of the different human activity systems to which an individual knowledge worker or teacher may belong, each of which is contained within larger HAS in different domains of action.

Figure 2: Examples of Human Activity Systems in Different Domains



Each of the human activity systems may be organised and structured in different ways in order to fulfill their purpose. It is easy to see for example, that a family in the family domain has a different structure and set of relationships to that of school in the work domain or that of a club in the leisure domain. Rather than work through an exhaustive typology of these different arrangements, the intention now is to explore some common methods of organisation to see how they deal with complexity and to reveal some principles shared with

Beer's conception of the VSM. The starting point for this exploration is the metaphor approach, where particular conceptions can be examined in terms of another using the method of analogy (Leonard, 2007). In Heylighen's (1990) terms, this exploration is conducted from an inter-disciplinary position or a stand between disciplines.

In *'Images of Organisation'* Gareth Morgan (1997), argues that:

> *"In all aspects of life … we define our reality in terms of metaphors and then proceed to act on the basis of the metaphors. We draw inferences, set goals, make commitments, and execute plans, all on the basis of how we in part structure our experience, consciously and unconsciously, by means of metaphor." (Morgan, 1997)*

Like Corning's (2001) view of the term complexity, metaphors derive much of their power from their systemic meanings, in that metaphors have the ability to encapsulate many well

Table 2: Archetypical Metaphors of Organisation

Metaphor	Associated Concepts
Machines	Efficiency, waste, maintenance, order, clockwork, cogs in a wheel, programmes, inputs and outputs, standardisation, production, measurement and control, design
Organisms	Living systems, environmental conditions, adaptation, life cycles, recycling, needs, homeostasis, evolution, survival of the fittest, health, illness
Brains	Learning, parallel information processing, distributed control, mindsets, intelligence, feedback, requisite variety, knowledge, networks
Cultures	Society, values, beliefs, laws, ideology, rituals, diversity, traditions, history, service, shared vision and mission, understanding, qualities, families
Political Systems	Interests and rights, power, hidden agendas and back room deals, authority, alliances, party-line, censorship, gatekeepers, leaders, conflict management
Psychic Prisons	Conscious & unconscious processes, repression & regression, ego, denial, projection, coping & defence mechanisms, pain & pleasure principle, dysfunction, workaholic
Flux and Transformation	Constant change, dynamic equilibrium, flow, self-organisation, systemic wisdom, attractors, chaos, complexity, butterfly effect, emergent properties, dialectics, paradox
Instruments of Domination	Alienation, repression, imposing values, compliance, charisma, maintenance of power, force, exploitation, divide and rule, discrimination, corporate interest

known, if not well understood concepts. Stafford Beer also makes use of the power of the metaphor in the titles of some his *books: 'The Heart of Enterprise'* (1979) and *'The Brain of the Firm'* (1981). In describing human activity systems, Morgan (1997) identifies eight archetypical metaphors. These are shown in table 2 along with some associated concepts. Instead of examining the methods of organisation through each of the eight metaphors, the list has been conflated into three different perspectives according to their underlying rationale. This is shown in table 3.

Table 3: Perspectives on Metaphor

Perspective	**Morgan's Metaphors**	**Paradigm**
Machines	Machines	Traditional Science
Organisms	Organism/Brains	Biological/Ecological
Social systems	Cultures/Political/Psychic	Sociological

As the theme of this thesis is essentially how organisations organise themselves to cope with the effects of change and complexity, *'Flux and transformation'* has been omitted from the list. Similarly, *'Instruments of Domination'* has been omitted as any of the structures within three perspectives could be conceived of as an *'instrument of domination'* and is therefore common to each of the different perspectives.

2.1.1 Organisation as machines

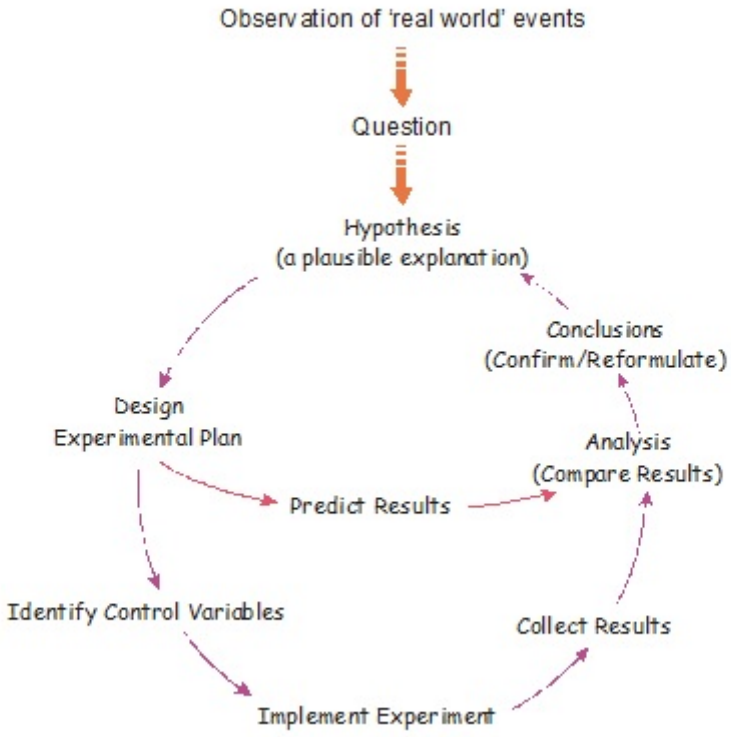
Described as the Classical or Scientific approach to management (Bennet, 1997, Lee and Lawrence, 1985), this perspective views organisation from the standpoint of traditional science. Science with its emphasis on observation, experiment, measurement and repeatability has been extraordinarily successful over the years. However, as Checkland (1981) and Coveney and Highfield (1995) note, most of this success has largely been accomplished within the domains of *'Natural Systems'* and *'Designed Systems'*. Banathy (1997) describes natural systems as all those physical systems which in a hierarchy, make up the universe. They range from the sub atomic through systems of ecology to the galactic and systems of the universe. Designed systems include all those made by man. They may be either physical artifacts or abstract such as language, mathematics or models.

In making such rapid progress, science has proceeded through a process of reductionism or reducing observations of the *'real world'* into smaller and smaller parts. In the abstract world of knowledge, this has led to increasing fragmentation in how we study and understand the world. So in schools, we see knowledge taught in *'chunks'* through a number of disciplines, ranging from the traditional sciences like physics, chemistry, biology through to subjects like drama, art and music. From within the scientific approach to management, the power of reductionism was used to tackle the issue of how to organise organisations. Here, the complexity of how to manage the complex operations involved in the management of organisations, was reduced by the increasing fragmentation of functions, the growth of specialisation and the development of hierarchical structures. So in a typical manufacturing organisation, there would be senior managers responsible managing departments: each of which would correspond to some aspect of the organisation's purpose, for example, production, design and marketing supported by accountancy and personnel functions and so on. Espejo (1997) identifies this approach of fragmentation and specialisation as an effective way reducing the complexity of a managers job and helping them by making their job more manageable. There is a cost though, which Espejo argues is in lower overall performance as increasing specialisation raises the internal complexity of an organisation. This in turn leads to problems of integration and coordination as the specialised nature of work disconnects the worker from what can seen as the main business of the organisation (Burns, 1963). According to Espejo (1997), these problems are resolved from the scientific standpoint, through top down centralised planning and the exercise of traditional authority. In other words, people sacrifice their freedom for independent action through the need to remain within and coordinate their actions with the rest of the organisation.

Reductionism with its principles of fragmentation and specialisation represent one organisational strategy for reducing and dealing with complexity. Another, is science's concern with control, repeatability and determinism. While Lee (1989) acknowledges that *"Scientists have not yet settled among themselves on a single model of what science is."*, many in the physical sciences would at least agree on the idealised model shown in figure 3. Essentially the model illustrates the iterative nature of the way science progresses. Following an observation of a *'real world'* event, a question might arise as to what's happening. A hypothesis is formed that might reasonably explain what's happening and an experiment designed. Part of the experimental design will include the formulation of

predictions or outcomes expected as a result of the experiment. The other part includes the isolation of control variables or the factors to be kept constant during the course of the experiment. This also includes any effects derived from the scientist who is seen as an objective and independent observer of the process. After the experiment, the collected results are compared with the predicted results. If the predicted results are the same as the actual results, then some kind of relationship can be made between the changed input values at the start of the experiment with the actual outcomes at the end. Such a result would confirm the initial hypothesis. Differences between predicted and actual results lead (*'feedback')* to a reformulation of the initial hypothesis and a recycling of the experimental process.

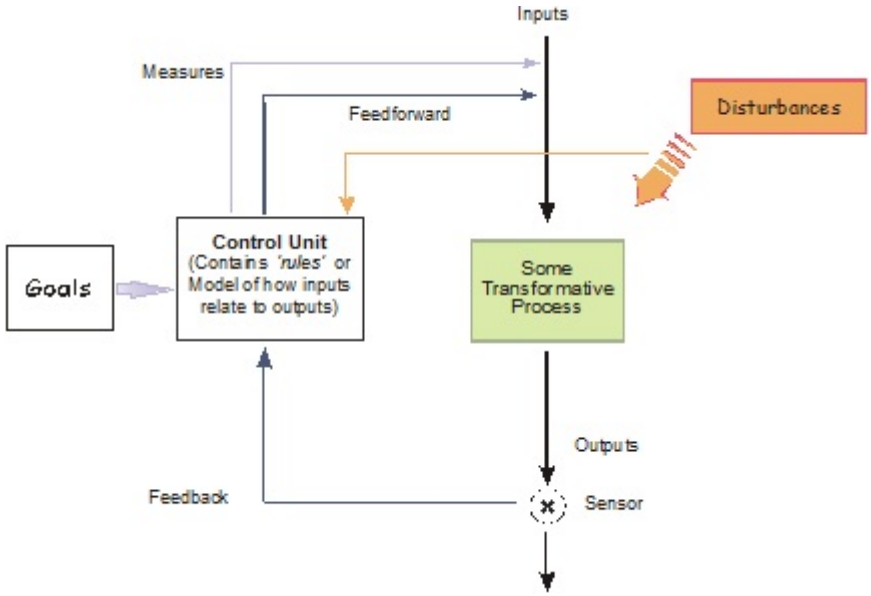
Figure 3: An idealised model of 'traditional' scientific inquiry.



Complexity is dealt within the model, first by the initial hypothesis which abstracts from the totality of 'real world' events, the features to be considered, i.e. reductionism. Second, through the design of the experimental plan, where the intention is to establish tight control

of the input variables to the experiment and on making the experimental system as *'closed'* as possible to an *'external world'*. This is to insulate the results from the effects of unknown external factors. In the comparison between the predicted and actual outcomes, the scientist is trying to establish linear relationships between input and output variables, and thereby infer the causes and effects in the changes or transformations that occur as part of the experimental process. Here, the aim is to establish a set of deterministic *'rules'*, where known inputs into a system, lead to known outputs. It is this *'predictive'* capacity where events, given certain conditions, can be forecast into the future from a known starting point that makes the scientific approach so attractive. Not only is uncertainty about future outcomes removed or reduced, but also some understanding is reached over what must be done to inputs (*'feed-forward'*) in order to arrive at desired outcomes following some change or transformative process.

Figure 4: Process Control and Self Regulation (Single loop learning)



In an organisational setting many of these key components of science and reducers of complexity can be seen operating within Ross Ashby's (1960) model of control and self-regulating systems. According to Espejo (2002) many organisations and other disciplines have been implicitly using the model in figure 4, regardless of whether they have been aware of cybernetics or not.

As identified earlier, in any human activity system, people come together to fulfil a purpose which involves transformative processes. For example, it is easy to see that in a manufacturing organisation transformative processes would involve the activities concerned with the assembly of complete items. Perhaps less obviously in a school, they involve the change from someone who knows less about a topic to someone who knows more about a topic; illustrating the idea that inputs into a transformative process isn't just confined to the obvious like men, money, materials and machinery, but can also include information. The purpose, like the hypothesis in experimental science, represents an abstraction or selection from the totality of all possible purposes. Ashby's (1960) model shows that control or *'management'* as Beer (1979) describes it, has to be exercised from outside the transformative process.

The control unit contains the *'rules'* or set of linear relationships that define how the inputs are related to the outputs of transformative process. These have been established earlier in the scientific process where the objective has been to develop an understanding of the cause and effect relationships of how the state of one system changes to another. Results from the outputs are *'fed back'* to the control unit for comparison with the predicted results. These are contained within the set of rules and according to goals that have been assigned to the process. Depending on the cause of deviation identified in the deterministic set of rules, the control unit *'feeds forwards'* actions, to change inputs to the process in order to affect change in the outputs of the process. As well as deviation arising from within the process itself, deviation in outputs can be also caused by events external to the process. The model shows how these can be anticipated by the control system monitoring the broader environment and compensating for these changes by altering the inputs in anticipation of the transformative process.

Self regulation in the model comes from the circularity that follows once the goals or the parameters within which the system has to work have been set. Once done, the system can be allowed to run automatically using feedback from outputs to change inputs to a system, via the control unit as it cycles through time. Reflecting Ashby's concern with man machine interfaces, thermostats and speed governors are commonly given examples to this self regulating process (Checkland, 1981, Heylighen and Joslyn, 2001). In a temperature dependent system, for example, the goal becomes the set temperature on the thermostat.

The output temperature is constantly monitored and as long as it falls below the set parameter, heat is allowed to be injected into the system. When the output temperature rises above the set temperature, the thermostat sends a signal that cuts off the supply of heat, and automatically sends another signal to inject more heat once the temperature has fallen below the set goal.

As another example on a broader scale, Umpleby and Dent (1999) maintains that the scientific approach in combination with Ashby's control model, can be seen in Deming's approach to Total Quality Management (TQM) and quality control. Here, in a production process the quality of the output is defined by a set of standards. Deviation from these standards recognised by measurements in the outputs, is corrected via action on the inputs to the process, possibly by tighter specifications on the materials, a realignment or investment in new technology or increased training in the operators. In the same vein, the focus on control through the use of feedback loops, comparison to standards and working to standard operating procedures can be seen in a range contexts: from Taylor's (1947) time and motion studies through to Business Process Re-engineering (Hammer and Champy, 1994).

Some limitations to the scientific approach to management and the management of complexity are revealed on closer consideration of Ashby's model, which has become associated with first order cybernetics (Krippendorff, 1986, Espejo et al, 1996). First, from the social systems perspective, it reduces people to cipher's working to meet the goals or targets handed down from above, while giving no clue as to how they might be generated. This reenforces an earlier point made by Espejo (1997), that organisations based on the mechanistic metaphor rely on hierarchal structures and authority for control in order to manage complexity. The theories of Weber with his notions of bureaucracy and authority, together with Fayol's *'principles of management'* mark the extreme end of this approach.

Second and more fundamentally, control of the transformative process is only as good as the model or set of rules used to control it. If, for example an event happens that can't be accounted for in the control model, then the control unit will be unable to make an adequate feed-forward action to bring the process in line with set goals or targets. At this point, by definition, the transformative process can be considered as *'out of control'*. Recognition that control is dependant on the sophistication of the model within the control unit, led

Ashby (1956) to formulate his *'Law of Requisite Variety'* - also known as Ashby's Law. This law, which Beer (1979) and Waelchli (1989) believe to be of equal importance to Newton's law of gravity, broadly states:

> *"(1) the amount of appropriate selection that can be performed is limited by the amount of information available. (2) for appropriate regulation the variety in the regulator must be equal to or greater than the variety in the system being regulated. Or, the greater the variety within a system, the greater its ability to reduce variety in its environment through regulation. Only variety (in the regulator) can destroy variety (in the system being regulated)."*

Variety as a measure of complexity is discussed in a later section, but essentially the law makes the point that effective control is dependent on the control unit being able to match or exceed in terms of responses it can take with the range of disturbances likely to affect the system being controlled. This was later developed into the Conant Ashby Theorem (1970) which states:

> *"Every good regulator of a system must be a model of that system" (Conant & Ashby, 1970)*

Unaware of the cybernetic implications of control, *'scientific'* management theorists have continued to concentrate on trying to insulate transformative processes from effects of change or maintain the *'closure'* of the system Change for these organisations can be difficult and major criticisms of *'bureaucratic'* organisations include slow decision taking, discouragement of initiative, unthinking compliance with excessive systems of rules and written decisions (Bennett, 1997). For these reasons, Burns (1963) and Burns and Stalker (1994) have identified that mechanistic organisations, operated from a scientific standpoint to management, are best suited to stable conditions. Similarly Lawrence and Lorsch (1967) recommend that organisations adopt different structures and integrative mechanisms according to dynamism of environmental conditions. This contingency approach is taken up by Mintzberg (1983), who outlines alternative organisation structures in the way that different parts are configured in relation to one another. According to Mintzberg, the size of the parts and their relationship to one another is contingent upon the degree to which

standardisation is required in work processes, outputs, skills etc. While these approaches acknowledge the influence of environmental conditions, *'opening'* systems previously treated as *'closed'*, Espejo (1997, 1999) sees these alternative structures as different strategies for separating out complexity to different parts of the organisation.

Finally, the last major concern from the systems and cybernetic perspective in how the scientific approach deals with complexity revolves around emergent behaviours and properties. The scientific method described earlier, uses reductionism as its mode of enquiry, but as Stafford Beer explains, the:

> *"... difficulty about the reductive technique to youngsters, I usually point out that if you take a radio set to pieces you can certainly understand how it works, and even build a duplicate that works. But although you may survey all the components, neatly spread out and labelled, you never seem to find the voice. And the same thing happens when you dismantle an engine: you cannot find the speed. But the voice and the speed are just the things that matter. We are using a technique of enquiry that causes the very attributes of the radio system and the engine system in which we are the most interested to disappear." (Beer, 1997)*

Similarly, schools can be decomposed into all its parts and yet not find a box labelled ethos or respect. Consequently in order to discover ethos, respect or in Beer's examples, *'voice'* and *'speed',* a completely different method to traditional scientific enquiry is required.

Despite all the concerns so far expressed about the scientific approach to management, the scientific method has been extremely successful. Certainly it has demonstrated the principle of design and the discussion has highlighted the importance of information. The topic of how to use design and the sorts of information that needs to be exchanged is the subject of the next sections.

2.1.2 Organisation as organisms

The work of Burns and Stalker (1994), Lawrence and Lorsch (1967) suggests that way that human activity systems are best organised is contingent upon environmental factors or conditions. When they are stable, a *'mechanistic'* view of organisation as a structure which uses hierarchy, specialisation, top down planning and centralised control as strategies to handle complexity might be appropriate. When they are less stable and more prone to change, Burns and Stalker recommend moving to more organic, flexible open type structures: structures that can adapt to conditions as they change. For system theorists like Boulding, von Bertalanffy and Churchman, natural systems, particularly those within the biological field appear as an obvious source for models of adaptive systems. Living systems after all, have the capacity within limits, for self organisation, self repair and as Darwin's work revealed, the ability to adapt over time: exactly the characteristics that enable analogies to be made between the biological world and organisations.

Similar to Ashby with *'Design for a Brain'* (1960), Stafford Beer with a background in psychiatry makes extensive use of biological metaphors. In *'Brain of the Firm'* first published in 1972, Beer uses the neurophysiological system to explain the beginnings of what has become the VSM. Central to his model is the brain receiving information from the immediate environment via the senses, sight, hearing, taste etc. Depending on the results of cognitive processes, a decision is made, possibly to make some action in the environment in reaction to the information received. This action may be orientated towards changing the environment or moving to a new environment. A simple example would be in dim conditions, making the decision to turning on a light (changing the environment) or moving to a brighter position (moving to a new environment). Organisational examples can include embarking on an advertising campaign to change the perceptions of customers or clients (changing or adapting the environment) or developing new products or services (choosing new environments).

The brain is also connected to the autonomic nervous system (ANS) which acts as a control system responsible for maintaining *'homeostasis'* or balance in the internal environment of the organism. The ANS for the most part operates without conscious thought or sensation and includes such things as the regulation of heart rate, digestion, respiration rate,

salivation, perspiration, diameter of the pupils etc. Control by the ANS is achieved through the dual operation of the sympathetic and parasympathetic nervous systems. The sympathetic nervous system, located within sympathetic ganglia along the spinal cord, is responsible for coordination of various organs, muscles, heart, kidney etc. and becomes particularly dominant in times of stress, for example fight or flight responses. Coordination is achieved through the vertical connections along the length of the central nervous system to the lower part of the brain. Generally though, sympathetic ganglia continue to regulate their respective organs independently from one another, through the use of reflex arcs without *'involving'* the brain. So a tap on the knee generates a signal to the relevant sympathetic ganglia which in turn, generates a another signal to muscles resulting a twitch of the leg: all of which occurs without a *'consultation'* to the brain to discover what to do. The parasympathetic nervous system is connected directly from the lower part of the brain to the organs, muscles and so on and is most often involved in the results of conscious thought. In combination, the sympathetic and parasympathetic systems form a system of devolved regulation, freeing the upper parts of the brain for more conscious thinking. For example, a decision to turn on the light, is passed to the ANS which then becomes responsible through the use of feedback mechanisms (reflex arcs), for coordinating all the muscle movements and actions necessary to turn the decision into reality without further decision making or thought.

In an organisational context, Beer's neurophysiological model broadly equates to *'management by exception'*. This is the process where authority is delegated downwards together with autonomy or freedom for action to manage operations locally. Agreements are made between management levels over expected outcomes and from the perspective of upper management, local operations are allowed to continue with little involvement. Upper management becomes involved in only those situations in which actual results differ significantly from agreed outcomes. The idea is that management or the *'brain'* should spend its valuable time concentrating on the more important items such as shaping the organisation's future strategic course while sharing the responsibility for the implementation of the current plan. The other advantage is that managers avoid the *'activity trap'* of getting too heavily involved in day to day activities and forget to attend their main purpose and objectives. These are some of the principles that underlie the reasoning in *'In Search of Excellence'* (Peters and Waterman, 1988) and Drucker's *'Management by Objectives'*

(1954).

The strategies for dealing with complexity in Beer's neurophysiological model and *'management by exception'* techniques are in complete contrast with those used in the scientific approach to management. First, authority and autonomy for action are devolved downwards through organised systems, empowering *'lower'* systems to manage issues arising from complexity at the lowest possible level. *'Upper'* management or the *'brain'* is then left to deal with the residual complexity or the issues that can't be dealt with at *'lower'* levels. Second, it introduces a new concept of hierarchy.

The *'traditional'* view of hierarchy associates authority, power and importance with position in the organisational chart. The higher or more senior the position, the more *'right'* someone has to tell others that are below them or more *'junior'* what to do. Beer's model on the other hand, sees all systems equally significant and important to the survival of the organism and as he argues, you wouldn't *"... consider A more senior to B, just because it comes before B in the alphabet" (Beer, 1979).* This is reflected in the neurophysiological model where the *'survivability'* of the organism depends upon the continual integrated and coordinated action of all the essential systems required for continued existence. The brain for example, which under the traditional hierarchic view would be considered the apex or the organisational chart, cannot survive without the continued and simultaneous operation of the heart and lungs, no matter how much the brain wills it. Similarly the cardiopulmonary system cannot continue without the effective regulation exercised by the kidney on blood pH, blood pressure and volume and the removal of waste products etc. Likewise, none of the previous systems would be able to function without effective operation of the liver and digestive systems. And of course, to illustrate the self reflexive circular notion of this alternative concept of hierarchy, none of the cardiopulmonary, kidney, liver functions etc. would be possible without continued operation of brain functions. From a management perspective applying this model, the trick lies in identifying goals and the essential activities required to support the purposes of the organisation. As Drucker says "... *Management by Objectives works if you know the objectives, 90% of the time you don't."*. The other difficulty revolves around issue of explaining adaptive behaviour within the context of model for self regulation. (See figure 4)

Maturana and Varela (1980) from their work in biology, make the distinction between allopoietic and autopoietic systems. Allopoietic systems use raw materials to make things other than itself, for example car factories create cars that are different to car factories. Autopoietic systems by contrast, are systems that use raw materials to make more of itself, for example in living systems, cells assemble with nucleic acids, proteins etc. more cells. It is this property that endows systems with the capacity for self-repair and self-production. Schools represent another good example of an autopoietic system in that they use *'knowledgeable'* people to produce more *'knowledgeable'* people. However Maturana and Varela (1980) go on to apply their concept of autopoiesis to man made as opposed to natural systems. Here, they define:

> *"An autopoietic machine is a machine organized (defined as a unity) as a network of processes of production (transformation and destruction) of components which: (I) through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it (the machine) as a concrete unity in space in which they (the components) exist by specifying the topological domain of its realization as such a network." (Maturana, Varela, 1980)*

Beer uses this concept of autopoiesis to define the objective of any organisational system, which is to produce more of itself, or to remain *'viable'* within its environment. Here, Beer defines viability as:

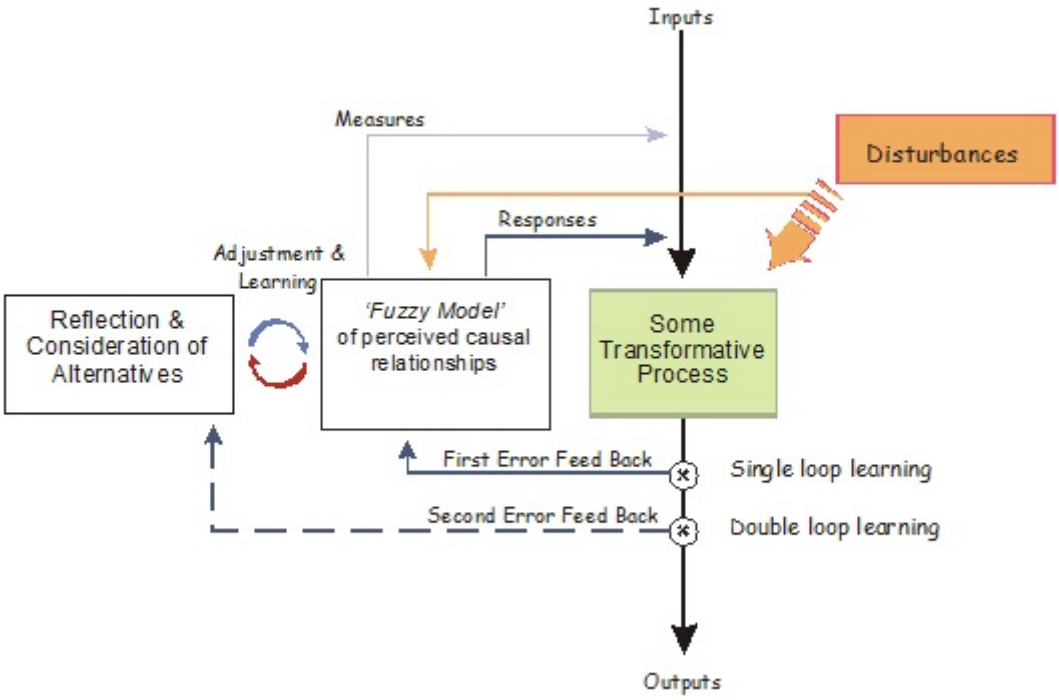
> *"... the ability to maintain a separate existence." (Beer, 1979)*

Maintaining a separate existence is not meant to infer that the organisational system remains *'closed'* to the environment. Rather, as Ashby (1960) argues, the system is in balance with its environment, deploying the requisite number of responses to offset disturbances or change generated in the environment. Also, in setting out viability as the prime objective of any organisation Beer is not defining the system in the allopoietic sense of making things different from itself, or in a machine like sense, but in the sense that its aim is to constantly regenerate itself in the continuous operation of the processes that carry out the organisational transformations implied in its purpose.

Using viability as an overriding goal has two advantages. First, it focuses attention on the essential interactions and transformations that are necessary to reproduce it in the autopoietic sense, and thereby encourages a more holistic view. This helps identify the subsystems necessary for self-repair and self-production. Second, it fosters a long term outlook that steps beyond the satisfaction of narrow interests and short term measures such as maximising profit or Rapport's (1986) aim of maximising shareholder value, which Mintzberg, Simon and Basu (2002) find so damaging.

Resolving the issue of adaptive behaviour in organisms and in organisations, is suggested in Beer's neurophysiological model by the *'sense - decision - action'* loop that exists between the organism and the environment. The process of learning and modifying behaviour is elaborated in Argyris and Schön's (1978) learning model seen in figure 5.

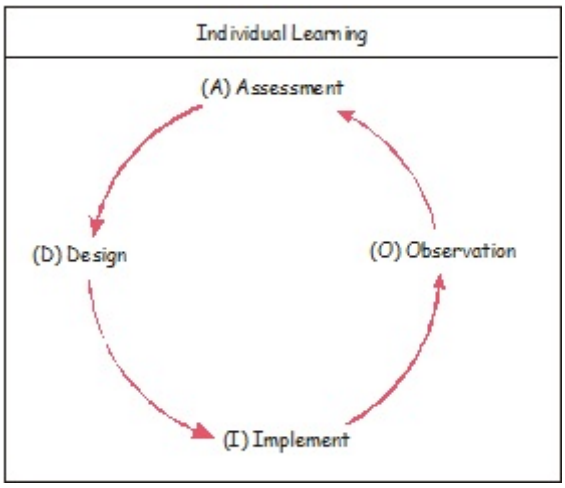
Figure 5: Single and Double Loop Learning



The diagram shows a modified version of figure 4. Based on prior learning and experience, the *'control unit'* now contains a network of *'fuzzy'* models based on perceived relationships between events in the *'real'* world and actions. Whenever a disturbance occurs in the way

of change that affects some transformative process, actions are undertaken to alter inputs to achieve desirable outcomes. Espejo et al (1996) makes the distinction between two different types of change. First order change or *'more of the same'*, represents fluctuations that have been dealt with before. A set of routines exist in the model developed through experience, which when triggered, produce an almost automatic responses to bring the transformative process back under *'control'*, though there may be some *'enrichment'* of the model depending on the context and frequency of the change. Argyris and Schön call this *'single loop learning'*. Second order change is something novel and new. Disturbances caused by this novel change, which may or may not be recognised as new, produce responses that are based either on similar events (experiential learning) or from superstitious learning, i.e. reasoning without a rational basis (Levitt and March, 1988, Eraut, 1994). Failure of these responses to affect desirable outcomes initiates a reflective process and a consideration of alternatives. An internal dialogue develops following the *'OADI cycle'* shown in figure 6: a modification by Kim of Kofman's individual learning cycle (Kim, 1993).

Figure 6: OADI Cycle of Individual Learning
(Koffman in Kim, 1993)



Beginning with the observation of *'error'* in outcomes, following previous actions, an assessment is made after reflection as to possible reasons. The design or development of new actions are tested by implementation in the *'real'* world. Successful actions are used to update the *'fuzzy'* models through which the *'real'* world is interpreted leading to enhanced

capacity for individual action. Conversely, actions that fail to bring about desirable outcomes initiate further cycling of the process. Argyris and Schön (1978) identify this as *'double loop learning'* and together with single loop learning, their model provides a mechanism for explaining adaptive behaviour by which individuals can react and adapt to change. In an organisational context Argyris and Schön identify *'single loop learning'* as being dominant when goals, frameworks and strategies are taken for granted. Usher and Bryant (1989) maintain that in this situation, the focus of learning is orientated towards improving techniques and making existing actions and responses more efficient. *'Double loop learning'* in contrast, occurs when there is less agreement and *"involves questioning the role of the framing and learning systems which underlie actual goals and strategies" (Usher and Bryant, 1989)*.

One last notable difference between the learning model in figure 5 and the regulatory model in figure 4 concerns goal setting. In figure 4 these were shown to be determined externally by some *'higher'* authority. In the learning model these have been replaced by the proposed reflective process and consideration of alternatives. Within Beer's (1981) neurophysiological model, the goals in this case are generated internally, driven by the need to maintain viability with respect to its autopoietic purpose. However as Rosenhead (2001) observes along with Lee and Lawrence (1985), organisations are not biological systems. Instead they see organisations as collections of people each with different motivations, forming coalitions seeking to achieve desirable outcomes through the exercise of political acts. How this view fits within cybernetic thinking and how it manages complexity is the subject of the next section.

2.1.3 Organisation as social systems

Discussion so far has centred around the way the structure of organisations handles the complexity generated by the environment or some transformative process. However, as Lee and Lawrence (1985) assert, organisations don't have an existence independent of the people that make them. Instead, they argue it is people that make organisations and only by studying the way people work and what motivates them can one understand organisations. Since the work of Maslow (1970) it has been widely recognised that people work to satisfy a range of needs and Herzburg (1987) proposed his *'Two factor theory'* to explain how to

create commitment to work through job satisfaction. The relationship between these two theories are shown in table 4.

Table 4: Employee Needs and Development

Maslow's Hierarchy of Needs		**Herzberg's Two factor Theory**	
Need (in order of urgency)	**Satisfies**	**Hygiene factors** (negative aspects leads to job dis-satisfaction and lower performance	**Motivating factors** (leads to job satisfaction and Higher performance)
1. Physiological or basic needs	Hunger, thirst, shelter, sex	Company policy, Supervision. Salary, Relationships, working conditions.	
2. Safety needs	Security, stability, freedom from fear, anxiety. Need for structure, order etc.		
3. Social Needs	*'Belongingness'* - need to join and belong.		
4. Ego Needs	Desire for individual strength, achievement, mastery, competence, confidence and freedom. Desire for reputation, prestige, status, recognition, importance, appreciation etc.		Achievement, Recognition, Work itself Responsibility, Advancement
5. Self-actualisation needs	*'To be what one can be'*, the desire to self-fulfilment and the realisation of potential		

From the sociological perspective, *'man'* will, in order to fulfill these needs - though not necessarily all within the same organisation - act *'politically'* forming affiliations and groups and generally try to attain favourable outcomes through the exercise of power and influence. One way of achieving this is through force of personality and leadership style (Goleman et al, 2002). Another, is through the demonstration of technical knowledge and competence (Eraut, 1994) and Senge (1992) proposes that most favourable outcomes will be achieved by people who can demonstrate mastery of five disciplines, that include: -

- Personal Mastery: the discipline of continually seeking to clarify visions, focussing energies and attempting to see *'reality'* objectively.
- Mental Models: the ability to make explicit the assumptions and models that influence how the world is understood and how to influence it through action.
- Building shared visions: the ability to develop visions that encourage commitment rather than just compliance.
- Team learning: the ability of *'thinking together'* with others
- Systems thinking: the ability to see connections, patterns and influences that are usually hidden.

As well as working actively in a *'political'* way to achieve positive outcomes, Argyris (1990) has observed a variety of actions, of what he describes as organisational defensive

Table 5: Organizational Defensive Patterns of Behaviour (ODP) (Argyris, 1990)

Behaviourial Strategy	**Effect and Symptoms**
Organisational Malaise	A sense of helplessness and inability to affect situations. Symptoms include: • Seeking and finding fault with the organisation but refusing responsibility to correct it, preferring to blame others or *'the system'*. • Accentuating the negative and de-emphasising the positive. Participants magnify faults In the organisation to make them more powerful and hence explain their own feelings of helplessness • Espousing values and actions that everyone knows can't be implemented and helps participants to distance themselves from current actions.
Skilled Incompetence	A sense of helplessness created when trying to achieve an important objective. Frequently accompanied by reasoned excuses for not acting. After time, cynicism and a feeling of hopelessness emerge.
Fancy footwork	People use defensive reasoning to focus on non-controversial issues while suppressing important ones and often end up creating situations they were trying to abolish.
Defensive routines	Policies or actions that prevent people or systems experiencing embarrassment or threat at the same time as preventing the correction of the cause of embarrassment and threat. A strategy often employed by those using skilled incompetence.

patterns (ODP) of behaviour. These self-reinforcing behaviours, summarised in table 5, emerge in the day to day conversations and interactions between people and represent powerful ways which can be used to resist change.

The feelings of helplessness and hopelessness engendered in these behaviours demonstrate that *'man'* doesn't always necessarily behave *'rationally'* or pursue their own best interests when it comes to meeting personal needs or objectives. They also show that in contrast to previous sections, man is not a disinterested, objective observer of situations, but rather gets involved in the messy political interactions between people, both promoting ideas and actions and obstructing others.

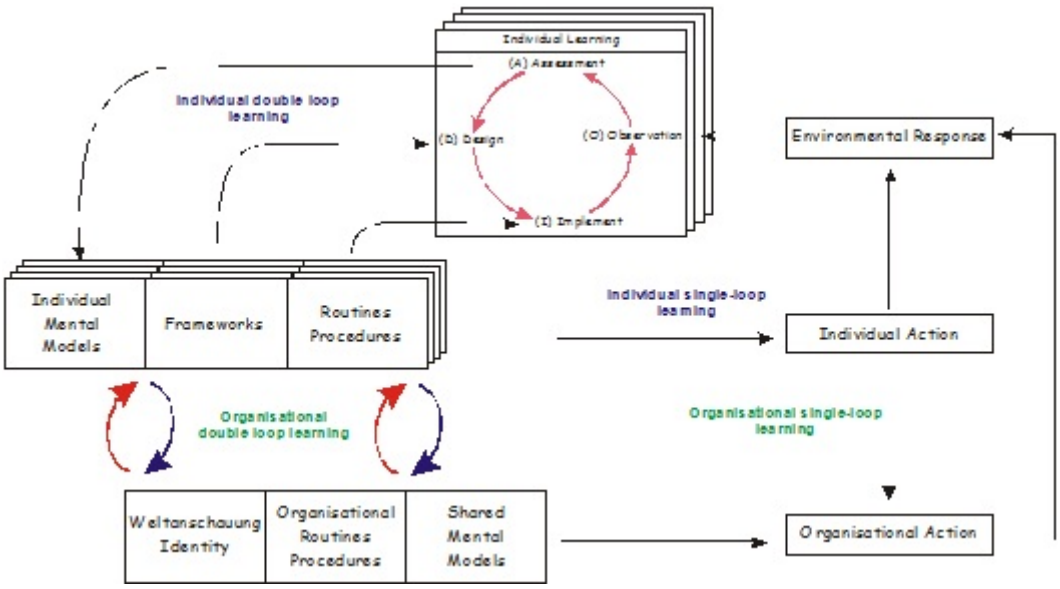
Viewing organisations from the purely political standpoint of Lee and Lawrence (1985) where organisations are created through the enactment of *'political'* activities, complexity is handled through the continuous rich conversations between participants. Espejo et al (1996) proposes that these conversations are a significant method by which participants coordinate their actions with respect to one another. Gordon Pask with his Conversation Theory (CT) (Scott, 2001, Green, 2004) demonstrated how feedback loops exist in conversations and showed how new knowledge, concepts and understanding on actions can emerge from cyclic dialogues between actors. Coordination is also helped through the use of common sources of information and culture. Schein (1996) describes organisational culture as:

> *"... the basic tacit assumptions about how the world is and ought to be that a group of people are sharing and that determines their perceptions, thoughts, feelings, and their overt behaviour" (Schein, 1996)*

In this context, Espejo et al (1996) regard a shared organisational culture, as the *'mood music'* which helps support people in conversations and coordinated action, even though they may be separated in time and space. The way in which Schein's view of culture is *'realized'* is through relationships formed by people's interactions over time. Giddens, in his *'Theory of Structuration'* (1984), describes relationships as the place where people ground an attachment to meanings (signification), establish explicit or implicit norms (legitimation) and accept the power (domination) to allocate resources. Using this interpretation of relationships, Espejo et al (1996) define an organisation as a *"... closed*

network of interrelated people with an identity of its own", putting people at the centre. This definition, they argue, is not meant to suggest organisations are closed systems, but rather to emphasise that the relationships are sufficient in themselves to provide a cohesion and identity to the organisation. Recalling the point about human activity systems being purposeful, it can be seen that organisational identity emerges from the way that people arrange themselves with respect to one another, in order to fulfill some common purpose. The configuration of these arrangements defines the structure of the organisation and provides the framework for Lee and Lawrence's (1985) *'political'* activities. In terms of managing complexity, the common purpose selects from the total environmental complexity, the complexity that the organisation has chosen to deal with. The organisational structure reflects the way in which participants have organised themselves in order to manage that complexity identified in the organisation's purpose. It follows that effective and socially

Figure 7: OADI-SMM model of organisational learning (Kim, 1993)



responsible organisations will structure themselves in a way, that enables people to realise their self actualisation needs, discussed at the beginning of this section, and minimising Argyris's ODP type behaviours.

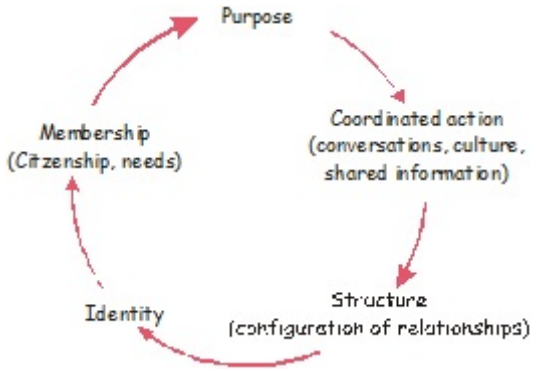
The issue, that now arises, is who defines the purpose? In nature, organisation can be seen to spontaneously emerge from the application of an external force, for example Bernoulli cells or convection currents in fluids from the application of heat (Ball, 2001). But, from the

sociological perspective, organisations are not natural or biological systems. Heinz von Foerster (1973, 1979, 1992) developed along with Ashby, Maturana and Pask the idea of second order cybernetics which incorporated the idea that *'reality'* is a social construction. Classical science and first order cybernetics regard systems as objective *'things'* which can be modelled. These *'things'* exist independently of any observer and they can be freely observed and manipulated: exactly the outlook underlying *'managerialism'* and criticised by organisational behaviorists. However, Heisenberg's Uncertainty Principle and Schrödinger's Cat experiment demonstrated that even in classical science, the act of observation could have an effect on the system being observed. In second order cybernetics, systems are recognised as an agent in their own right, but interacting with an observer as another agent. So when an observer thinks about the cybernetics of systems, they also have to consider the cybernetics of their own thinking, leading to the *'cybernetics of cybernetics'*, or second order cybernetics. Or in Ashby's (1960) terms, in creating a model of how the brain works that model, for it to be complete, also has to account for the initial action of modelling the brain in the first place. In terms of analysis, an observer enters the process by identifying the system's purpose (first order cybernetics) and then thinks about the system by identifying his own purpose (second order cybernetics). As we are all observers the argument goes, we all define our own purposes in what we observe.

The preceding argument makes the case that those responsible for defining the organisation's purpose are in fact the members of the organisation, thereby achieving *'closure'*, completing the cycle of concepts so far discussed. - see figure 8

The diagram shows that membership of an organisation defines its purpose. Fulfilment of the purpose requires coordinated action between members achieved through conversations and supported by culture. The configuration of these conversations provide the organisation with structure and an identity. People become members of the organisation in order to satisfy their needs. So far this model explains the organisation in terms of its social relationships, but offers very little in the way of explaining self control and adaptive behaviour. For example adaptive behaviour implies change; if people are at the centre of the organisation, how does change in people feed through to change in the organisation, particularly if people ascribe different purposes to a system? Some ways were discussed earlier, but as Argyris (1990) discovered, people can be very successful in blocking change.

Figure 8: Purpose, Structure & Identity



Another way as Espejo et al (1996) and Kim (1993) argue, is to link individual single and double loop learning (see figure 5) into the organisation. This is shown in figure 7
The OADI - SMM (Observation, Analysis, Design, Implementation - Shared Mental Models) model in figure 7 represents a conflation of two theories. At its centre is the OADI cycle of Kofman's model of individual learning (see figure 6). Overlaid on this, is Argyris and Schön's (1978) theory of single and double loop learning, where learning occurs through the process of changing or modifying existing mental models. Essentially the process is this: if after observing that an individual action has failed to produce a suitable response in some transformation, the individual makes an assessment by consulting their mental model which embodies all their implicit and explicit understanding of the world. Part of their *'world view'* or mental model includes frameworks. Frameworks are used for *'conceptual learning'* and contain methods used by individuals to frame and solve problems in various contexts. After the creation of possible new courses of actions, the individual considers the routines and procedures to follow for implementation. The routines and procedures represent *'operational learning'* or the memory of past successful actions and the way they were implemented. As the individual gains experience with the implementation of new actions then the routines part of the model changes to include these actions as part of the set of standard routines.

The distinction between *'conceptual learning'* and *'operational learning'* is significant. From the model it can be seen that conceptual learning is closely associated with assessment and design, involving the building of new or adaption of existing models in an attempt to

understand the *'why'* of a situation. On the other hand, operational learning is associated with observation and implementation, driven by the need to understand the *'how'* to do of a task. Conceptual learning and operational learning can be discontinuous, developing at different rates and different times. Conceptual learning without operational learning (i.e. *'theory without practice')*, leads to theories that lack a factual basis or haven't been tested by practice. Conversely, operational learning without conceptual learning (i.e. *'practice without theory'*) leads to a *'trial and error'* process to action.

Organisational learning occurs in the organisational conversations between participants, where information is shared, allowing members to enrich their views of how the world works or their mental models. Collectively, these conversations represent the organisation's *'active memory'* of how things *'are done around here'*. Some aspects of this active memory can be seen in the myths, legends and stories that surround particular individuals or particular events in the organisation's history. The shared mental model also includes all the explicit and implicit organisational knowledge whether tacit or expressly assumed. Together, the organisational identity or prevailing world view (weltanschauung), organisational routines and the shared mental model determines organisational action - how it reacts and what it does in the environment.

The significance of the model presented in figure 7 is three fold. First, it shows how individual learning and actions link into organisational learning and actions. So adaptive changes by individuals can lead to changes in organisational actions, providing the organisation with adaptive potential. Second, and important from a sociological perspective, it shows how coordinated individual and organisational action is not dependent on a monolithic, top down world view. Individuals can still have different personal world views, different opinions and see different purposes in what they do, but they come to be aligned through organisational conversations. Finally, it shows how breaks in the feedback loops can lead to failures in handling complexity. Espejo et al (1996) identify seven possible failures in individual and organisational learning. These are summarised in table 6, 34 and their locations shown in figure 9.

As Espejo et al (1996) admit, disentangling and diagnosing the failures in individual and organisational learning can be difficult. More than one obstacle may be in operation and

Table 6: Failures in learning

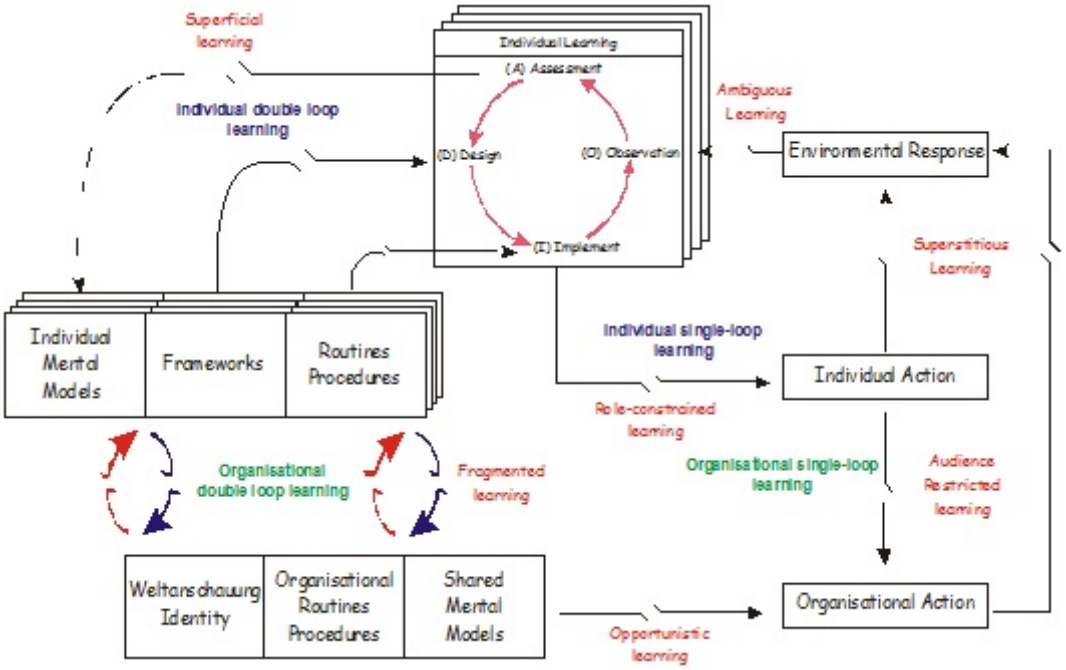
Loop	Obstacle	Description
Single loop learning	Role-constrained learning	A *'non-behaviour'* where individuals fail to take action even though they have the knowledge. Conceptual knowledge is not converted into action.
	Audience-restricted learning	A *'non-behaviour'* by the organisation, where it fails to act, despite the efforts of individuals with the required knowledge to influence outcomes even if they issue *'orders'*.
	Superstitious learning	Action is inhibited through missing conceptual frameworks and models. Action proceeds through *'trial and error'* without a conceptual basis.
	Ambiguous learning	The use of inappropriate measures or the failure to measure responses to actions so any conclusions made are unsupported by data.
Double loop learning	Superficial learning	Failure to modify mental models or when operational and conceptual learning is discontinuous leading to theory without practice or practice without theory.
	Fragmented learning	Individuals learn and change their models, but they do not become part of the organisation's model. Knowledge is available in the individual but remains *'lost'* to the organisation.

they can be working in the single and double loops simultaneously. Additionally, an obstacle in one set of loops may generate obstacles in others. However, as they argue, organisational structures and conversations must be designed to reduce or eliminate the obstacles to learning to maximise on the participants ability to deal with changing conditions arising from complexity. Where the configuration of relationships - i.e. structure - is inconsistent with participants needs and the obstacles to learning are recognised, they form parallel *'underground'* informal networks, in an attempt to shortcut formal relationships which in turn can generate Argyris's (1990) ODP behaviours in table 5.

The model in figure 9 also makes a distinction between two different domains. First there is the informational domain where learning occurs. Then there is the action or operational domain where individuals and organisations make actions grounded in learning. This distinction is important, because as Espejo (1997) describes, he can distinguish all the possible moves and actions necessary to be a world tennis champion (the informational

domain), but this is a long way from actually enacting this learning in practice (the operational domain). Although attention to both domains is important, action in the operational domain is the point at where complexity is dealt with as it demonstrates the actual handling of complexity rather than just the act of thinking about it. This represents a difference with Senge (1992), who with his archetypes, places greater emphasis on dynamic complexity and distinctions made in the informational domain.

Figure 9: Breaks in learning cycles (Espejo et al 1996)



Complexity it is argued is an invariant feature that all organisations have to deal with. So far in this and the last two sections, strategies for how organisation's deal with complexity from within three major paradigms have been discussed. In the course of the discussion some cybernetic concepts have been elaborated in relation to these strategies, and it is suggested that all organisations have been knowingly or unknowingly been based on cybernetic principles. These cybernetic concepts and strategies are summarised in table 7.

Table 7: Summary of strategies used for managing complexity and related cybernetic concepts

Paradigm Perspective	Strategies for dealing with complexity	Cybernetic Concept
Scientific	Hierarchy Traditional power structures Functional specialisation	Self Regulation -Ashby's Law, Conant-Ashby Theorem, Feedback, feed forward (1st Order Cybernetics)
Biological	Devolved power Autonomous units	Autopoiesis - self repair, self production. Homeostasis Viability Aspects of change Information & Action domains Single loop learning Double loop learning
Sociological	Political networks Individual competencies and needs. Conversations & shared information sources. Culture & relationships. Identity	*'Reality'* socially constructed Mental Models, Shared Mental models (SMM). Organisational learning (2nd Order Cybernetics)

2.2 Measuring Complexity, Managing Variety

2.2.1 Measuring Complexity

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind ...." -William Thompson (Lord Kelvin), 1824-1907

For an arch empiricist's like Kelvin, measuring complexity is an extremely problematic issue. Primarily because, as the discussion in Chapter 1 revealed, there is no commonly accepted definition of complexity and therefore no common measure. As a result different disciplines ranging from physics, maths, computing and cybernetics have each developed

their own measures which lack relevance in other fields.

Boulding (1956) produced a nine-point scale showing levels of increasing complexity and matched them to related disciplines (see table 8). Purely at an intuitive level, Checkland (1981) considers that Boulding's scale has an internal logic and sense which most observers would find difficult to disagree with.

Table 8: Boulding's (1956) hierarchy of systems complexity with related disciplines.

Level	Characteristics	Examples (concrete or abstract)	Relevant disciplines
1. Structures. Frameworks	Static	Crystal structures, bridges	Description, verbal or pictorial, in any discipline
2. Clock-works	Predetermined motion (may exhibit equilibrium)	Clocks, machines, the solar system	Physics, classical natural science
3. Control mechanisms	Closed loop	Thermostats, Homeostasis mechanisms in organisms.	Control theory, cybernetics
4. Open Systems	Structurally self maintaining	Flames, biological cells	Theory of metabolism (information theory)
5. Lower organisms	Organised whole with functional parts, 'blue printed' growth, reproduction	Plants	Botany
6. Animals	A brain to guide total behaviour, ability to learn	Birds and beasts	Zoology
7. Man	Self-consciousness, knowledge of knowledge, symbolic language.	Human beings	Biology, psychology
8. Socio-cultural systems	Roles, communication, transmission of values	Families, the Boy Scouts, drinking clubs, nations	History, sociology, anthropology, behavioural science
9. Transcendental systems	'Inescapable unknowables'	The idea of God	?

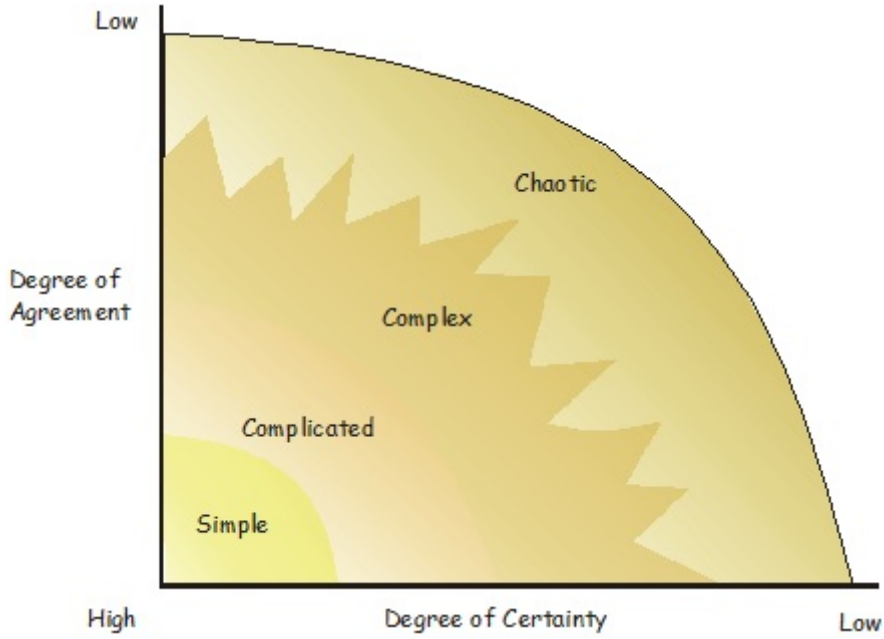
What has changed however, is the position of cybernetics and its relevance to other levels of complexity. In Boulding's hierarchy, cybernetics is associated with control systems at level 3 and at the time, following the work described by Umpleby and Dent (1999) of Weiner's work in teleological systems and McCulloch's attempts to understand the brain and others of that period, this was generally true. But as the preceding sections demonstrated, cybernetics has developed considerably since then, particularly with the change from first to second order cybernetics. From the perspective of management cybernetics, the VSM has been used to examine the behaviour and characteristics of ant colonies from the individual to the colony as a whole (Foss, 1989) - Boulding's Level 6. And famously, it was used at a national level to manage the social economy of Chile during Allende's presidency until his overthrow by Pinochet in 1973 (Beer, 1981, 1989) - Boulding's Level 8. More recently, cybernetics has been used in relation to the Taoist tradition of Feng Shui (Zude and Yolles, 2002, 2005) - Boulding's Level 9.

Ralph Stacey (2000) also attempted to create a scale of complexity, however rather than define particular levels of complexity, he sees it emerging in the phase transitions between:

- The Certainty of the future (from High to Low) for a particular organisation (as a system) and the level of: -
- The Agreement (from High to Low) that exists within the organisation regarding the actions that ought to be taken for future direction

The relationship between the two dimensions is shown in figure 10. Stacey (2000) believes that system complexity increases to the chaotic, as the degree of certainty over the organisation's future declines, together with a fall in the degree of agreement over future actions. The drive for change arises from an dynamic generated through internal tension created through an organisational paradox. Organisations, he argues are pulled towards stability (bottom left) by the forces of integration and maintenance control, together with the human needs for security and certainty and the need to adapt to the environment. Stacey describes this as *'Ordinary Management'*. On the other hand, organisations are also pulled towards the unstable extreme of the spectrum (top right) by the forces of division and decentralisation, together with the human needs for excitement and innovation.

Figure 10: Stacey's Agreement vs Uncertainty Matrix (2000)



If the organisation surrenders to the pull towards stability, it will fail according to Stacey, because it becomes ossified and cannot change. Conversely, if it moves too far towards instability, it will also fail through disintegration. The job for managers therefore, is to manage this tension and maintain the organisation on the edge of chaos, maximising creativity and innovation with the need for cohesion and stability. Stacey describes this task as *'Extraordinary Management*'. Consequently, an organisation faces unknowable specific futures arising out of this internal dynamic.

Although Rosenhead (2001) points out the risk of running an organisation continually teetering on the brink of chaos, Stacey's concept of complexity falling within a range marked by transitions from the simple to the chaotic is useful when it comes to considering how measures change as the degree of agreement and certainty about possible futures declines.

Table 9 summarises how some features of measures change with respect to the consideration

of possible futures. Some measures (Kolmogorov, Cyclomatic complexity) have already been discussed in Chapter 1. These are distinct from the other examples in that they try to measure complexity in themselves. The remaining examples selected from an educational context (e.g. RR, NCF, NCD) - discussed in more detail in Chapter 4 - are used to attempt to capture some sense of dynamics in changing situations and reflect different degrees of complexity. Broadly, as systems move from the simple (the here and now) to the chaotic (possible futures), measures change from commonly accepted and understood measures concerned with quantification, to those based on probability. These more interpretive

Table 9: Complexity Measures

Scale of System Complexity (Agreement vs Future Certainty)				
	High/High			Low/ Low
				
System State	Simple	Complicated	Complex	Chaotic
Status of Measures	Broadly accepted and agreed simple measures.	More specialised measures bounded by context.	Orientated towards capturing Critical Success Factors (CSF)	Probabilistic measures, open to interpretation in terms of methodology & selection of data.
Examples	School role, number of passes, attendance, inventory, cost etc.	Simple Ratios (grades attained as proportion of year group etc., Relative Ratings (RR) etc.)	National Comparison Factors (NCF), National Comparison Deciles (NCD) Kolmogorov Complexity Cyclomatic or McCabe Complexity Halstead Complexity	Stochastic probability (Population growth, Cognitive Ability Test (CAT) scores)
Concerned with	Quantification	Seeking Patterns & Comparison		
Systemic Content	Low	Medium	High	High
User	General	General to Expert	Expert	

measures are less concerned with absolute values and are more orientated towards seeking patterns in data and for making comparisons, either in relation to historical performance or with other systems or organisations (bench marking).

Implied in the table is the idea that simple systems can be controlled through the management of a few variables, but as complexity increases, so do the number of variables that have to be measured and managed. Rockart (1979) and Huotari and Wilson (2001) suggest that managers select from these innumerable variables, ones that they identify as being critical to the success of the system that they are managing. Concern over some of these variables or factors will be shared with others. Others though, will be either role related or unique to them, depending on how they see the situation for which they are responsible. From this, it follows they argue, information systems should therefore be designed with a focus on these *'Critical Success Factors'* and in recognition of the fact, that different people need different sets of information. Thus as complexity increases, the universality of measures used in simple systems changes. Measures become increasingly specific and bound by context and the choice of which measures to use becomes increasingly subjective.

The proclaimed objectivity of measures is further undermined by the amount of systemic content represented by the selected measure. As complexity increases, measures used represent aggregates of other measures. The choice of these sub-measures to include in an aggregate measure can be subjective in itself and the way in which they are combined can change the meaning attributed to the overall measure. For example Hornby (2007) has developed a single measure of complexity in structure and organisation. This measure is an aggregation of sixteen sub-measures which can be combined in eight different ways.

The way in which measures are aggregated affects the transparency and therefore the generality of understanding of the measure. Simple systems using basic quantification measures have the ability to be understood by everyone who can count: totals based in the *'concrete'* world after all can be agreed on. However, as the amount of mathematical abstraction increases in aggregate measures, and through this abstraction process increasing the distance from the *'real word'*, the transparency of the calculation and hence the shared meaning attributed to the measure declines. In other words, the complexity embedded

within the calculated measure limits the potential audience to only those who have the mathematical competence to comprehend the meanings and assumptions contained within the calculation. Logically therefore, measures should be kept as close to the raw data as possible to maintain shared comprehension.

Measures have so far, been discussed in terms of objectivity, transparency and generality of use (all decline with increasing complexity). Ashby (1956) and Beer (1979) however, propose the measure of *'Variety'*: a measure alluded to earlier, during the discussion of the Law of Requisite Variety.

Espejo et al (1996) define complexity as:

> *"... the property of a system being able to adopt a large number of states or behaviours." (Espejo et al 1996 p. 60)*

This definition of complexity is not one adopted in this thesis (Chapter 1), as it fails to suggest the ability of complex systems to produce emergent behaviours different to the sum of its parts. And it also confines complexity to state change, rather than recognising that part of complexity can be intrinsic to the system itself or dependent on how observers see situations. Neither does it make time explicit, without which the suggestion that systems can change or evolve through time is lost. Nevertheless, the definition provides a useful starting point to the discussion of Variety.

For Ashby and Beer, Variety is defined as:

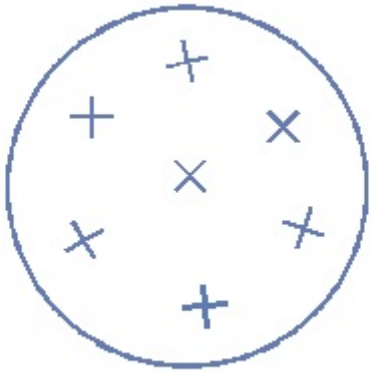
> *'... the number of possible states of whatever it is whose complexity we want to measure' (Beer, 1979 p.32).*

Consequently Variety is a simple quantification measure and in principle, this means that there is something that can be counted to a precise number, i.e. a number given to describing the number of possible states of a system. One distinct advantage of Variety is that by counting the number of states in different systems, unlike things can be made commensurable. However, given the nature of complexity, this number can quickly rise to

immense proportions. Beer (1979) in *' The Heart of Enterprise'* uses the example in figure 11 to show that Variety is both dependent upon the purposes ascribed to a situation by an observer - which can be counted - and the number of possible states of the system that can be adopted by the system.

Among six possible options that figure 11 could represent, Beer suggests the figure's purpose could be to exemplify a dynamic system, in which, at any one time, any of the directional relationships may or may not be active. Thus:-

Figure 11: An exhibit which depicts something or other.



$V = 2^{42} = 4{,}398{,}046{,}511{,}404$ or $(4.0 \langle V \langle 4.5$ million million)

As Beer points out, the six possibilities that he puts forward are not exhaustive of all the possible viewpoints or interpretations that might and could be placed on a system: the number is only limited by the imagination of the observer.

While the example appears rather abstract, it emphasises first, how inherent complexity in even a simple object explodes into further complexity of enormous proportions, particularly when the dynamics of a situation is taken into account. Second, it demonstrates the subjective complexity in the nature of what we observe: Finally, the illustration shows how situational complexity can be further complicated through the range of possible viewpoints taken of a situation. In the example, only six distinctions were made, though there could be many more. Some observers may make only one or two distinctions. Yet others might see

six or ten. And to make things more complicated, the distinctions made by one observer, may not be the same as those made by another. This becomes important in organisational terms where individual, group and organisational actions are the outcome of many conversations between people holding different viewpoints about a situation. The conversations between participants help others recognise distinctions and viewpoints that were previously unknown to them with the consequence that they can now see more states and hence more complexity in a system.

In *'real world'* dynamic interactions, Variety quickly rises to phenomenally large quantities. The *'largeness'* of such numbers for Ashby and Beer, make the subjective nature of observations inevitable. In other words, the Variety generated by systems is so large that there is no viewpoint which can capture the full Variety of the system observed: we have neither the time or the mental capacity to process and experience all the possible states in a situation. Reenforcing Johnson-Laird's (1983) work on mental models, Espejo et al (1996) argue that we constitute our reality, *"... where in metaphorical terms we only see a 'side of thing.'"*. Or as Felix Geyer (1996) quotes Waldrop in a discussion on paradigms *"all the blind men seem to have their hands on the same elephant"* where the *'side of the thing'* that we see, depends upon our mental model created from past experience and learning. So while empiricists like Rivett (1977) attack Variety as a subjective measure unsuitable for scientific work, the consequence of complexity make it clear that all measures are in the limit subjective. Nevertheless, the potential *'largeness'* of Variety measures can appear daunting. For his part, Espejo (1989a, 1997, 2011) prefers counting the number of distinctions that can be made and as Jackson (1989) notes, perhaps Variety's greatest usefulness lies in the heuristic role of comparing actual and potential Varieties between systems (Rosenkranz & Holten, 2011). It is easy to see for example, that a teacher is capable of occupying more states and making a greater number of distinctions than a single pupil. Conversely, a class of pupils has the potential to generate more Variety than a teacher.

Returning to Ashby's Law of Requisite Variety, first introduced on page 44. This law essentially identified that control can only be maintained if the variety of the controller is at least as great as the variety of the situation to be controlled; or in more prosaic terms *"only Variety can destroy Variety" (Ashby, 1964)*. How Variety can be used to create systems in equilibrium with one another is the subject of the next section.

2.2.2 Managing Variety

Zeleny (1986) believes that the Law of Requisite Variety reduces people to a machine like status. And Checkland *(1980)* regards Ashby's Law as trite and simplistic which may be of only limited relevance to machine based systems. For Checkland, the Law suggests quite unexceptionally that if a *'control system of any entity is to survive in a changing environment,* [then it] *must have a trick up its sleeve in response to every trick the environment can play on it.' (Checkland 1980 p.421)*. However, Checkland fails to acknowledge the power of *'Variety Engineering'* and the ability to *'leverage'* the capacity to generate multiple states on one side to match that of another larger system. He also makes the assumption that all the Variety generated by one side should be equally matched with the other at the same level.

Figure 12: Imbalances in variety

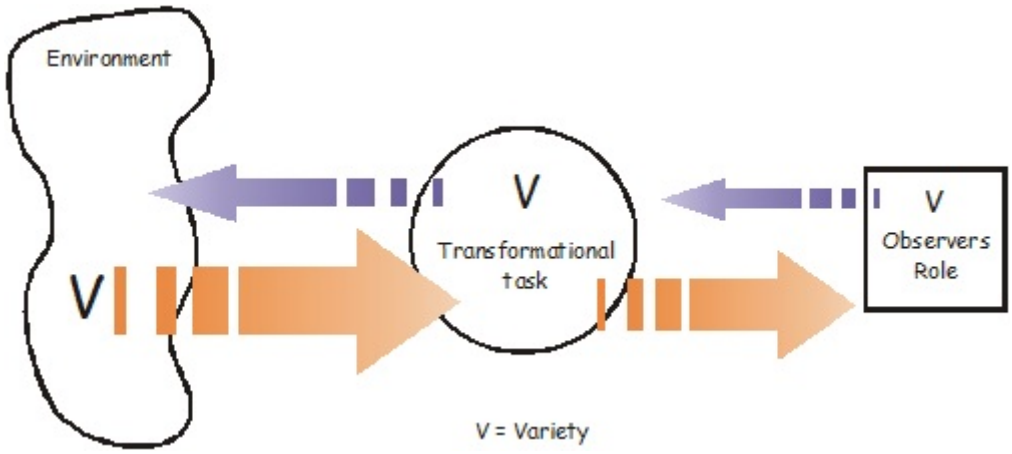


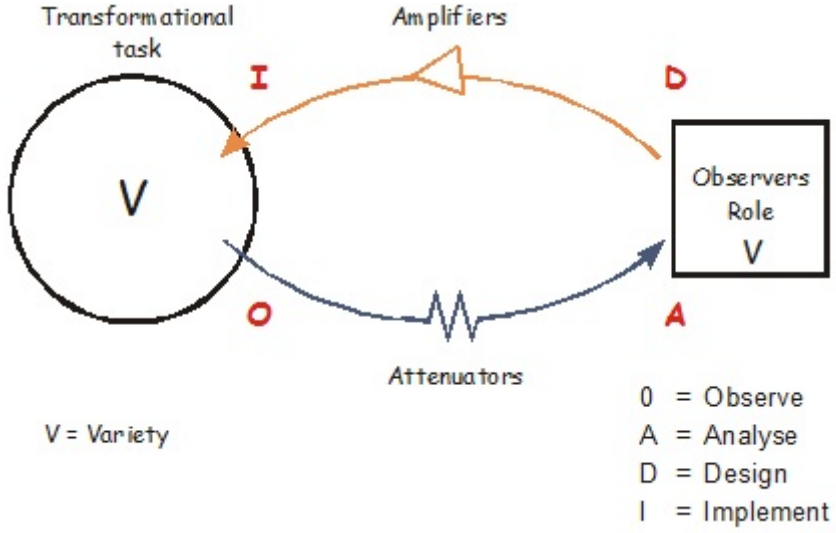
Figure 12 shows some transformational task unfolded from its environment in which it is embedded. The amount of Variety or number of states generated by the environment is considerably greater than that generated by the transformational task. The transformational task after all, represents a sub set of all potential states in the environment that an observer has selected to deal with, according to some purpose identified by the observer. In turn, the transformational task can produce a greater measure of Variety than the Observer, who has to perform actions in the operational domain to maintain the transformational task within the observer's criteria for success. Part of this success will be judged on how the products of

the transformational task feedback into the environment. For an individual, the environment includes other parts of the organisation or users of the transformational product. For an organisation, success will depend on how its products or services are projected and delivered into marketplace.

Despite the imbalances in Variety, the implications of Ashby's Law determines that they must be *'designed'* to equate through a process recognised as *'Variety Engineering*. Failure, will mean that the observer will always feel overwhelmed by oscillations in the transformational task and be unable to produce adequate responses to bring the transformational task under control. Beer (1979, 1981) and Espejo (1989, 1997) identify three major strategies, two of which are shown in figure 13.

One strategy they describe is *'attenuation'*. Bearing in mind that the consequence of complexity is that we lack the intellectual and time capacity to know everything about a situation, attenuation is the careful selection of measures and observations or *'filtrations'*

Figure 13: Strategies for dealing with Variety.



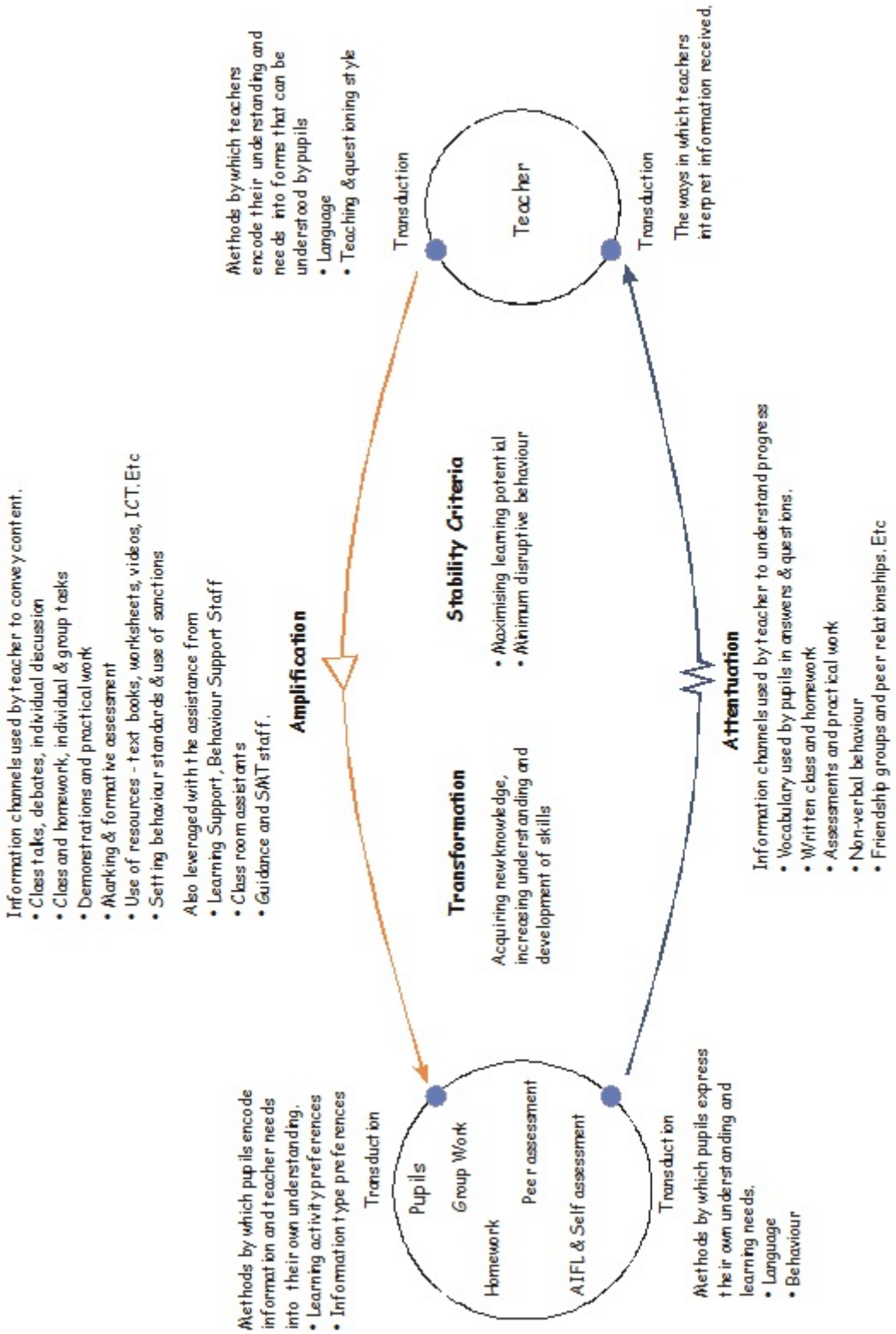
used by the observer, to make distinctions in what's happening in the task under their control (i.e. reducing variety). While ignorance is, as Espejo notes (1997) the greatest attenuator of all, the distinctions made from the totality of task states will depend on the mental models and conceptual frameworks of the observer. Poor or bad models of the task will lead the

observer to miss important distinctions, generate irrelevant ones and lead subsequently to inadequate actions. The other strategy they describe is *'amplification'*, where observer's or organisation's can *'leverage'* their response capacity (i.e. turning a decision into action) through the use of other people, organisations or technologies. Rather than suggest one to one matching implied by Checkland's criticism of Requisite Variety above, Espejo (1997) likens this process to jujitsu where an observer can throw an opponent many times more than their own weight and where the observer's strength is derived from their understanding of the situation.

Providing a link back to individual learning, figure 13 is overlaid with Kim's (1993) OADI learning model. The learning loop shows how observers can learn more about a situation, leading to improved mental models that make more relevant distinctions in the variety being generated by the transformational task. These in turn lead to improved actions and better performance. The third strategy for dealing with the Variety being generated by the task is to arrange things so that much of the Variety is cancelled out in the mutual interactions in the task or environment. Reyes (2006) describes an example of this strategy with a lecturer arranging for students to undertake independent group work. Through discussion students help clarify certain points to each other, and in this way the lecturer reduces the amount of Variety in the questions that may otherwise have to be faced if the class were to be addressed on a one to many basis. Reyes also describes how the lecturer *'amplified'* their capacity to deal with the students through the use of teaching assistants assigned to each group to help them deal with issues that may not be able to resolve for themselves.

Figure 14 is another example of Variety Engineering in the class room showing all three strategies at work. In the example, the teacher has identified the transformation in their task, together with criteria for success. Several examples are given of how a teacher may amplify their Variety to the class and how they may attenuate the complexity of class room interactions into their own understanding of the situation. Also shown are *'transducers'*. Corning (2001) points out that while Shannon's work in information theory describes the amount of information that may be carried in an informational channel, this information is

Figure 14: Variety engineering in the class room



free of meaning. *'Transduction'* is the process whereby meaning is attributed to information as it crosses system boundaries. So as Pollard (2005) indicates, teachers have to be careful of the language they use in the way they encode concepts into a form that can be understood by pupils. Language that is inappropriate, too high or too basic, can prove an obstacle to understanding. Similarly, in order to maximise learning teachers should take into account pupil preferences for particular types of information (text, graphic or audio)and learning activities. Teachers should also be sensitive to how they interpret the language and behaviour used by pupils as this can be a major source of conflict between teachers and pupils, as pupils express themselves in ways misunderstood by teachers. The concern with learning and sensitivity as to how information is interpreted at the heart of Ashby's law, places it a long way from Zeleny's view of it reducing people to machine like status.

While the purpose of strategies for handling Variety are aimed at assisting the observer or the organisation to reach equilibrium with the task or the environment, there will be occasions when the Variety of the task will exceed that of the observer. This left over or *'residual variety'* is then handled by other structural relationships within the organisation. In this way, Variety is filtered or dissipated through the organisation to manageable proportions. This is similar to Stacey's (2000) view of organisations that sees them as dissipative structures that absorb the energy put into them, except in this case, its complexity that is dissipated rather than energy. Failure to deal with the residual variety which may contain important distinctions to the organisation can threaten the viability of the organisation, so rather than being unexceptional according to Checkland (1980), the implications of Ashby's law are of considerable significance. How the organisational structure deals with or dissipates remaining complexity is the subject of the following sections.

2.3 Managerial Cybernetics and the Topology of the VSM

Cybernetics stemming from *'kybernetes'*, is the Greek for Steersman. The classic definition provided by Norbert Weiner describes cybernetics as:

> *"as the study of control and communication in the animal and the machine" (OED)*

However, there are alternatives and Umpleby and Dent (1999) describe how different interpretations during the emergence of the discipline in the early 1940's led to three distinct traditions. Laying down the foundation of Artificial Intelligence (AI) there is what they describe as *'Turing's Cybernetics'*. Then there is *'McCulloch's Cybernetics'* with its emphasis on neurophysiology and its attempt to understand knowledge through understanding the brain. The concept of second order cybernetics arises from this tradition through the work of von Foerster and Maturana and Varela. Finally there is *'Weiner's Cybernetics'* that focussed on teleological systems or systems less influenced by events in the immediate past and more by events in the future. This was expressed in Weiner's attempts to develop machines that would sense their environment and act in response to environmental changes. Ashby's Law of Requisite Variety and the Conant-Ashby theorem stems from work within this tradition.

While these traditions continue, concepts developed within them have been used to develop new different *'flavours'* of cybernetics. On a broad scale, there is *'Socio-cybernetics'* which uses cybernetic concepts merged with ideas from sociology to study regulation and control in large social systems (Geyer, 1996, Dijkum, 1996, Lee et al, 2000, Jung, 2006). At a more focussed level is Beer's version of cybernetics. Beer defines *'Management Cybernetics'* as:

> *"... the science of effective organisation." (Beer, 1985)*

Beginning with *'Decision and Control',* first published in 1966, Beer developed his ideas over the following twenty years on how organisations are able to maintain a separate existence or viability within a sustaining environment and in particular, how organisations should be structured for effective management. Using concepts on adaptive systems from within Weiner's Cybernetics and ideas on cognition and understanding from McCulloch's Cybernetics, Beer has developed the Viable Systems Model. This is a recursive self reflexive model that aims to show how goal seeking purposive systems should be structured in order to deal with complexity. The next section discusses how the VSM can be used before turning to a description of the model itself.

2.3.1 The Pathology of Viable Systems

Beer's (1979,1981, 1985) aim in producing the VSM was to produce a model of viability. Briefly, the VSM consists of five interrelated subsystems, each one of which has a distinctive role to play in the maintenance of viability. Using Occam's Razor or *'Law of Parsimony'* Beer argues that these five subsystems are the minimum required, under the criteria of *'necessity'* and *'sufficiency'*, to assure the ability of any system to maintain a long term existence. Viability as a prime objective of any system is an emergent property that develops from the relationships in the way that the five subsystems are linked together.

Beer's essential argument then, is that any viable system will conform to the structure of viability as defined by the VSM. This suggests that any system deficient in any of the five subsystems, or in their structural relationships, would not be viable. Consequently, almost by definition, such systems lacking viability would not exist. However, as Beer (1979) acknowledges, there are organisations that don't conform to the specifications of viability and further, some have persisted for considerable periods. Rather than accepting Popper's (1963) argument of '*falsifiability*' and accusations of *'non-science'*, Beer maintains that discrepancies between existing non-conforming systems and his model of viability, highlight areas of *'pathogenicity'* (Beer, 1979, 1984). This is where the viability of the non-conforming system is artificially maintained, only by and through the assistance of other systems. Beer uses the analogy of a patient on life support: the patient retains their viability, but only with the support of ventilators, intravenous drips etc. For organisations, the situation is perhaps not as dramatic as this, but where the viability of a system is maintained at cost to other systems, then these discrepancies represent areas of lost efficiency and effectiveness. If these discrepancies or *'pathogens'* are allowed to persist, then Beer argues that they represent a continuing threat to the long term viability of the organisation.

For Beer, it is the very fact that there are differences between his model of viability and existing organisations that imparts such a powerful *'diagnostic'* capability to the VSM. Furthermore, the principles on which the VSM is constructed, also imparts a powerful *'design'* capability. The argument for this goes broadly as follows. First the structure of the system whatever it is, is mapped onto the VSM. Discrepancies between the system as mapped, and the VSM model, identifies costs in terms of efficiency and effectiveness

(*'diagnosis')*. Second these areas of *'pathogenicity'* can be analysed in terms of variety engineering principles and improvements for the specific system *'designed'* with reference back to the VSM (Rios, 2010).

2.3.2 The VSM Model

Earlier sections referred to the VSM as being constituted of five interrelated systems that repeat in a recursive pattern. Here the role of each system is summarised.

- **System 1: Operations or Primary Activities** includes all the primary activities directly involved in producing the transformations in line with the purpose ascribed to the system by observers. In line with earlier discussions, Maturana and Varela (1980) refer to these, as autopoietic activities and the process whereby the primary activities constantly *'self-produce'* the system to which they belong as autopoiesis. As primary activities constantly self-producing the system, autopoiesis provides a constant affirmation of identity. In other words, whatever else is happening, this is what the system does. This is important for two reasons. Primarily because it indicates a fundamental goal and meaning of viability, i.e. viable systems are those that are directed at their own production. Secondly, it has implications for organisational design. If System 1 encloses all autopoietic activities, then the purpose of the system can be identified by what the system is doing in *'reality'*, as opposed to what observers might think it to be. The remaining or secondary activities not directly involved in autopoiesis are orientated towards the maintenance of the primary activities
- **System 2: Coordinating Activities** represents information channels between the management units of System 1 activities and also to System 3; the control function within the metasystem. Its role is to provide a coordinating function to prevent the different activities of System 1's from conflicting with one another.
- **System 3-star: Monitoring and Audit** provides the metasystem with direct access to monitor and audit the operations of System 1. This means that

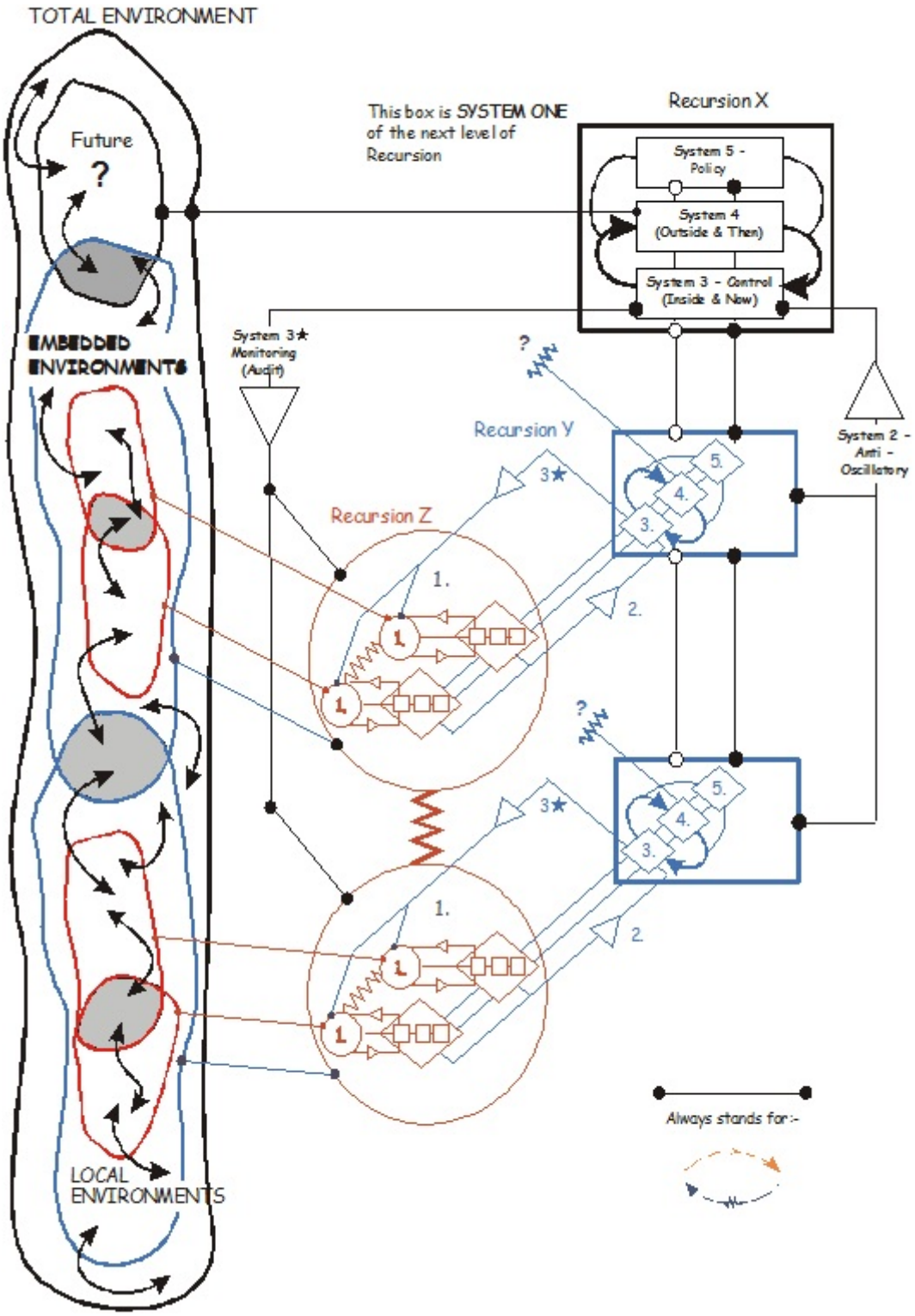
metasystemic management doesn't have to rely on information from the localised management of the primary activities.

- **System 3: Inside and Now** is responsible for the internal regulation of all the contained System 1 activities. From the preceding discussions it should be clear that it is the place where *'rules'* are established, where *'resource bargaining'* occurs and responsibility lies for the creation and management of System 2 and System 3★ functions.
- **System 4: Outside an Then** is *'intelligence'* function responsible for monitoring events in the environment and for anticipating future environmental states in order to generate possible future directions of the organisation. Typical System 4 functions include research and development, market research, and corporate planning. Whereas System 3 is focussed on internal operations, System 4 is orientated towards looking outwards to the environment to monitor how the organisation needs to adapt to remain viable.
- **System 5: Policy and Closure** is responsible for policy decisions affecting the organisation as whole and for providing *'closure'* to the working of the other systems. Beer (1979) and Schwaninger (1996, 2004) both suggest that the way in which System 5 operates has lessons for leadership.

Figure 15 shows how each of the systems stand in relation to one another in a complete model. Like Mandelbrot's fractals, the VSM, it is essentially a simple configuration made apparently more complicated by repeats of the same pattern through different levels of recursion.

The diagram shows three recursion levels, the red embedded in the blue and the blue embedded in the black. In each level, the topology of the VSM is invariant, which is to say the structure at any recursion level is identical to the one that it contains and the one IT, itself is contained in. This demonstrates that the VSM has what Havel (1995) describes as *'scale thickness'*. Similar to fractals, the VSM has infinite scale extension. No matter how deeply we zoom in or out, it always shows the same recurrent structure. In relation to viability, Beer formulated this principle as the *'Recursive System Theorem'* which states:

Figure 15: The Total Viable System Model



> *In a recursive organisational structure, any viable system contains, and is contained in, a viable system*. (Beer, 1979)

Understanding the recursive aspect to the VSM explains why the metasystem of Recursion X, is identified as being System 1 of the next higher level of recursion. The black operations circle that goes with the metasystem at Recursion X and would normally surround its System 1 activities, the management boxes at Recursion level Y (blue) has been omitted to avoid clutter. These boxes are the metasystem's to Recursion level Z (red). For the purpose of illustration, only two management boxes, i.e. metasystem's are shown at Recursion levels Y (blue) and Z (red). In a *'real'* viable system there could be many more than this, though as a practical point, Beer recommends that the number of primary System 1 activities at any one recursion level should conform to the *'seven plus or minus two'* rule. According to Beer (1979), more than nine, the Variety generated by each of the System 1 activities starts to become unmanageable for the management of the metasystem, causing them to over-attenuate and thereby losing perhaps critical information, or becoming too general in their amplification leading to information without content. Less than five, Beer considers is insufficient to usefully occupy the metasystem. In this case Beer recommends that an entire recursion level should be removed. However, as Beer readily admits, the application of this rule is contingent on the degree of inter-connectivity between the activities of each unit at any one recursion level. If the inter-connectivity is weak, then more than nine could be accommodated and visa versa.

The left-hand side of the diagram represents the environments in which each viable system operates and has to survive. Each recursion level operates within its own environment and these too, are contained in and contain other environments. As an aid, in figure 15, they are coloured according to their matching recursion level. The shaded areas iconographically represent environmental overlaps in the *'real'* world and the arrows indicate the interactions between them. Looking at Recursion X, System 4, a line is drawn that depicts the activities linking the metasystem at that recursion level to its current and problematic future environments. For the sake of clarity, and due to the limitation of the two-dimensional space, only the vestigial remain of this link is shown at Recursion level Y and has been omitted altogether at Recursion level Z.

Criticisms of orthodox management practice have focussed on the failure to perceive complexity and the systemic interrelated nature of things. Through the invariant topology of the VSM, Beer's model is directly orientated towards addressing this problem. Beer (1979), Schiemenz (2002) and Espejo (2002) all maintain that the recursive nature of the model, endows it with a powerful capacity for dealing with complexity. The nesting arrangement with viable systems successively embedded with one another forms a structure that dissipates the effect of environmental complexity as passes through the organisation. The exact means of how each recursion level is related to others, is solved in the modelling of the links between each metasystem and its respective System 1's: the circle of operations that encompasses all the activities of the next lower recursion level. So for Beer, the potency and the utility of the VSM is not just contained within its cybernetic logic, but is also due in large part to its invariance. A viable system Beer argues, no matter what it is, will always conform to this arrangement. If the model is valid and Beer believes the logic still remains to be refuted, then it's reasonable to expect structures of existing viable organisations to be congruent with the structure of viability as modelled by the VSM. This of course, in an educational context, is one of the intentions behind the research.

2.3.3 Management in Systems 5-4-3 Relationship:

Schwaninger (2000, 2004) and Schwaninger and Ambroz (2010) describe the cause of the tension between System 3 and System 4 and explain that it arises because each system is pursuing different sets of goal states and these goal states belong to different logical levels of management. He identifies these as:

- *Normative management*: Provides the ethical base of the organisation through reaffirmation of identity, purpose and values that govern it.
- *Strategic Management*: The discovery of potentials and creation of plans for their realisation.
- *Operative Management'*: The realisation of plans to achieve potentials and the delivering of value to stakeholders.

The relationship between these different levels of management to Systems 5-4-3 is shown in figure 16 or what Schwaninger describes as the *'Model of Systemic Control'* (MSC). The

Figure 16: Model of Systemic Control (MSC) (after Schwaninger, 2000)

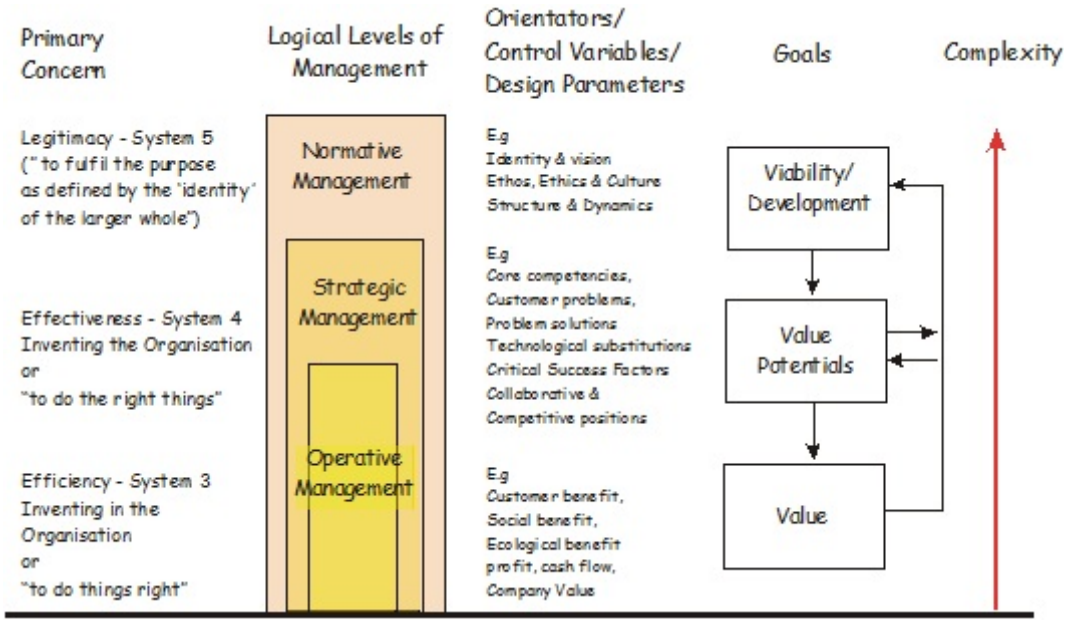


diagram shows how the primary concerns and goals of each system corresponds to each level of management. Some typical examples of variables used by each level/system to orientate themselves to their respective goal are provided. Schwaninger goes onto affirm that effective management of complexity requires that this model exists at each level within each level of the organisation.

With System 5, there no longer appears to be a logical need for further systems, reaching a point where the criteria of *'necessity'* and *'sufficiency'* to support viability has been satisfied. In other words, the emergent properties from the interactions of System's 1 through to 5, provide the viable system at the level being examined, the facility of self-organisation, self repair, self regulation, self production and self awareness.

2.4 Achieving wider recognition?

This section briefly considers some of the reasons why the VSM has yet to achieve wider recognition. Towards the end, the discussion is centred around the criticisms of Ulrich and Checkland, primarily because they make similar points although from completely different standpoints. Ulrich sees the VSM originating from within the organic or biological paradigm, while Checkland sees the VSM as representing organisations like machines. The end of the section, suggests that like the blindfolded men with their hands on the proverbial elephant, they are only seeing a single aspect of the VSM and are failing to appreciate Beer's theory in its entirety.

Since its original conception in 1972 with Beer's work in Chile (Beer, 1981), the VSM has been applied in a wide range of contexts. Though it appears to have been adopted as a tool by a number of consultancies, it has continued to struggle to find acceptance amongst the academic community. One reason, is the belief that the VSM represents a metaphor (Morgan, 1997). Beer (1984) however, has argued that the VSM is a scientific model rather than a metaphor, with foundations built on scientific principles that are logically necessary to manage complexity, in much the same way as Newton's laws explain gravity. He accepts, that under Popper's criterion of *'falsifiability'* there is no way of disproving the theory, but maintains that the continued application of the VSM adds to the sample of cases that support the theory in the same way that repeated observation of falling apples supports Newton's ideas about gravity. Nevertheless, under objections that organisations are neither machines (Checkland, 1981) nor organisms (Rosenhead 2001) the VSM has continued to be perceived as an organisational metaphor. In part this may be due to the method of its exposition and partly due to its representation.

Throughout his many writings about the VSM, but particularly in *'Brain of the Firm'* first published in 1972, Beer developed the model with reference to the human neurophysiological systems and electromechanical devices. And it seems, that it is in these terms, that the VSM has come to be understood, blurring the boundary between analogies used to explain the model and the model itself. Beer naturally argues that the VSM has an existence independent of any analogy used to explain the model, but in *'Heart of the Enterprise'* (1979) has continued to employ the biological metaphor to emphasise the

parallels in systems required to maintain the viability of living organisms and those needed in organisations to support their separate existence within their own environment.

The appearance of the model also reenforces the perception of the VSM as a representation of organisations as a mechanical or biological system and on encountering the total model for the first time can appear daunting. Resembling circuit diagrams or neural networks, the arrangement of circles and squares connected by straight lines appear to represent a certainty and *'hardness'* about things which are not reflected in real life. Especially in comparison to Checkland's (1981) *'rich pictures'* with their looping connecting lines aimed at capturing the messiness of *'real life'* problems. However, at its heart the VSM recognises that people make organisations and aims to show how organisational structure can be configured to support their relationships and work. Consequently, underlying these connections there is *'softness'* in their apparent *'hardness'*. To an extent Beer has attempted to capture this *'softness'* with the inclusion of hand drawn diagrams, particularly in *'Diagnosing the System'* (Beer, 1985) to demonstrate the flexibility, creativity and spontaneity with which VSM models can be developed. Others have also experimented with different ways of representing the VSM. Holmberg (1989) for example used cut out shapes which could be rearranged and connected by hand drawn lines on a background. Ultimately though, the apparent *'hardness'* of text book representations of the VSM has more to do with the problems associated with representing a three dimensional object in a two-dimensional space. Its use in *'reality'* is more likely to resemble the untidiness of Beer's hand drawn models.

Associated with its appearance, the VSM can be accused of being too complex. This apparent complexity is however misleading and comes from the recursive repetition of the five essential systems. As soon as the theoretical implications of the five systems and their invariant arrangements are understood, then it can be applied to any level of the organisation and show how one level relates to another, building up a holistic model of the complete organisation. The recursive nature of the model is therefore, a good example of an effective attenuator that helps reduce the mass of organisational complexity while retaining the ability to follow relationships up or down through successive recursion levels and across levels through systemic examination: features which are not readily accessible with other methodologies like Checkland's SSM.

It is true to say however, that a full appreciation of Beer's theory takes time and effort. There are subtleties and implications to each part of the VSM which require detailed explanation for full understanding, particularly with respect to the language used. Also, as Beer admits in *'Heart of Enterprise'* some systems, functions or roles in organisations don't lend themselves to easy categorisation, especially those involved in System 4 functions. With his work in Chile, Beer (1981) discusses the need to introduce the VSM to a cadre of specialists prior to its application. A similar preparation time of a few days has also been needed to introduce VSM concepts to core teams in other large scale projects involving amongst others the reorganisation of Hoechst AG (Espejo et al, 1996) and NatWest (Espejo, 1997). However, they do report that once introduced, the meta language of the VSM provides an extremely effective short hand method of describing systems in ways that can be easily understood by participants that perhaps regains time used in preparation. It's also not always necessary to convince others of the theory in the development of solutions. Informed by theory, possible solutions can be developed and explained to *'clients'* in the context of the problem rather than in relation to the theory. In Chapter 6 for example, attempts were made to explain the underlying theory to the solution developed in the action research project, but the focus of the SMT and staff remained on the solution itself and its consequences.

Criticising Beer's theory on the grounds that its richness takes time and effort to appreciate is misplaced. The desire for something that's simple and works, demonstrates a form of reductionism that shows a failure to understand the nature of complexity and is perhaps the one of the few points on which Beer (1996) and Checkland (1982) agree. As described earlier, complex systems have emergent properties not apparent in their component parts. By reducing the control of a system to a few key variables without regard to the wider system, risks as Beer points out, losing sight of perhaps the very property that needs to be controlled (Beer, 1996). Given that we interpret *'reality'* through mental models, then complex systems Beer argues, require equally complex models to manage them. Attempting to manage complex systems (high variety) with simple models (low variety) will inevitably lead to loss of control as complex systems occupy states that cannot be accounted for in the low variety models.

Jackson (1989) mentions the difficulty that some find in applying recommendations implied

in the model to practical situations. There is the assumption that the model must be applied in its entirety and that it's difficult to unpack in order to apply it to a single level or a single organisational aspect. To an extent this is true, but it ignores the two modes and the two step process that Beer describes how the VSM can be used. The first step involves applying the VSM in *'diagnostic'* mode to the system of interest. Espejo et al (1996) and Espejo (1997) describe how quickly using *'quick and dirty'* methods, organisational structures and processes can be captured with the VSM and even several different models can be quickly produced to reflect different points of view. The emphasis with these models is on *'description'* of systems which are after all, already in existence and on uncovering, in Beer's (1979, 1981) terms, *'pathogenic'* faults when compared to the idealised VSM model. In the second and longer step, the VSM can be applied in the second *'design'* mode to produce solutions to just tackle the pathogenic faults uncovered in the first step. Espejo (1997), for example, describes how a rearrangement of the relationships between NatWest's Lending and Service centres led to dramatic improvements in regional performance. It's also worth noting that this rearrangement occurred in the technological informational domain through the creation of virtual teams rather than a realignment of organisational units in physical space. A similar approach is used in Chapter 6 where a solution was created to tackle *'pathogenic'* faults primarily located in System 2 coordinating functions at all levels of recursion and yet left the existing organisational structure unaltered.

Other reservations about the usefulness of the VSM have their origins with Beer's work in Chile and his claims that the VSM is entirely consistent with the promotion of democracy (Beer, 1981, 1989). The VSM, he argues, encourages the decentralisation of power and control and the breakdown of traditional hierarchies. In the interests of efficiency, maximum autonomy consistent with systemic cohesiveness, should be given to successively embedded System 1's to allow them to deal with their relevant complexities close to the point of generation. This, in turn Beer maintains is entirely consistent with ideas of human dignity and freedom. On one hand this points towards one practical obstacle to the VSM achieving wider recognition as it implies loss and the handing over of power by those who have worked hard to achieve it. On the other hand Ulrich (1981) in particular and Checkland (1980) criticise the application of the VSM on the grounds of *'purposes'* and question the interests of those who might use it. Both point to fact that it can be used for authoritarian as well as democratic purposes. Ulrich (1981) for example, describes how the

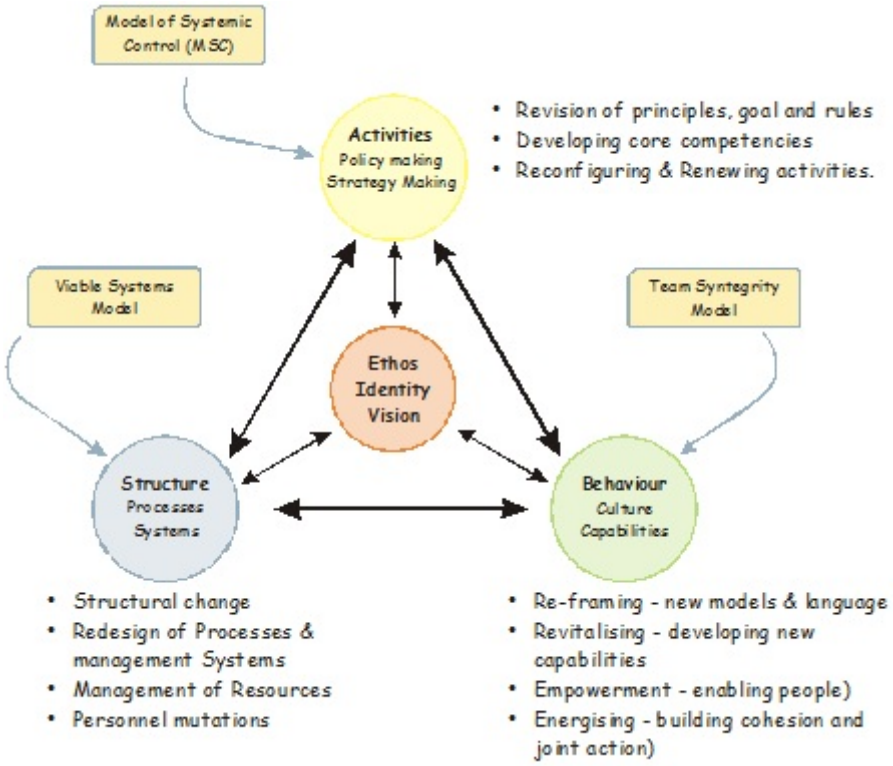
logic embedded within the computer programmes used to monitor outputs of the nationalised economy of Chile, exercised a form of tyrannical control over successive System 1's at each level of recursion, continuing all the way down to factory cooperatives. Monitored variables were decided at the top level of recursion and each recursion level had to maintain outputs within certain limits. If the monitored variables, say at the factory level, stepped outside the proscribed limits they had a certain time to bring them back under control, before alerting reports were automatically generated to the next higher recursion level and so on back to the top. Consequently Ulrich argues, even if the intention of top level - in case of Chile, Allende's government and the designer, Beer - is the promotion of democracy, the system can still result in tyrannical control through the need of contained System 1's to satisfy targets developed from the purposes established at the highest level of recursion. With respect to the way the VSM was implemented in Chile, Ulrich certainly has a point. Unfortunately, as Ulrich points out, the coup d'etat by Pinochet in 1972 denied Beer the opportunity to work through the implications of this and refine his theory.

Purposes, Ulrich (1981, 1993) and Checkland (1980, 1989) argue, emerge from negotiation and renegotiation between participants, each with their own appreciation and perception of *'reality'*. So rather than concentrating on the logical design of adaptive goal seeking systems, managers would find it more productive to create methods which encourage constructive debate for development of purposes. Checkland offers his soft systems methodology as way of arriving at an accommodation between different appreciative points of view, while Ulrich advances critical heuristics as way of widening participation in goal setting. In choosing to criticise Beer's ideas in terms of purposes, both Ulrich and Checkland have overlooked other aspects of his theory, possibly because of the way it was implemented in Chile, possibly in the interests of advancing their own theories and maybe because of Kuhn's (1970) *'paradigm in-commensurability'* prevents them appreciating the full scope of his theory.

Schwaninger (2000) brings together the various concepts of Beer's work in figure 17. Checkland and Ulrich in their criticisms, have focussed mainly on structure, processes and systems aspects of organisation as represented in the overall configuration of the VSM. They have failed to see the implied Model of Systemic Control (MSC) - discussed in section 2.3.3 and shown in figure 16 (page 83) - that emerges from the System 5-4-3 interaction.

Contrary to Checkland's (1980) assumption that the VSM imposes a unitary viewpoint, the MSC relies upon the fact that each system necessarily has a different appreciation of *'reality'* because of their different perspectives on the organisation and it is assumed that each participant within each system may equally have a different view. Nevertheless, a

Figure 17: Integrating Beer's Concepts (after Schwaninger, 2000)



sense of common purpose ends up being ascribed to the System 1 or the primary transformative activity of their concern through the System 3-4 debates, whereby each System seeks accommodation with the other's appreciation of *'reality'* with reference to the normative values represented in System 5. It is in these debates where participants provide *'semantic'* meaning to one another's *'syntactic'* information; a difference that Ulrich (1981) mistakenly believes cannot be accounted for by the VSM.

While the MSC, which exists at each recursion level of the VSM, reveals how a common sense of purpose can emerge from accommodation between different appreciative systems, satisfying Ulrich and Checkland's demand for constructive debate for the development of

common purposes, the final aspect of Beer's work includes Team Syntegrity (Rios, 2012). This is a method particularly suited for large groups (Beer, 1994, Leonard, 2006) for supporting the System 5-4-3 interaction. Team Syntegrity though is just one method. As described in previous sections other methods can also be used, including both Checkland's SSM (1981) and Ulrich (1993) critical heuristics.

Finally, returning to a more practical issue preventing wider use of the VSM. Up until recently there lacked a clear methodology to guide its systematic and systemic application. Ulrich (1981) saw this as a major failure of Beer's work in Chile and warns of the hegemony of the expert. This is the situation where solutions are developed and implemented according to how the expert sees the world, irrespective of how the participants see it: a situation which develops as the expert lays claim to privileged knowledge not available elsewhere in the organisation. However, since the development of the Cybernetic Methodology (Espejo 1989a, Espejo et al, 1996, Espejo 1997) as an action research methodology, discussed in detail in the next chapter, there now exists a process where solutions can be developed in partnership with organisational members.

2.5 Summary

This chapter has focussed on how organisations deal with complexity. It began with a conception of organisations as a collection of systems and by describing how they come into existence in order to fulfil some purpose. These Human Activity Systems, it was argued, could be organised and structured in different ways and a number of metaphors were given to show the essential characteristics of these different forms. The metaphors were grouped according to different paradigms which they represented, to provide three main perspectives on organisations - machines, organisms and social systems. Recognising Kuhn's (1970) issues with *'paradigm in-commensurability'*, and avoiding attempts to reconcile the differences between them, the way organisations from within these different paradigms dealt with complexity was discussed. These discussions were used to highlight a number of different cybernetic concepts with the clear implication that all organisations, whether they have been aware of it or not, have been using aspects of cybernetics in the management of complexity.

Following the elucidation of strategies used by organisations to deal with complexity, some measures of complexity were discussed with reference to objectivity, transparency and generality of use (all decline with increasing complexity). Instead of using complicated mathematical techniques which have the effect of excluding users and disconnecting the measure from the *'real'* world, Variety was offered as an alternative measure which relies on simple counting. It also has the capacity of making all unlike things comparable. Through an extended example, it was shown how Variety quickly rises to enormous proportions. This explained why, it was suggested, we cannot experience the *'real'* world directly, but instead have to interpret it through mental models we have of situations which incorporates our understanding of the way the world works.

While absolute measures of Variety have perhaps little practical use because of the large numbers involved, its greatest value lies in the relative differences between different systems. From Ashby's law it was suggested that the Varieties between different systems should be designed to equate. Introducing the concept of Variety Engineering, a teaching situation was used to highlight the three main strategies that could be used to deal with the differences between in Variety between systems.

The central theme running throughout the thesis is that complexity arises through change and the rate of change is increasing. Consequently, organisations should organise and structure themselves in a way to deal with this complexity. Beer, it was shown, sees this in terms of viability and organisations cease to exist or experience difficulties when they fail to adequately manage complexity. He describes the study of the viability of organisations as *'Management Cybernetics'*.

In order to examine how organisations are configured to deal with their related complexity, Beer has developed the VSM; a recursive self reflexive model that aims to show how goal seeking purposive systems should be structured in order to deal with complexity. The purpose and epistemology of each of the five systems, Beer identified as *'necessary'* and *'sufficient'* to support viability was discussed. The VSM relies upon decentralised autonomy and authority for effective management of complexity and shows how the tensions involved in adaptive behaviour can be resolved.

Finally, it was suggested that many of the criticisms of Beer's work are founded on an inadequate appreciation of the different aspects of his work with the VSM. Critics, have tended to perceive the VSM in terms of its impact on the structure and processes of organisations and therefore make claims to its *'machine'* like treatment of individuals. They fail to appreciate how the interactions between the systems of the VSM relate to management activities or how shared concerns, responsibilities and commitment to action can be created through such mechanisms as the *'Team Syntegrity'* model. Neither do they appear to appreciate that each of these three different aspects are in operation at each level of recursion of the organisation.

The next chapter looks at methodologies used in the research to map a school onto the VSM to see how it is configured to deal with complexity and to develop an application aimed at providing requisite variety to identified recursion levels and to the organisation as whole.

Chapter 3: Research Methodology

The first part of chapter 2 examined some of the strategies used by organisations to deal with the *'phenomenon'* of complexity. Using Flood's (1997) terminology, the second part laid out the framework (F) or the set of linked ideas embedded within the VSM. This chapter, considers some of the methodologies or ways of applying these ideas (M) within the application area (A) of educational management. As suggested in the last chapter, the essential purpose (P) is discover the extent to which school management conforms to the idealised configuration of the VSM as way of dealing with complexity.

This chapter begins with outlining the main strategy used to guide the research. Later, another methodology used in the analytical stage is discussed, when the research became more action orientated to take advantage of opportunities to apply aspects of the VSM after uncovering *'failures'* in the way complexity is managed. Similar to Checkland's (1981) Soft Systems Methodology (SSM) this Cybernetic Methodology (CM) or what Espejo et al (1996) and Espejo (2002) have come to call VIPLAN, is focussed on a cybernetic method for studying organisations. Broadly the entire process mirrors Koffman's OADI cycle of individual learning (Kim, 1993). After observation (O), the cybernetic methodology (CM) is used at the analytical (A) stage to design (D) and implement (I) an intervention to overcome individual and organisational barriers to learning in an organisational setting.

3.1 Case Study as a research methodology

Within education, quantitative research methodologies are very much the norm. These are used to research a wide range of issues, for example from investigating the differences in attainment between boys and girls (Powney, 1997, Forde et al, 2006) to the effects of using ICT in schools (Lancaster, 1988). Essentially, these methods rely on quantitative data obtained from samples selected from the general population of interest. This data, subjected to various statistical techniques is used by investigators to make certain inferences from the data to confirm theoretical propositions or generalise new theories about the population as a whole. The confidence with which these generalisations are expressed is mostly contingent upon the size and internal variation within the population and the sample. Underlying this

strategy and form of statistical variation is a positivist philosophy that broadly sees the world as external and objective. Accordingly, investigators perceive themselves as being independent from what they observe and that the science behind their investigations is value free (Easterby-Smith et al, 1991)

In contrast, the research strategy selected for this inquiry is the case study approach described by Yin (1994). Yin doesn't describe the case study strategy in relation to the focus of the investigation, for example as a method for studying decision making processes etc. Rather, Yin defines a case study as a form of empirical inquiry that: -

> *"… investigates a contemporary phenomenon within its real life context, especially when the boundaries between* **[the]** *phenomenon and context are not clearly evident" (Yin, 1994 p.13)*

For Yin, the particular strengths of the case study as a method of inquiry lies in its ability to: -

- *"cope with the technically distinctive situation in which there will be many more variables of interest than data points,*
- *and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion,*
- *and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis" (Yin, 1993 p.13)*

Thus, for Yin, the case study is more than just a data collection tactic. Under his definition the case study is a comprehensive research strategy with its own internal logic of design that incorporates specific approaches to data collection and analysis.

3.2 Other Features of the Case Study Approach

The case study as a methodology selected for this inquiry is also distinguished from other more quantitative type methodologies in its relationship between data and theory.

While survey type strategies rely on statistical generalisation, the case study approach uses a method of *'analytical generalisation'*. As Yin (1994) argues, the significant difference is that with analytical generalisation, *'cases'* are not the same as sampling units or equivalent to respondents as in a survey. Instead, case studies are selected on the same basis as a laboratory investigator selects the topic or subject of a new experiment. With analytical generalisation a previously developed theory, in this instance Beer's model of organisation, is used as a template to compare the empirical results obtained from the object of the case study (i.e. the school). If the results are shown to support the theory then *'replication'* can be claimed.

Another feature of the case study approach lies in the philosophy underlying its conduct. Yin bypasses the qualitative versus quantitative debate by arguing that the choice in selecting a research strategy is more dependant upon the nature of the study questions than on adherence to a particular ideological or philosophical basis. In support of his pragmatic approach, Yin shows it is reasonable to expect case study and historical research to include both quantitative and qualitative evidence. Conversely he also shows it is legitimate for successful experimental or survey research strategies to rely on qualitative evidence. Examples include experimental approaches into psycho physical perceptions or surveys that require categorical rather than numerical responses. Despite this however, the conduct of the case study will be from a phenomenological perspective examining as it does, the phenomena of complexity. Contrasting with positivistic beliefs and consistent with the definition of complexity, the phenomenological viewpoint regards the *'real'* world as a social construction. Instead of an objective *'reality'*, phenomenologists view the world as being entirely subjective. Furthermore, it is assumed that science is driven by human interests and far from being independent from what is being observed, as in the classical approach to science, the investigator is assumed to be part of what is observed. (Easterby-Smith et al, 1991).

The philosophical beliefs underlying the case study are highlighted here for two reasons. First, the idea that it is possible for different people to have equally *'valid'* viewpoints or interpretations of the same fact, event or system, is in accordance with Ashby's Law of Requisite Variety. This consistency of approach is important because the law is the ultimate foundation upon which Beer's theory of organisation is built. Briefly, the law contends that *'reality'* is so complex, that an observer cannot capture the complete *'truth'* of a situation. Instead observers are constrained to selecting only those parts of the *'truth'* that has meaning for them and the meaning that they ascribe to what they observe is dependant upon their mental model or understanding they have of how the world works. This mental model is of course, according to Ashby's law, is a necessarily an incomplete reflection of *'reality'*. While this emphasises the subjective nature of the world and the involvement of the researcher, it also has implications for methods of data collection and analysis and the procedures for ensuring the validity and reliability of the case study.

The second reason for bringing to attention the philosophical basis on which the case study is conducted, is to make explicit an apparent paradox. While Ashby's law is consistent with the phenomenological basis to the case study, both Beer (1981) and Waelchli (1989) contend, and this is the paradox, that this law is to social science what Newton's laws are to physics. For Beer, Ashby's law explains *'why'* the world can only be seen in subjective terms, irrespective of any formal philosophical debate, i.e. it is because of the operation of Ashby's law that leads to the validity of the phenomenological viewpoint. For laws to qualify in the scientific sense of being both explanatory and predictive, requires a positivistic and deterministic frame of reference. To the extent that the case study is focussed on clarifying the management processes and of how schools are structured in order to satisfy Ashby's law, then this aspect of positivism is retained.

3.3 Form of the Case Study and Unit of Analysis

In addressing the research questions to discover how schools are organised to cope with complexity and the extent to which the organisation conforms to Beer's theory, the research concentrates on a single case. As defined by Yin (1994), this single study is regarded as a *'critical case'* for testing Beer's comprehensive theory. This method of treatment is analogous to the type of critical experiment conducted in laboratory conditions used to

confirm, challenge or extend a well developed scientific theory. Similarly Beer's theory is constructed with a set of clear propositions arising from the condition of increasing complexity. If, like the results from the critical experiment, the case study can be used to determine whether the propositions are correct, then Beer's theory can be considered to have been corroborated. That the theory can be extended to other schools will be argued on the basis of *'replication'* as shown by the empirical results from this single case.

The legitimacy of using this critical case study approach is derived from two principal reasons. First, it is partly due to the logic of analytical generalisation and the nature of the critical experiment. Second, it is due to the nature of the theory and the phenomenon being studied. Ultimately, Beer's theory of organisation (Beer, 1979, 1981, 1985) rests upon the idea that organisations should be structured in a specific way (i.e. according to the format of the VSM) to cope with the condition of complexity. Beer proposes that failure to correspond to this format results in a threat to the organisation's viability in the long term posed by the short term effects of lost efficiency and effectiveness. The generalisability of this theory relies first upon Beer's point that the condition of complexity facing organisations is universal, regardless of the actual form complexity takes. Second, the theory only specifies that a viable organisation should contain certain systems and that these systems should have particular relationships with one another. Though the theory incorporates criteria against which they can be assessed, the contents of the systems and the actual processes linking the systems together are not specified. These are being taken as being contingent on the exact purpose and identity of the organisation. It follows therefore, that if the theory can be confirmed in the critical case, then its legitimate to generalise the validated VSM structure to other school organisations. This acknowledges that although the precise system contents, processes and relationships will vary from school to school according to the nature of the complexity they individually have to deal with, the arrangement of the systems with respect to one another will remain the same.

With regards the specific form of the case study, one of the principal aims of the research is to build a *'holistic'* model of how the school is structured and organised in order to cope with the complexity it faces. Despite this intention and the proposition that the phenomena of complexity pervades the entire organisation, the case study will nevertheless include multiple units of analysis. This form of *'embedded case study design'* has been selected for

three significant reasons.

First, while Beer's theory is concerned with the global nature of organisations, one of its theoretical proposition is that organisations consist of a number of logical activities related together through a series of recursion levels. To ensure viability, these logical sub-units should exist at an appropriate recursion level in accordance with how the organisation deals with complexity and congruent to its purpose. For efficiency and to support effective collaboration between the sub-systems within the whole, they must be linked together by mechanisms that meet the requirement of Ashby's law. It is argued that this ability to relate the various units from the individual to the entire organisation, is one of the greatest strengths of the theory. In existing organisations, such as the school used as the subject of the case study, these sub-units and recursion levels may be entangled and blurred. Therefore a major first task of the research is to discover and disentangle these activities and then to examine the extent to which they conform to the theoretical proposition contained within the theory. Rather than use any clustering or sampling techniques, the method by which the sub-units will be identified with follow Espejo's cybernetic methodology described in later sections.

A second reason for using an embedded case study approach is that experience in school has shown that there are indeed logical sub-units that together form the whole organisation. These can be loosely recognised as the individual, departmental team and the senior management group. However it is not assumed at the outset of the case study that these will be the actual embedded units of analysis. This is because the research is focussed on the structure and processes by which the school deals with complexity, and the way that it does this, may or may not correspond to the organisational chart.

The third reason for using an embedded case study design is that it provides the means for linking operational detail in the object of study with the phenomena of complexity to overcome what Yin (1994) considers as two justifiable criticisms of the case study approach. One, is that discussion of *'whole'* organisation at a *'holistic'* single level results in data being treated at an abstract level, disconnected from the actual point at which it's generated. Another is that complete case study description can result in slippage between the actual conduct and orientation of the research and the initial study questions. According

to Yin, using an embedded case study design helps retain the focus of the research on the study questions. However, as Yin point out, this can expose the researcher to the risk of getting over involved with one unit of analysis, forgetting to return to the larger unit. This danger will be avoided through the use of the VSM which operates as a template for the critical case study.

Another disadvantage implicit in the case study research strategy (i.e. single case with embedded units of analysis.) as described so far, is the danger of misrepresentation. This is the risk of forcing data to fit the theory or bias introduced in the data collection process where only data that supports the theory is gathered. Alternatively, the data collected maybe incomplete or irrelevant, failing to describe the actual processes and events occurring in *'reality'*. For these reasons, the discussion in the following section is concerned with the sources of data and the procedures used for ensuring the validity, completeness and reliability of the case study.

3.4 Construct Validity and Reliability: principles for data collection

From the nature of complexity arises the idea that there will be different viewpoints on any situation, all of which can be equally valid. This accords with the phenomenological stance underlying the conduct of the case study which assumes a socially constructed and subjective *'reality'*. Compared to other contrasting research strategies (e.g. survey type), this has significant consequences for how the data is collected and analysed.

- Knowing what data to collect. This is especially significant with a phenomena like complexity where the boundaries between the factors that lead to its emergence, the way its perceived and the way that it's managed are blurred and tangled.
- Knowing whether the gathered data is actually representative of both the observed situation and the claims subsequently made for it.
- The logic that supports the case study approach. Earlier sections discussed the principle of analytical generalisation whereby *'replication'* can be claimed if the data supports the theoretical propositions. Claims of replication are only justifiable if exactly the *'same'* case study can be repeated by another researcher, who following the same methodology arrives at the same conclusions.

Together these issues for the single critical case revolve around concerns for the construct validity, internal validity and reliability of the case study. So before detailing the methods used to collect the data, the remainder of this section is focussed on principles used to ensure the construct validity and reliability of the data collected. Although closely intertwined with data collection, procedures for ensuring the internal validity of the data is covered in the next section.

Using *'multiple sources of evidence'* is one method Yin (1994) describes for ensuring construct validity and reliability and this relates to the status given to data at the point of capture. During its collection, data from whatever source is treated with scepticism. Only when data is corroborated from another source will it be included as part of the evidentiary base, with the result that findings or conclusions arising from the research is based on more than one source of evidence. The effect of this approach is to add to the accuracy of the case study, as essentially the strategy of using multiple sources of evidence provides multiple measures of the same phenomenon. Removing researcher bias and supporting the construct validity of the case is the aim Miles and Huberman (1984) ascribe to using multiple sources of evidence or *'data triangulation'* to converge on substantive facts.

Maintaining a separation between collected data or the evidentiary base and the case study report is another method for supporting the reliability of the completed case study. This method is similar Yin (1994) argues, to classical scientific practice where a distinction is made between the results of an experiment and their analysis. The overall aim of this separation, Yin believes is to create a situation where independent researchers could review the data directly, develop their own conclusions and compare these to one made in the final report.

- Case study notes forming the core of the evidentiary base. Derived from conversations, interviews, observations and documents, these notes are in a variety of forms, ranging from hand written or typed notes to cognitive maps and preliminary models. Regardless of form the notes are generally descriptive, describing either the researcher's observations or those obtained from a respondent. To retain their *'freshness'* and limit the effects of post rationalisation of the researcher, forcing the data to fit the theory, the notes are made either during the course of conversation or immediately soon after.

Where the notes are typed, emphasis is given to maintaining the notes in the rawest form, with editorial changes limited to making the notes presentable.

- Narratives or commentaries. Distinct from the case study notes in that they are orientated towards the researcher's own interpretations of the data contained within the notes. As such, the narratives are an integral part of the analytical stage where the aim is to provide the researcher's own answers to the study questions. In composition, the narratives are linked to the sources that provides the researcher with the evidence that leads the researcher to the initial interpretations of the data. There is a two-fold purpose to the narratives. First, by documenting and making connections between specific pieces of evidence, the narratives in a modified form provide the core of the case study report. Second, reflections in the narratives maintain the *'chain of evidence'* that enable other researchers to follow the sequence from the raw data to the presented findings and conclusions.
- Documents or tabulated materials collected in the course of the case study. If obtained in specific situations they are cross referenced to the case study notes. They are similarly referenced if they are included in the narratives.

The case study notes, narratives and documents are all orientated towards meeting the overall strategic aim of increasing the reliability of the case study. In combination the intention is to satisfy what Yin (1994) and Miles and Huberman (1984) describe as *'maintaining a chain of evidence'* so that other researchers could follow the derivation of evidence from the initial questions through the analytical stage to the final conclusions.

The last strategy used to ensure construct validity and reliability was to have key informants review the draft case study report. Feedback from two senior staff members in the school was used to ensure bias was eliminated and that the case study was an accurate reflection of their understanding of the case.

3.4.1 Sources and Methods of Data Collection

A fundamental idea behind the research includes the view that organisations are purposeful and that they should have a structure that supports effective joint action to help the organisation achieve its strategic aims. Given organisations are created and shaped by

organisational members, as opposed to having an existence independent from them, a major task of the research is to uncover what view members have of their organisation's purpose and how they relate their activities with those of others. Other tasks include examining whether the processes and mechanisms actually used in the organisation have any relation to the formal procedures and stated aims, and the extent to which either correspond to Beer's theory of viability. For these reasons the process of data collection will concentrate on the various sources and methods of data collection. These include: -

1. Documents.
2. Organisational participants including staff, pupils, council educational advisors and members of HMIE.
3. Observations.
4. Personal experience as an organisational employee and object of council and school initiatives.

3.4.1.1 Documentation as evidence

Table 10 lists some of the strengths and weaknesses given by Yin (1994) and Easterby-Smith et al (1991) to using documents as evidence.
In order to minimise bias, any inferences based on documentary evidence will have to be

Table 10: Documents as evidence

Advantages	**Disadvantages**
Stable and allow repeated viewing	Danger of bias reflecting the purpose of the author(s)
Unobtrusive and not created as part of the case study.	Danger of incomplete collection

supported by data obtained from other sources using the principle of *'triangulation*'.
Following a technique recommended by Yin to address the possibility of bias introduced through partial collection, is to have a plan in advance that details the kinds of documents to be collected together with reasons for their collection. With many documents in the public domain, issues surrounding the retrieveability of the documents are expected to be minimal and will be collected over the course of the study.

3.4.1.2 Externally Produced Documents

These fall into a number of categories:

- Documents that specify the duties, responsibilities and legal obligations of the school laid down by government and local education authority with the aim of establishing some of the constraints the school has to work within and the extent to which they impact on the work and structural relationships in the school.
- Documents that provide prescriptive advice to school management in order to assist them in implementing policies to help establish the character of the broad educational landscape and assist in corroborating management justifications for particular decisions and actions.
- *'Directive'* documents aimed at particular schools, for example HMIE inspectorate reports with the aim of obtaining an independent evaluations of the *'site'*.

3.4.1.3 Internally Produced Documents

These include documents produced for external consumption and those intended for internal use.

- The *'internally produced for external consumption'* category includes statistical reports on the performance of the school, financial and planning reports, other formal reports dealing with the transmission of information to other government and local authority agencies, communications with businesses and associated primaries and finally documents relaying information to parents. The aims in collecting these documents is to:

    - Establish the complexity faced by the organisation in terms of the range of external stakeholders and the demands that the school has to communicate with and satisfy.
    - Identify the constraints the school has to operate within and the resources they have available.
    - Corroborate other sources as to the roles, functions and responsibilities of particular individuals as well as the levels where decisions can be taken.
    - To assess the suitability of the mechanisms which the school uses to communicate

with external stakeholders.

- Provide as starting point to trace back into the activities to corroborate and confirm organisational routines and procedures.

- The, *'internally produced for internal consumption'* category includes statements describing the school's purpose as well as its aims and objectives, policy statements, minutes and plans, documents that detail the routines and procedures of the school. The aim in collecting these documents is to: -

  - Assist in establishing the nature of the internal complexity of the organisation.
  - Obtain a formal record of the purposes, aims, plans and routines of the school and reveal the *'theoretical'* mechanisms the school uses to manage the complexity of its activities.
  - Clarify the structure of the school in terms of its component parts, the responsibilities and constraints on each part and how they are all related together to form a coherent whole.

3.4.2.1 Participants as evidence

Initially, the intention was to utilise the strengths of the formal interview technique, exploiting some of the advantages described by Yin (1994) and Easterby-Smith et al, (1991) taking care to avoid biases introduced by the method Yin (1994) and Miles and Huberman (1984) - see table 11.

With limited time frame of a teaching period (50-55 minutes) available for interviews the initial intention was to follow a semi-structured format with topic headings providing starting points to lines of questioning. To reduce bias in the process, the emphasis in interviews was to be on detecting what respondent's recognised as interruptions in their normal flow of action.

Table 11: Strengths and weakness of the interview technique

Advantages	Disadvantages
Can obtain multiple perspectives on the same event and richer insights into routines, processes and working practices when compared to questionnaires or surveys	Pre-prepared carefully considered list of questions, while reducing interview bias, had the possibility of leading to stilted interviews
Can focus questions on selected topics.	Lose the advantage of being able to pursue interesting lines of inquiry as they arise.
	Open-ended interview has a high risk of digression and is time consuming.
	Bias introduced through poorly constructed questions

The focus on problem solving was aimed at separating the respondent's espoused practice from actual practice and uncover the structural relationships with the rest of the organisation. It would also enable the examination of Beer's theory that such interruptions are partly the result of dysfunctional organisational relations. Furthermore, the tactic of focussing on the respondent's problems and the situation as is, was directly aimed at encouraging the respondent's cooperation by reducing the possibility of any perceived threat or implied criticism felt by the interviewee.

Two methods were to be used to *'capture'* information during the semi-structured interview.

- Interviews were to be recorded and transcribed afterwards. As teachers are frequently observed by pupils and others on a regular basis, it was anticipated that objections recorded interviews would minimal given assurances with respect to the confidentiality.
- The contemporaneous building of cognitive style models or maps using methods described by Eden (1989) and Ackerman et al (1990). To aid the recording process and guide the interview, skeletal maps were prepared in advance, with topics providing the bones of the model. In this role, the skeletal model was expected to perform a similar function to the empty data shells recommended by Yin (1994) and Miles and Huberman (1984). As the interview progressed data was to be added to the initial model in the form

of annotations, building up a record of the interview. The graphical format was expected to enable easier identification of relationships in the emerging data and easier identification of possible interesting lines of inquiry, allowing the researcher to follow them to their logical conclusion. The developing model was also expected to clarify for the respondent, the researcher's intentions and reassure them as to the motivations behind the research and thereby encourage their active participation. Increasing the completeness and reliability of the information was another reason for using this method. Sharing the developing model with the respondent was expected to act as a stimulus to trigger further recall and to make sure inaccuracies were corrected at the point of capture.

For the analytical phase of the case study, the developed models were to be the primary source of data with the recording working as a backup of the actual interview and help support the chain of evidence. It was also hoped that the model building process would free the researcher from the concern and mechanics of the recording process and give greater opportunity for reflection on the information provided by the respondent as the model developed.

Using the methods described, some pilot interviews were conducted which revealed some significant flaws in both the interview method and in the data *'capture'* process.

- Interviews took much longer than anticipated and were never completed within the time limit, principally, because they were always subject to continuous interruptions from pupils or by other members of staff.
- Revealed demonstrated a degree of naivete by the researcher about the sensitivity of information provided. Respondents failed to make the distinction between the behaviours of individuals and posts or functions they were expected to perform. Descriptions of interruptions in their flow of action was frequently provided in form of personalised *'stories'* that often showed others in a *'bad light'*. At these points, the respondent would switch off the recorder and prefix comments with statements like *"Don't write this down, but..."* and it was noticeable that respondents were much more forthcoming when the recorder was switched off. This mix in the way information was delivered, made disentangling the *'personal'* from the actual *'facts'* in the contemporaneous building of cognitive models difficult and reenforced the view that this

is a method best reserved for expert users.

The practical difficulties encountered with the interview process resulted in a change of approach. Originally, in an effort to minimise researcher bias and subjectivity, the intention was to operate as *'independent observer'* maintaining a separation between the researcher and the evidence through the method of inquiry. But as experience with the pilot interviews showed, this was going to be difficult to achieve so a decision was made to fully acknowledge and accept the position of shared employment and approach the evidence from the role of *'researcher as employee'*.

As Easterby-Smith et al (1991) describe, this methodology has its roots in ethnographic studies where the researcher works alongside other members of the organisation and has the advantages of: -

- Providing greater insight into the dynamics of the system through working within the same structure, sharing similar experiences and being subject to the same routines and processes as other members.

- Ensuring that findings are more accurate descriptions of *'reality'* like the grounded theory approach of Glaser and Strauss (1967) as opposed to theories ascribed to situations by interview respondents.

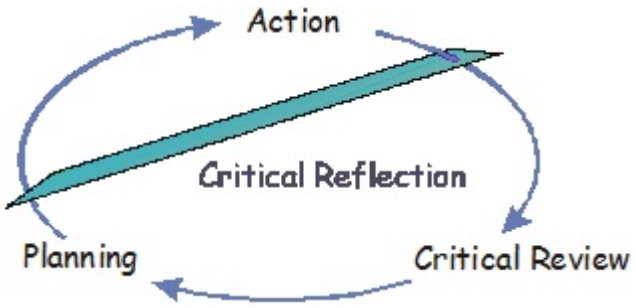
'Researching as an employee' resulted in some changes to the way information was gathered from colleagues. Recording interviews was dropped altogether. Instead they became much less formal and more akin to conversations carried out in normal day to day working with the recording of data and cognitive model building conducted from memory as soon as possible.

The ethical dilemmas that Easterby-Smith et al (1991) identify in *'researching as employee'* and which revolve around the explicitness of the role, was resolved by being open about the purposes for which the information was needed. When the research became more *'action'* orientated, the role of *'researcher as an employee'* was known to everybody in the school.

The validity and reliability of the case study report was maintained by the opportunity to have *'multiple conversations'* with the same colleague and others across the case, to continually refine questions and ideas about the situation. Additionally, as Glaser and Strauss (1967) acknowledge with their *'Grounded Theory'*, establishing the reliability of the case study with the *'researcher as employee'*, places greater emphasis on extended case study description in which readers can intuitively recognise as capturing the *'truth'* of the situation. To this end, the completed case study report was reviewed by several members of the school. Finally, as the research became more *'action'* orientated, still with the *'researcher as employee'*, many of the models derived from *'conversations'* were validated by senior staff and teachers. Opportunities were also taken to validate them in discussions with HMIE inspectors and authority education advisors.

At the start, the research could be described as *'actively passive'* with efforts focussed on the collection of information about the case. Relatively early in the process however, several System 2 *'pathogenic'* failures were identified that presented obstacles to individual and organisational learning. The SMT similarly aware of the failures in the technical sense of not being able to access the information they required and knowing of my research interest, asked if solutions could be developed. At this point, research switched to a stage that could be described as *'actively active'* with a focus on seeking to changing the situation to a new state through action. This involved working collaboratively with all staff and the use of key informants from within the SMT, PT group, teachers and office staff. Further details of the methodology used for the action research are provided in section 3.6 but it primarily follows the cycle summarised in figure 18 and the sequence described by Eden and Huxham (1996), Reason (2001) and Reason and Torbert (2001).

Figure 18: An action research spiral



Beginning with the critical review, the cycle starts with reflection on the situation as it is through the evidence obtained from conversations with participants and from other sources, including one's own experience and observations. Like *'Grounded Theory'* (Glaser and Strauss, 1967), ideas or theories underpinning the situation are developed from the evidence. But in contrast to the approach recommended by Glaser and Strauss, the critical review can include the consideration of other theories and the contribution they can make to understanding the situation. Revealing a bias towards practical application and another contrast to the *'Grounded Theory'* approach, part of the aim of the critical review is to develop plans to change the situation as it currently is to a new state. Together with other participants (Reason and Bradbury, 2000) these plans are enacted, which subsequently trigger another cycle of critical reflection. What prevents this approach from being described as a *'hit or miss'* affair or a *'trial and error'* process is the systematic approach taken in the critical review stage to the gathering of the evidence, the systematic development of new ideas or theories based on the evidence and lastly the iterative nature of the cycle. Kock et al (1997) describe how each cycle can lead to further refinement and insight as the cycle spirals through a succession of iterations on the development of new theories based on actions in the *'real'* world. With respect to the overall methodology used for analysis, the action research cycle corresponds to the outer learning loop of figure 19 on page 113.

3.4.1.3 Observation as evidence

This section considers *'observation'* as a method of collecting data as being distinctly different to researching as an employee. As a data collection method, observation allows the researcher to see events in *'real time'* and within context, as opposed to other data collection methods which are primarily focussed on historical data separated from the context of their creation, recorded either in documents or in post event explanations or rationalisations provided by interview respondents.

Yin (1994) makes the distinction in observation as a method of data collection between *'direct observation'* and *'participant observation'*. Direct observation is a method that might be used in a field visit to a site. Here, the researcher is a passive observer of events: a role similar to one a researcher might adopt in the conduct of laboratory experiments where

the concern is to avoid *'reflexivity'* or altering the development of events through the act of observation.

Participant observation in contrast, is a method where the researcher becomes part of events being observed. Although Yin (1994) sees risk of *'reflexivity'* and bias being introduced through the researcher manipulating events, others (Flood, 1997, Eden and Huxham, 1996, Warmington, 1980) argue that the opportunity of actively seeking to influence outcomes is a distinct advantage to the method in that it allows the researcher to gain a deeper understanding of the processes and events involved in change. Consistent with the role of *'researcher as an employee'*, participant observation is the dominant observational mode of data collection used in the inquiry. As an employee the observational process is relatively casual and informal. This is different to the more formal direct observational mode, where for example, the incidence of certain behaviours in particular contexts could measured or counted over certain periods of time.

Depending on circumstances, observations are recorded in the case study notes, either as they are observed or at the end of the day. While the latter approach places demands upon the researcher's ability for accurate recollection, the opportunity to make *'repeated observations'* during the life of the study overcomes the disadvantages of *'partial sightings'* of events where only part of an event is seen and *'partial recording'* of events where an initial event is fully observed but only partially recorded in the case study notes. Repeated observations also enable the researcher to check the accuracy of initial observations. Helping maintain the reliability of the case study, inferences made with data gathered from observations will only be included if they are supported with evidence from other sources.

3.5 Strategy and Methods of Data Analysis

The aim at this stage of the research is to produce compelling and valid conclusions based upon a fair and unbiased treatment of the data. Various approaches to analysis have been suggested, ranging from playing with the data (Glaser and Strauss, 1967), to the assorted analytic techniques of Miles and Huberman (1984). Yin (1994) proposes that it's more important to have an initial strategy in place before starting, to guide the researcher in selecting from the range of analytic techniques available, the most appropriate for the

successful completion of the analytical phase of the case study. If it's consistent with the overall approach of the case study, Yin (1994) believes it enhances the internal validity of the case study.

The general strategy chosen is to use the theoretical propositions contained within Beer's theory to guide the case study analysis, reflecting the approach used throughout the case study as a whole: propositions have shaped the case study questions, the design of the case study and the data collection plan. This is in stark contrast to the approach advocated by Glaser and Strauss (1967) which is to use a general strategy of building a case description without theoretical propositions. The benefit of using the theoretical propositions as a strategy for guiding the analysis, is that it provides a clear focus on the data and helps organise the entire case study.

Analysing the data within the overall strategy involves the combined use of two dominant modes of analysis. The first of these, *'pattern matching',* was briefly introduced in the discussion on the key features of the case study as a methodology for research. The second approach, which Yin (1994) describes as a variation on pattern matching, is to analyse the data by building an explanation about the case.

The logic behind pattern matching, which is essentially the method used in laboratory experiments, is to compare an empirically based pattern of results with a predicted set. If the patterns match, then the results strengthen the internal validity of the case study. In this instance, the case study is looking to see if a pattern of non-equivalent variables matches a predicted pattern derived from Beer's theory.

An alternative type of pattern matching involves making a comparison between the empirical results and patterns derived from rival explanations. The possibility of using rival explanations in this case isn't a feasible option. Primarily, because it's a technique that relies upon the presence of certain variable predicted by one explanation that cannot be accounted for by other rival explanations. Rival explanations have to be mutually exclusive.

However, Beer's theory is not exclusive in the terms of the variables that it seeks to explain.

For example, Ball (1987) contrasts the organisational scientific view of how schools are managed with actual practice. He argues that the actual processes occurring in schools can be better explained in terms of micro-political theory. Taking two concepts, Ball believes school management is more accurately characterised by conflict and control, rather than by consensus and consent under the scientific model. While the opposing viewpoints represent rival explanations, Beer's theory goes beyond the micro-political view and explains *'why'* there is conflict and *'why'* management employs certain strategies to exercise control. The distinctiveness of Beer's theory from Ball's micro-political one, lies not the concepts or variables, but in the underlying causes. Ball's micro-political theory relies upon a behaviourist perspective of an individual's actions and motivations while Beer seeks to explain these in terms of coping strategies used by individuals to deal with the phenomenon of complexity arising from of the operation of scientific principles, e.g. Ashby's law. With reference to the case study, the aim of using *'building an explanation'* as a mode of analysis, rather than *'rival explanations'* is to discover whether Beer's proposed principles are in operation and make them explicit.

Glaser and Strauss (1967) advocate the use of *'explanation building'* as a mode of analysis within their grounded theory methodology seeing it as part of a hypothesis generating process where the aim is to develop ideas for further inquiry. In this case study *'explanation building'* is used towards the end of the research in the analytical phase.

As a mode of analysis, *'explanation building'* involves stipulating a set of causal links about the phenomenon under study and its effects. If the links can be demonstrated, then concrete recommendations can be made as to future actions. Unfortunately as Yin (1994) points out, and this is particularly true in this case given the phenomenon under study, the demonstration of such links can be complex and difficult to measure in any precise manner. Consequently, Yin argues, it is better to develop and compare explanations against some a priori propositions which is the intention here. It follows that if the pattern of the explanation building exercise accords with previously developed explanations then this would add to the evidence supporting the validity of the theory.

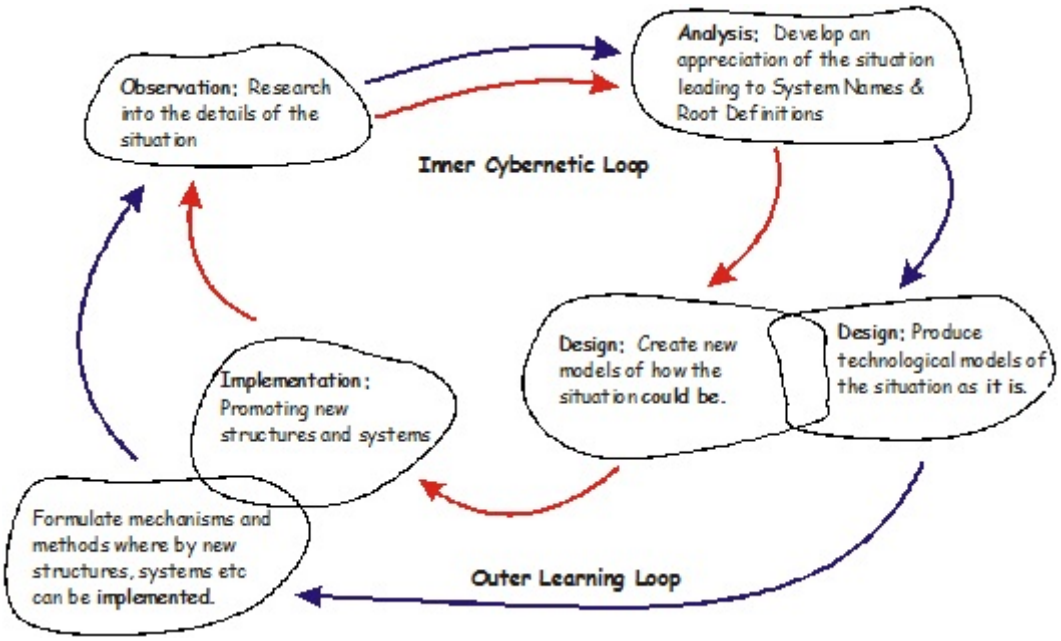
The general form of the case study has been described as including multiple units of analysis, embedded within the context of the whole case. The *'embedded case study'* design

enables *repeated observations'* which although Yin (1994) believes lacks the capacity by itself to reflect all concerns of the case study, but when used across embedded units can provide considerable support to the case study findings. This method is useful in explanation building where comparison between repeated observations can provide additional evidence linking the phenomenon of complexity to the coping strategies used to deal with it.

3.6 A Cybernetic Method of Analysis

The previous section discussed three strategic approaches to the analysis of data, i.e. pattern matching, explanation building and repeated observations. In actual practice, the process of analysis is closely intertwined with the data collection phase, with the results of preliminary analysis feeding back, to trigger further rounds of investigation and data gathering. To ensure the research remains focussed, Espejo's (1989) cybernetic methodology (adapted in Espejo et al (1996) to include OADI terminology) is used to manage and guide the analytical process.

Figure 19: Cybernetic Methodology to study organisations and problem solving



Similar to Kock et al (1997) approach to action research, the circular aspect to Figure 19 reveals the iterative nature of the methodology. The outer learning loop broadly corresponds to the research and data gathering process and represented by the case study notes described in section 3.4. Here the emphasis is *'diagnostic'* and related to describing organisations as they appear to observers. The inner cybernetic loop represents analytical thinking about the data: in section 3.4 this is represented by the commentaries or narratives developed from the case study notes. The orientation in this part of the model is towards *'design'* or what the organisation or situation could be. The overlaps show how the two stages are closely intertwined.

As the model indicates, there are five main stages: -

1. Finding out about the situation: establishing organisational identities.
2. Construction of structural models
3. Unfolding of primary activities and structural levels.
4. Examination of the distribution of discretion and examination of regulatory mechanisms.
5. Consideration of changes required: managing the change process.

Similar to the beginning of Checkland's SSM (1981, 1989) the first step, finding out about a situation relies on observation. The goal is to develop an appreciation of the situation with the aim of developing a *'System Name'* and *'Root Definition'*. Espejo reserves Checkland's description of *'Root Definitions'* (RD's) as a *"a concise, tightly constructed description of a human activity system which states what the system is" (Checkland, 1981)* for *'System Names'*. This is because Checkland maintains that the SSM can be used to explore issues or what or how things could be and so appears to use the term inconsistently. While Espejo recognises that they can both be the same, he considers it significant to maintain the distinction between descriptions of systems as they are (*'System Name')* and systems as they could be (*'Root Definition'*), as they each have different modelling consequences.

Critical to both descriptions encompassed by *'System Names'* and *'Root Definitions'* is an indication of the system's purpose, i.e. the transformation which the system is trying to achieve. Both Checkland (1981) and Espejo (1989, 1996) provide criteria to assess the *'completeness'* of RD's and system names. They are however subtly different and a

comparison between the two sets are shown in table 12

Table 12: Comparing System Names and Root Definitions

Espejo's Cybernetic Method: Criteria for producing **System Names** (Summarised by the mnemonic: TASCOI)		Checkland's Soft Systems Methodology: Criteria for **Root Definitions** (Summarised by the mnemonic: CATWOE)	
Criteria	**Identifies**	Criteria	**Identifies**
Transformation	What inputs are transformed into what outputs.	Customers	The recipients of the system's output.
Actors	Who carries the activities implied in the transformation.	Actors	Those responsible for carrying out the transformation
Suppliers	Who supplies the inputs into the transformation.	Transformation	The change between inputs to outputs
Customers	Who are the immediate customers of the transformation.	Weltanschuumg	The world view that underlies the Root Definition.
Owners	Who has the overview of the transformation.	Owners	Those that enable the continuation of the transformation.
Interveners	Who defines the context of the transformation	Environment	Environmental constraints under which the transformation continues.
Orientation.	Grounded description of the situation as it is.	Orientation.	Ungrounded description of the situation as it could be.

In large group settings, facilitated work groups (Phillips and Phillips, 1993) and cognitive mapping (Eden, 1989) are among some of the methods that can be used to establish system names and RD's. In the context of this study though, a range of system names are generated from experience as an employee and discussed with a number of staff, although as Beer points out in one of his aphorisms;

> *"It is not necessary to enter the black box* [i.e. the system] *to understand the nature of the function* [i.e. the transformation] *it performs" (Beer, 1979 p.40)*

From the perspective of the researcher this means that the transformation and hence the system name can be established from observation alone. This is significant because as Argyris and Schön (1978) discovered, there can be considerable difference between *'espoused theory'* - the theory individuals may claim to use in action - and *'theory in use'*, the theory that underlies their action.

The second and third steps involve the process of modelling. On one side there is production of *'technological'* or *'structural'* models. These are descriptive models of processes and the transformation implied in the system name. Their aim is to capture what the system is currently doing and how it's structured to deal with complexity by identifying the primary activities of the system. On the other side, there is the production of *'conceptual models'* or models of the system as it could be, consistent with the description implied in the RD.

As Espejo presents the Cybernetic Methodology as a general problem solving methodology, these *'conceptual models'* don't necessarily have to involve the VSM. However, as this study involves an evaluation of the usefulness of the Beer's theory of viability and how complexity should be managed, the models in this analytical stage are predominantly based around the VSM. The first of these *'conceptual models'* involves the establishment of recursion levels and the unfolding of complexity consistent with activities identified in the *'technological model'*. Within the case study design, each recursion level corresponds to an embedded unit of analysis. And so the fourth step, using the pattern matching mode of analysis is to examine each recursion level in turn to discover the extent to which they conform to Beer's five systems of viability. These differences are discussed in greater detail in Chapter 5, following on from explanation building in the general case study description given in Chapter 4.

At the final stage a further distinction is made as to how the Espejo's methodology is used in the context of this study. In its original form, Espejo intends the problem solving methodology to be *'action orientated'* and so the final step, involves management of the change process. This involves consideration of how the situation as it currently is, embodied in the *'technological models'* developed from the system name, can be changed to how it could be, as described in the *'conceptual models'* derived the root definition. The

management of the change process involves an examination of the possibilities and feasabilities of the change and the development of strategies to overcome learning obstacles involved in implementation.

The *'action orientated'* approach is used in Chapter 6 where differences between the models are used to develop an information system application aimed at improving System 2 functions. This application developed to test the practical utility of Beer's theory is aimed at overcoming role constrained learning difficulties through enabling coordinated action by teachers in *'real time'* and improving school and departmental performance by connecting measurable outcomes in what teachers actually do in the classroom with planning.

In the case study, this last stage by way of contrast is *'research orientated'*. Here discrepancies from how the situation as it is (i.e. how schools manage and deal with complexity) to how it could be (i.e. model of viability represented by the VSM) is used to make recommendations for improvements in how schools deal with complexity. This is the process that underlies the concept of *'analytical generalisation'* where conclusions from the case study are generalised to a theory, rather than a population as is the case with *'statistical generalisation'* and quantitative methodologies. .

3.7 Summary

This chapter has focussed on the methodologies used for the research. Table 13 summarises the key features of the research within Yin's (1994) definition of the Case Study approach while table 14 details the strategies and tactics used to maintain the validity and reliability of the research.

Cutting across all the different stages identified by Yin (1994) in case study research is the Cybernetic Methodology. While, Espejo (1989, 2002) argues that the Cybernetic Methodology is a problem solving methodology in its own right, in the context of this study it's used in two ways. First, as a strategic framework within the Case Study approach to guide the iterative and parallel operations of data gathering and analysis, and second, in its original conception as a problem solving methodology, to guide the *'action research'* element of the study. Described in Chapter 6, the argument is made that the project

qualifies as *'action research'* in that it meets nearly all of Lewin's criteria for action research given by Eden and Huxham (1993) as: -

Table 13: Key Features of the Research Methodology

Feature	Strategy or Tactic	Research Framework
Object of Study	The phenomenon of complexity and how its managed by schools.	**Cybernetic Methodology,** incorporating Action Research.
Relationship between data and theory.	Generalises to a theory (analytic generalisation) as opposed to generalising to a population (statistical generalisation)	
Philosophical basis to research	*'Reality'* is socially constructed and open to interpretation. - Investigator is part of what is observed.	
Principal Design	Longitudinal Critical Case with embedded units of analysis	
Role of Researcher	Researcher as employee and participant as opposed to independent objective observer.	
Data Sources	1. Documents a. External b. Internal 2. Participants 3. Observation	
Data Capture	Systematic Document Collection, cognitive sytle models & maps from observations and *'conversations'* recorded in evidentiary base.	
Data Analysis Strategies	1. Pattern matching 2. Explanation Building 3. Multiple observations across the case.	

- Being client centred - in the case, the client is the school - and;
- Problem driven.
- Produces change.
- Produces a practical theory with;
- Empirically dis-confirmable propositions that;
- Can be systematically interrelated into a theory.

Table 15 also shows how the project compares to Eden and Huxham's own criteria for distinguishing action research from other methodologies, although the contention is made that they are equally applicable to Espejo's Cybernetic Methodology.

Table 14: Strategies used to maintain validity and reliability of the case.

Case Study Characteristic	**Strategy or tactic.**
Construct Validity	1. Multiple Sources of evidence leading to *'data triangulation'* 2. Maintaining a separation between data and analysis 3. Maintaining a chain of evidence through contemporaneously recording and referencing evidence in notes, narratives and documents 4. Informants review draft case study report. 5. Participant collaborative action and commitment to change process. 6. Presentations and conversations with HMIE inspectors and authority advisors.
Validity	1. Pattern matching to existing theory. 2. Explanation building 3. Repeated observation in multiple units embedded within the study.
Reliability	1. Case study design 2. Separation of evidentiary base and case study report. 3. Evidential base maintaining chain of evidence triangulating on: 4. Case study notes. 5. Narrative or commentaries giving understanding to the notes. 6. Documents or tabulated evidence collected in the course of inquiry.

Table 15: Distinguishing Action Research (Eden & Huxham, 1993)

Distinguishing Characteristic	Action Research Project
i *"action research must have some general implications beyond those required for action in the domain of the project, or for the participants, and beyond developing 'local theory'"*	Addresses how schools can establish measures of performance at all levels, grounded in realtime pupil attainment. Addresses individual and organisational obstacles to learning inherent in common organisational school structures.
ii. *"action research demands a concern with theory as well as a practical orientation"*	Concerned with developing practical solutions through the application of cybernetic principles.
iii. *"grounded theory (Glaser and Strauss, 1967), in which the theory emerges from the data, will usually be the appropriate form of theory to aim for in action research."*	Tackles issues that emerged from the evidence independent from the application of a particular theory to identify issues.
iv. *"theory building, as a result of action research, will generally be incremental moving from the particular to the general in small steps."*	Follows an iterative cycle through three major interventions with successive refinements.
v. *"what is important for action research is not a (false) dichotomy between prescription and description but a prescriptive, even if implicit, form and style for the presentation of the research outcomes."*	Provides advice on the development of systems that enable teachers to distinguish and relate teaching practice to actual pupil outcomes.
vi. *"a high degree of method and orderliness is required for reflecting about, and holding on to, the emerging content of each episode of involvement in the organisation."*	C M used to guide and manage the research and act as a reminder of role adopted in each cycle, i.e. learning as a researcher in the role of employee, learning as a participant in change etc.
vii. *"for action research, the process of exploration (rather than collection) of the data, in the detecting of emergent theories, must be either, replicable, or demonstrable through argument or analysis."*	See tables 13 and 14
viii. *"action researchers need to be keenly aware of the key issues in the validity of action research and that the designed action research process must address these."*	

Chapter 4: The School Case Study

This Chapter examines in detail, using the framework of the VSM, the situation within an 'anonymised' but *'real'* school. The name of school has been withheld to both protect and encourage staff participation. The 'anonymisation' process has also been extended to other schools and areas that might be used to identify the school. The following Chapter looks at an action intervention designed and implemented according to VSM principles. This project was specifically orientated towards addressing some of the obstacles to individual and organisational learning identified in Chapter 2 and in the case study.

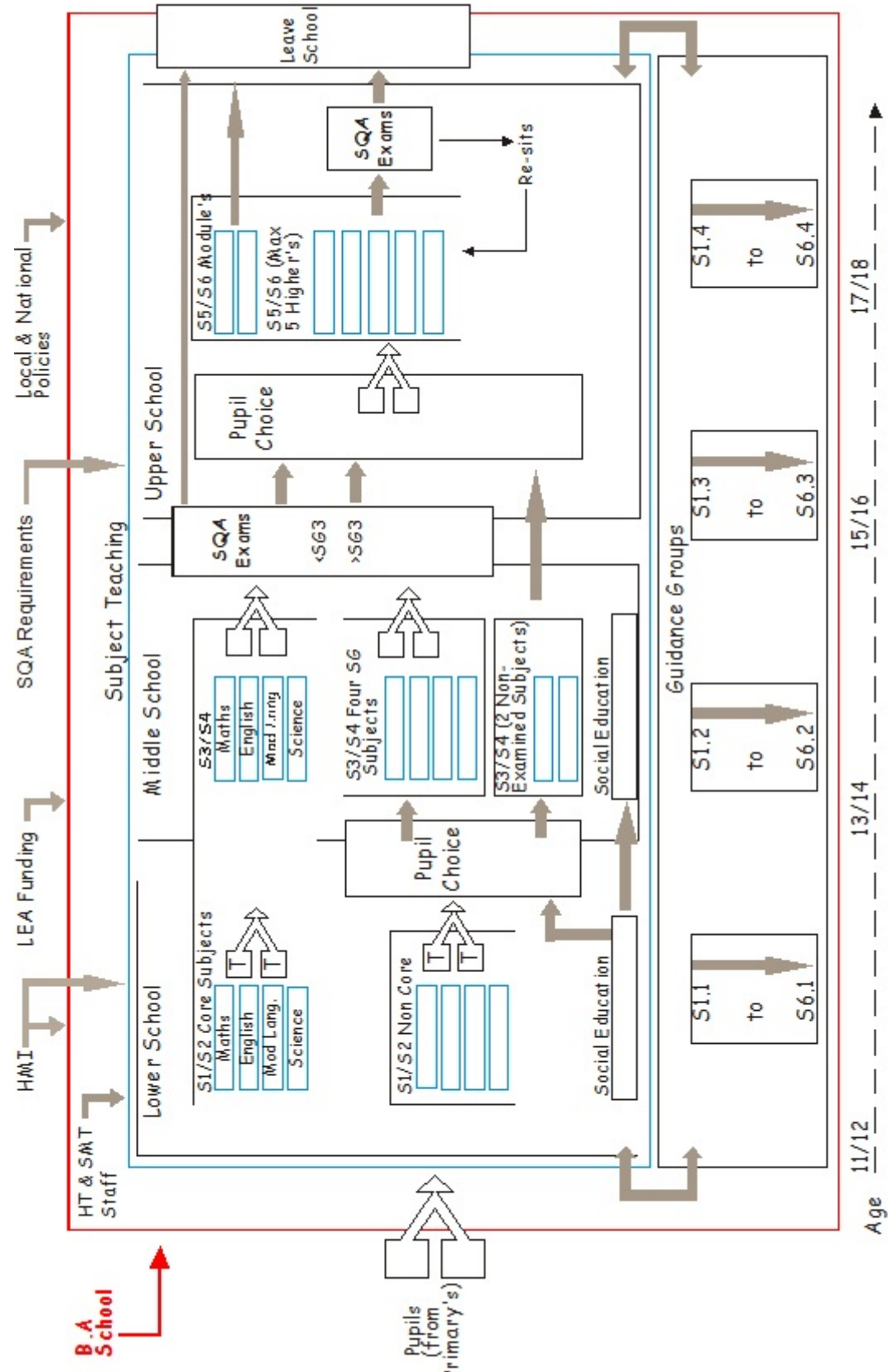
The study completed over a period of four academic sessions between 2000 and 2004, looks carefully at the structure of the school and the relationships between each part. Attention is given to capturing the dynamics of organisational interactions with respect to particular issues. The case study also considers some distinctive features of education, particularly with regard to how complexity is generated and managed.

The school is a six-year non-denominational comprehensive community school located on the edge of Kilbride. Built in the 1950's the school role reached a peak of 1,250 at the end of 70's. Following the closure of a nearby industrial centre, the school role has steadily declined to around 570 at the end of the study, and is expected to fall further to just below 500 by 2007. The decline in the role has left the school with considerable spare capacity and a large part of one wing was used to house a nursery unit for the local community. The school also contains a special unit for school refusers and pupils with socialisation difficulties. Serving a large area from the west of Glasgow, entry into this unit is determined by interview and psychological assessment.

4.1 Technical Models and Organisational Identity

Figure 20 is a technical model of the school's activities. Pupils from the primary schools become a members of a registration class (e.g. 1.1) within a Guidance group. Generally they remain in this class during their time at school. Each Guidance group (e.g. 1.1 to 6.1) is

Figure 20: A technical model of the schools' activities



managed by a Principal Teacher (Guidance) and together with register class teachers, they are responsible for social welfare and personal development of the pupils while they are at school.

From register classes, pupils in a variety of sub-groupings follow courses provided by a range of subject departments. During their first two years (S1 and S2) all pupils follow a common curriculum. Towards the end of S2, pupils can choose, in addition to core subjects which are compulsory, four additional subjects to study at Standard Grade level. Subject staff in conjunction with Guidance staff make recommendations to pupils as to which courses would be suitable or appropriate to their abilities. These recommendations are based in the main on the pupils overall tested performance (T in the diagram) that they manage to attain in a variety of subject specific assessments throughout S1 and S2.

For their Standard Grade subjects in S3 and S4, pupils are set into broad ability bands (Credit/General and General/Foundation). The band into which each pupil is placed is dependant on their tested performance in S1 and S2. Pupils also take two non-examined subjects or courses that do not lead to an SQA qualification. As in S1 and S2, social subjects are compulsory and in the school, these are taken by Principal Teachers' Guidance.

Depending on their performance in the SQA Standard Grade exams, pupils if they stay on post 16, can choose subjects to study in S5 at Higher or Intermediate levels. Pupils who attain Grade 3 or better are generally encouraged to take the subject at Higher level. Pupils who achieve below Grade 3 are encouraged to take the subject at intermediate level. Higher and Intermediate courses mostly last an academic year. If pupils fail these courses at the end of S5, they have the opportunity of re-sitting these exams in S6 or they can choose additional subjects to study. At the end of S6, pupils leave school.

Figure 20 shows that the school is funded by the local education authority it is subject to meeting targets embodied within Local and National policies on education. Subject teaching is driven by the SQA requirements and while it is true that S1 and S2 courses are not directly examined by the SQA, it is national policy that first and second year courses should articulate with subjects taught at Standard Grade level. School inspectors in the form of HMIE, periodically audit the school. They may do a whole school inspection looking at

all aspects of the school, or increasingly, they may only do a partial inspection where only a few areas/subjects are selected. During these inspections the HMIE look at how the school is doing compared to a long list of criteria, but broadly they examine how well local and national policies are being implemented, how the subject curriculum is delivered and how well the resources provided to the school are being utilised.

4.1.1 Organisational Identity

Figure 20 reveals the main structures of the school and consequently how the school organises itself in order to fulfill its purpose. From earlier discussions concerning Espejo's (1989) Cybernetic Methodology, the technical model in Figure 20 has been derived from what the school is actually doing as opposed to what staff or the school claim to be doing and from this, the following organisational identity or system name emerges.

> *"A Council owned, community-based organisation, responsible for the delivery of a broad-based curriculum to standards set by the SQA and HMIE, in order to maximise the academic potential of its pupils within a safe, caring and supportive environment."*

Implicit within the system bounded by the given organisational identity is the: -

Transformation	Realising academic potential and social development.
Actors	Subject teachers and Guidance staff
Suppliers	The local community
Customers	Pupils from the local community.
Owners	Local Education Authority and the local community
Interveners	SQA and HMIE

This organisational identity summarises the main purposes of the school, i.e. ensuring that pupils achieve the best possible grades within a subject-based curriculum and providing the personal and social support necessary in order to bring this achievement about. In terms of the VSM, these are the activities that the school as a whole wish to be viable.

4.1.2 Unfolding Complexity

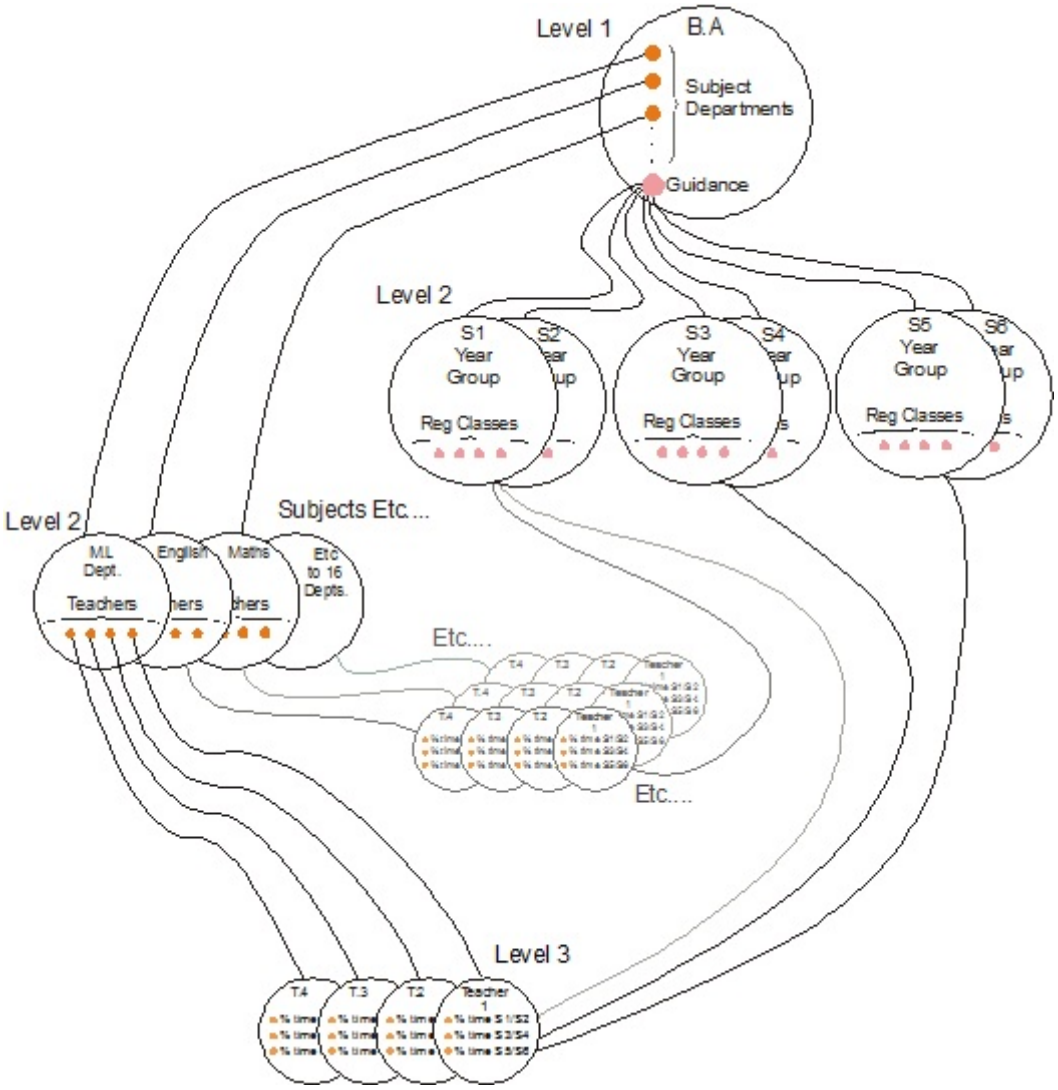
In combination with figure 20, the organisational identity assists in clarifying the structural strategy that the school uses to manage the complexity in line with its observed purpose. - In other words, the organisational identity, implicitly selects from the total environment, the complexity the school chooses to deal with and figure 20 reflects how the school is organised to deal with the complexity bounded in the organisational identity. - This structural strategy is developed in figure 21.

At the top level of the school, there is a split between the subject departments (11) responsible for delivery of the curriculum and the achievement of the best possible grades, and the Guidance Department, responsible for the personal and social welfare of the pupils.

In the second level, the Guidance department subdivides into year groups. These are made up in turn, by the registration classes belonging to that year group. The subject departments can be unfolded further into a third level, made up of teaching classes containing pupils abstracted from the registration classes where subject teachers work towards ensuring that the pupils achieve their potential, i.e. work towards fulfilling one of the principal purposes outlined in the organisational identity. The school doesn't break registration classes down any further and deals with year groups as a whole so the unfolding of complexity on the Guidance side is completed at level two. Thus, the second purpose of social welfare implicit in the schools' organisational identity is satisfied at the level of the registration class.

Figure 21 therefore, shows how the school structurally breaks up the total complexity it has selected from the environment into manageable levels. From this, it is possible to develop an overall VSM for the school.

Figure 21: Unfolding Complexity of the School



4.2 A Global VSM for the school

Figure 22 shows a partially complete global VSM for the school as it currently is. The metasystem at the top contains the School Management Team (SMT - Head Teacher & Deputes) responsible for the management of the school as a whole. The boxes representing the metasystemic management of the two primary activities enclosed within the red circles (i.e. Guidance and Subject Teaching) are shown at level two. On the subject teaching side, level three has been collapsed into level two for the sake of clarity at this global level of resolution.

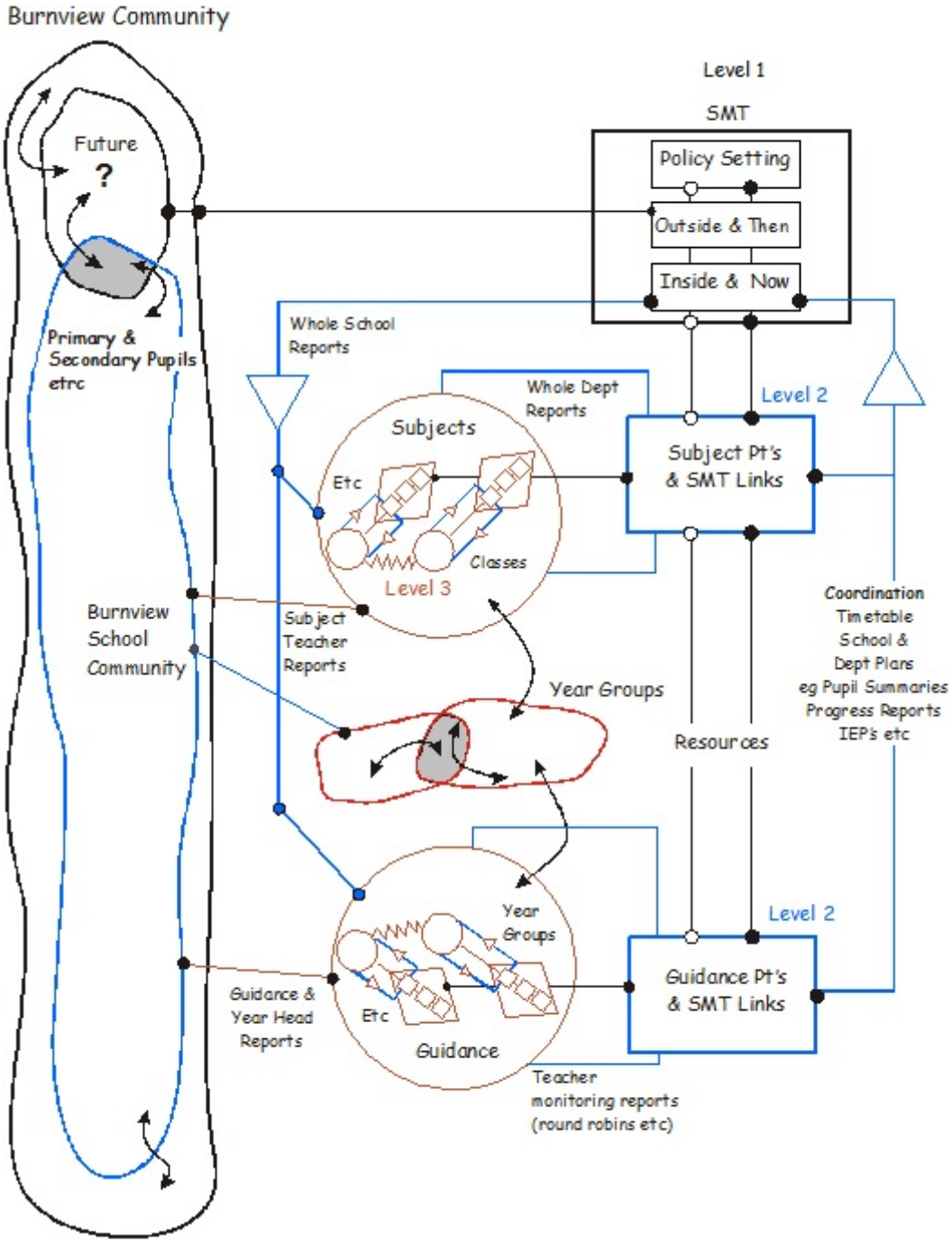
The blue lines in Monitoring and Coordination systems, linking the metasystemic management boxes to the primary activities enclosed in the red circles, represent the focus of the action research project aimed at adding requisite variety (or expanding the systems capacity to deal with complexity) to the total system. This action research project involved developing a distributed pupil profiling and information system aimed at supporting the organisation's identity and in line with Beer's principles.

Earlier in Chapter 1, as part of the rationale for the study, a number of general trends that could be identified in the field of education were highlighted. These included: -

- Increasing political priority given to education and the rate of legislational change, especially with regard to qualifications and curricular frameworks.
- The changing view of education from a *'good thing in itself'* to a utilitarian one necessary for economic benefit not just for the individual but for local and national competitive advantage.
- Schools becoming the front line for tackling perceived social problems such as teenage pregnancy, drink, drug and health related issues such as smoking and rising levels of obesity.
- Increasing social change and fragmentation of traditional *'family groupings'*.
- Social inclusion leading to wider range of needs that have to be satisfied in terms of physical, psychological and intellectual abilities.
- Increasing rights for parents and pupils.
- Pedagogical changes and a move from *'en bloc'* teaching to individual learning plans.

- Increasing accountability and changes in the teaching profession governing how, why and what teachers can do.

Figure 22: Global VSM for the school, highlighting loops in organisational learning



Following the research, the next section reveal how these general trends impact on each of the levels shown in Figure 22

4.3 Systemic Pressures

Table 16 lists how the principal systemic pressures, manifest themselves at each

Table 16: Some systemic issues arising from complexity in the school

Feature	Organisational Units			
	SMT	**Subject Department**	**Teacher**	**Guidance**
Contact (Compulsory Attendance)	Attendance, behaviour, Supporting staff, conflict with parents.	Behaviour	Behaviour	Attendance, legal knowledge & compliance with national & local policies. Defensive record keeping.
Selection of clientele/customers by organisation/sector	Perception of school, Parental & pupil preferences.	Competition to attract *'best'* pupils	Competition to avert the *'worst'* pupils.	Career requirements & subject choices.
Variety of pupils/parents	Legal knowledge & compliance with policy. Defensive record keeping, Specialist support.	Differentiated courses & materials.	Increased range of pupil types & behaviour. Greater repertoire of teaching strategies. Specialist support & exchange of information.	Greater repertoire of counselling skills, limitations and coping strategies.
General knowledge & experience of sector/profession.	Higher readiness to dispute decisions.	In/Appropriate matching between pupils & courses.	Higher readiness to dispute decisions.	Mediation & diplomatic skills.
Responsibility voluntarily delegated by client group.	Compliance with policy, information exchange.	Safety - avoidance of risk.	Defensive - avoidance of risk.	Parents representative in school - getting to know all pupils.

organisational level of the school.

Table 16: Systemic issues arising from complexity in the school continued:

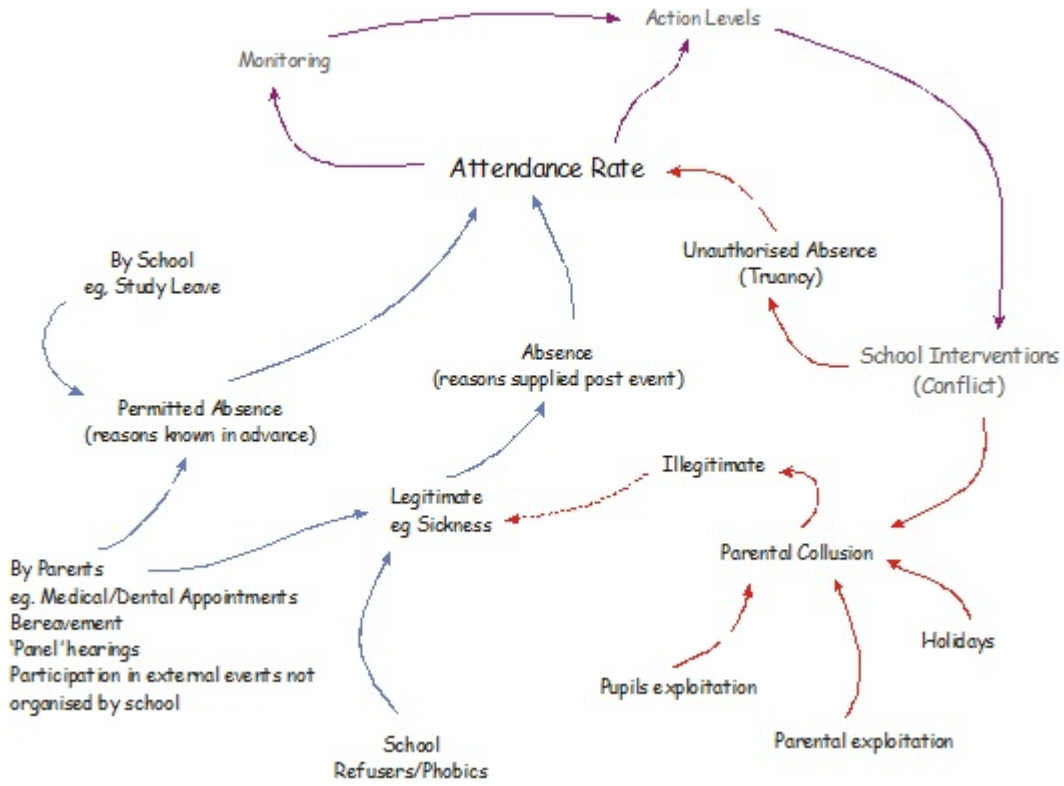
Feature	Organisational Units			
	SMT	**Subject Department**	**Teacher**	**Guidance**
Extent of direct contact with client groups	Overview of school character, detailed knowledge of *'problematic pupils'*.	Knowledge of year group.	Specific knowledge of each pupils character.	Torn loyalties - pupils/parents vs staff.
Breadth & extent of general social expectations.	Goals, planning, time tabling.	Development of new courses	Appeals on results	Incorporation into Guidance
Variability & clarity of outcomes	Setting targets, judging whole school progress.	Setting targets, judging departmental progress.	Assessing progress of individuals & classes.	Judging progress of Guidance Departments.
Time sensitivity/dependency of work.	Coordination between departments.	Coordination between courses/classes.	Organisation & pace of work, attendance - failure to meet completion targets.	Data collection, reporting (internal & external) pressures.
Control over working hours.	Staffing levels & time tabling, cover for staff.	Development time.	Involvement in extra curricular activities.	Torn between subject & guidance work.
Flexibility in task completion.	Checking procedures to conform to HMIE inspections.	Focus on course content in relation to syllabus.	Focus on course work & *'getting job done'*.	Suspicion by other staff on *'what's done'*.
Organisation progress judged by: -	Gathering & reporting data, skepticism over methodologies.	Comparisons made with other subject departments.	Cynicism - *'dumbing down'*.	Contribution to school by Guidance Department.

4.3.1 Systemic Issues in Attendance

Outside school, attendance is perceived to be as a straightforward issue. Being compulsory for all under sixteens, discussions tend to focus on ways of forcing parents/guardians to ensure pupil attendance. But simple measures of attendance, normally calculated as a percentage of days in school, masks a great deal of systemic complexity as shown in figure 23.

A major difficulty for the SMT and Guidance in trying to maintain high attendance rates, lies in knowing into which category each absence by any pupil on any particular occasion falls, so that they can take appropriate action. This can be particularly problematic in distinguishing between truancy and absence justified after the event, where explanations for absences are not always forthcoming from pupils or their parents/carers. Parents themselves also provide a further complication by occasionally colluding in and condoning absence and sometimes positively encouraging it.

Figure 23 : Complexity underlying attendance rates



Family holidays during term time can be extremely problematic for the school to manage as they tend to coincide with the key points of the year, marking either the start of courses or the run up to exams. While absence through holidays in term time is a growing trend, it is at least accountable. A more significant and insidious effect is where long term absence or erratic attendance is achieved with the tacit approval of parents. For example being used a carer for others.

Monitoring and tracking the attendance of all pupils is a time-consuming task especially in detecting emerging patterns of absence. For some, the underlying reasons can appear quite obscure: one pupil was absent whenever his football team lost to avoid being teased by others. Then having detected a pattern of absence there can difficulties at deciding at what level of absence merits intervention. Some pupils for example have quite legitimate reasons for being off school, such as long term chronic illness; while others with much lower rates of absence can be truanting.

Where the school decides to make some intervention, initially by the Guidance teacher and subsequently by the SMT, it often leads to conflict with parents. In severe cases, evidence has to be assembled and referred to the Children's Reporter which is only the beginning of another lengthy process, consuming more management time and effort.

Although the SMT and Guidance focus upon maximising attendance, departmental managers (PT's) and teachers in contrast, are more concerned with minimising the range and the complexity of behaviours exhibited by the pupils. Sometimes this is contrary to the need of retaining pupils within school.

4.3.2 Systemic Issues in Behaviour

Table 16 shows examples of how teachers describe pupils behaviour to one another, with illustrations of the systemic meanings embodied in those descriptions. The systemic content to the descriptions were established after further questioning and were implicitly understood by staff.

Table 17: Examples of typical teacher descriptions of pupil behaviour and their meaning

Teacher Description	Meaning
"... a really pleasant, conscientious [boy/girl]" , *"... a pleasure to teach"* or *"... demonstrates a mature approach to work"*	co-operative, does not interrupt, follows instructions, takes the initiative, always prepared for work and works hard.
"... a nice enough [boy/girl] *but makes absolutely no effort"*	co-operative, does not interrupt, follows instructions but does the minimum to get by.
"... a nice enough [boy/girl] *who works hard but lacks confidence"*	co-operative, does not interrupt, works hard but needs constant reassurance.
"... is a disruptive influence in the class"	arrives late, talks constantly, rarely listens to instructions, makes little effort, gets involved in name calling, makes inappropriate, immature comments. Rarely ready for work (i.e. with books, pens etc.).
"... is an absolute nuisance"	
"... is a sneaky" or *"... devious little sod"*	demonstrates some of the above, but less obviously. Aims to provoke others into reactions that will get them into trouble (manipulative).
"... is a right drama queen"	sensitive to any implied or perceived criticism from teacher or others which leads to violent outbursts of temper.
"... has absolutely no social skills whatsoever"	cannot work with others, interrupts teacher and others constantly. Deliberately and inadvertently causes offense to others.
"... a raving nutter"	acts contrary to own best interests, will not listen to warnings or advice on how to avoid trouble. Cannot seem to connect actions with consequences.
"... a little psychotic" or "... thinks [she/he] *is a hard man"*	argumentative, confrontational, physically and verbally aggressive both with teachers and others.
"... a strange [boy/girl]*"*	usually behaves well, but exhibits some unusual facet of behaviour or eccentricity e.g loner, elective mutes.

4.3.2.1 Describing Behaviour

The table gives some indication of the wide range of behaviour that can be shown by the pupils, with the shorthand way in which teachers can communicate these differences with one another. It shows that teachers can easily make distinctions between behaviour and aptitude or ability with descriptive comments about behaviour are often appended with some

statement about the pupils ability, for example *"... nice but dim"*, *"... an able* [boy/girl] *but lazy"*. Teachers don't see pupil behaviour as occupying a point on a single spectrum ranging from good to poor. Rather, they see it as emerging from the interactions between three continuous variables, so that any form of pupil behaviour is a point within a multi dimensional space. The variables seen as principal descriptors of pupil behaviour by teachers can be discerned in the matching meanings enclosed in table 16.

- **socialisation**: a measure of the ability to work co-operatively with other people. Typical pupils who would be considered highly socialised are polite, cooperative, considerate and helpful to others. Low socialised pupils are thought of as rude, uncooperative, find it difficult to settle and work with others.
- **effort**: a measure of the amount of work a pupil is prepared to do for their own learning. Pupils that work hard, conscientious and motivated, are considered organised and prepared for work would score highly. Conversely, low scoring pupils would be lazy, de-motivated, fail to come to work organised and prepared for work, i.e. without the requisite books, pens, pencils etc.
- **rationality**: the ability to connect action and consequence through time. High scorers, would be those that can make clear associations between consequences arriving from their actions and the time of making those actions, despite being widely separated by periods of time, i.e. have foresight and the ability to plan ahead. At the opposite end of the scale, are those who find it difficult to link their actions with consequences despite being closely associated in time. These types of pupils find it difficult to plan ahead and are thought of as acting perversely against their own best interests, when despite warnings they continue actions likely to lead to adverse consequences for them.

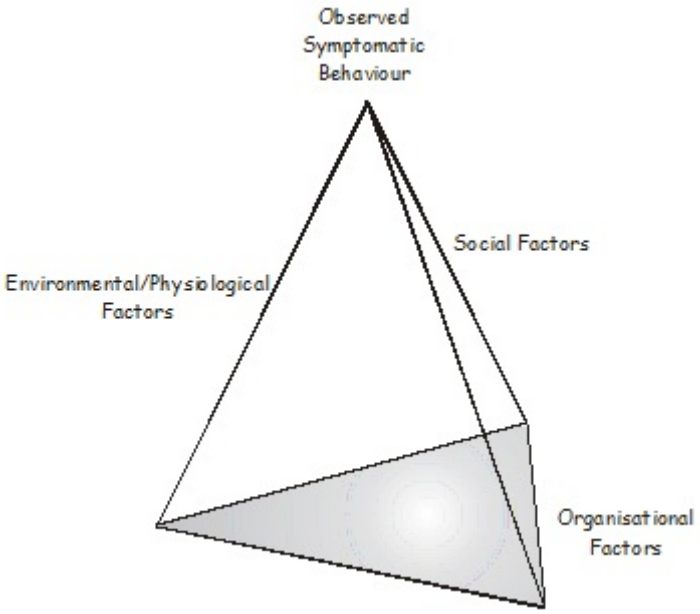
Thus, the behaviour of pupils perceived by teachers, is seen as a combination of how well socialised they are in they way that they get on with others, how much effort they are willing to make and how rational they are in working hard for delayed benefits. A *"well behaved"* pupil for example, would be considered as responsible, hard working (High effort), polite, helpful and considerate (High socialisation) and prepared to see benefits arriving in the long term for work done now (High rationality). In contrast, a *"poorly behaved"* pupil, is perceived as lazy, de-motivated (Low effort), rude, uncooperative and indulges in antisocial behaviour such as name calling etc. (Low socialisation) and cannot see how their behaviour

affects others or themselves (Low rationality). Between these two systemic concepts of behaviour lies an almost infinite range of behaviours, all of which have to be coped with by the teacher.

4.3.2.2 Influences on Behaviour

As well as being able to distinguish a wide range of behaviours, teachers appreciate that the behaviours themselves are symptomatic of various underlying, interacting causes. How these combine to produce the observed behaviour, is shown in figure 24.

Figure 24: Factors influencing pupil behaviour



Environmental/physiological factors include for example:

- Stages in the physical development of pupils, especially with regards to sexual activity.
- External environmental factors like extreme weather events.
- Biological factors including variations in blood sugar and diet.
- Time: both of the day and year.

Table 17 provides examples of how teachers understand how time affects the behaviour of classes and individuals.

Table 18: Time and its relationship to behaviour

Time	Typical comments concerning behaviour
time of day	*"... to get work done, its best to get them first thing in the morning. That way they haven't woken up enough, to start winding each other up."* (Geography Teacher BA) *"Don't expect too much of them last period in the day. They've been working all day and looking forward to going home. The kids in that class just haven't got the attention span or the social skills to keep going all day."* (PT Biology BA)
time of week	*"Monday's are a really bad time. They've been away from school for two days and they've got to learn how to behave all over again, that and catch up with what's been going on fights, football, boyfriends, girlfriends, that kind of thing."* (PT Physics BA) *"I've given up doing practical work Friday afternoons. They're so busy talking about what they're going to do at the weekend that they just make a dog's dinner of it. Any practical work is done as a demonstration and they just watch me doing it."* AHT & Chemistry Teacher (BA)
time of year	*"The two weeks, ten days before the Christmas holiday is absolute hell! To get them to work, when they more interested in who's doing what and who's getting what, is like getting blood out of a stone."* (PT Art BA). *"The time after the second year option choices have been made is awkward. You then have these kids in your class who aren't choosing your subject and yet they have to be there. They make no effort to complete work because they know it has no effect.* (Business Studies Teacher BA)

Organisational factors also have their part to play including for example:

- The state of school buildings and physical layout governing movement around the school.
- The timetable and prior experiences before arriving in class.

Social factors are perhaps the greatest influence on behaviour, often beyond any control teachers can exert and frequently exerting what teachers see as a negative influence.

- Parental upbringing and home circumstances.
- Parental expectations: academic and social.
- Friendship groups.
- Social allegiances, for example gang membership, supporters of football teams etc.
- Peer pressure.

Overlaid over all of these, are the things that teachers actually do. In contrast, how these effect behaviour are often well understood and include for example: -

- the level of teacher expectations,
- the level of organisation by the teacher,
- the pace of work,
- the nature and type of work being taught.

All these organisational, environmental/physiological and social factors combine together in uniquely different ways for each individual, to produce the kinds of behaviour observed by teachers. However for the teacher, the already enormous complexity entailed in the symptomatic behaviour observed is multiplied even further by the natural consequences of time and by the dynamics that can develop from certain combinations of individuals. For some, classrooms are seen as a venue for continuing feuds from outside, with classes becoming ungovernable because of the sheer number of disputes amongst members. In other classes, it can take the presence of just one individual to alter the entire teaching process.

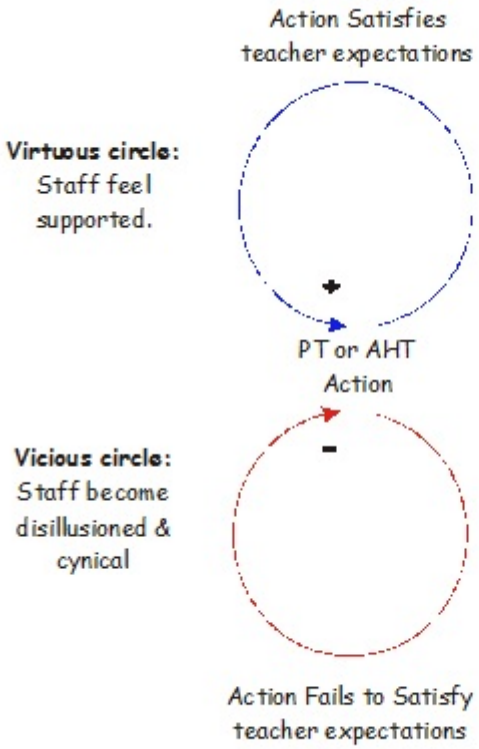
4.3.2.3 Organisational Conflict Arising from Misbehaviour

With such a vast spectrum of possible behaviours and only a few of which are considered conducive to effective learning (high socialisation, high effort and high rationality), teachers spend considerable time and effort to constrain the range of possible behaviours to acceptable limits.

Organisational conflict develops when pupils behaviour can't be brought within limits, both with the pupil and with school management, especially if the behaviour continues. Figure 25

shows how this can happen.

Figure 25: Organisational Conflict Arising from Pupil Misbehaviour



When behaviour has reached the point that the teacher refers pupils onwards to the SMT via the PT, they are looking for some form of exclusion, either from the school or from their class. AHT's, with overall responsibility for year group behaviour, may decide that a particular incident warrants exclusion, in which case teachers and PT's feels supported in their efforts to control behaviour. Where AHT's fail to exclude or administer in the eyes of the teacher or PT, a severe enough sanction, then staff feel that their authority has been undermined and become extremely cynical about the SMT's efforts to control behaviour. - see Annexe 1. However, AHT's have to reconcile a number of conflicting demands, some of which are: -

- Maximising attendance and minimising exclusions with expectations of staff.

- Different teachers have different comfort zones or acceptable ranges of behaviour in that what is seen as tolerable by one, is seen as intolerable by another.
- Differing levels of support given to the school, by both parents and the authority. While some parents can be very supportive. Others, according to one of the schools' AHT's, can be very assertive, anti-school, knowledgeable about their 'rights' and ready to contest every decision. - see Annexe 2.
- Procedural and legal constraints establishing a paper trail of evidence and showing all possibilities have been tried.
- The best interests of the pupil and staff needs - see Annexe 3.
- Mitigating home circumstances.

4.3.2.4 Future Trends in Pupil Behaviour

For teachers, behaviour is an extremely significant issue. All those that were interviewed or observed in conversation, maintained that at the school the general standard of pupil behaviour is deteriorating, generally due to the social factors previously discussed.
As well as seeing a general decline in the overall standard of behaviour, staff believe that some pupils are displaying more extreme forms of behaviour and that the number of pupils showing these extreme behaviours are also increasing.

The school, has to face the task of developing new ways to both constrain the behaviour of an increasing number of pupils who persistently challenge at a low level, the standards of behaviour expected within the school and an increasing number of pupils who defy those standards to an extreme degree.

4.3.3 Systemic Issues in Parent and Pupil Selection

The level of a school's roll is critical to its continuing viability and changes are felt at all organisational levels in the school.

4.3.3.1 At SMT and Whole School Level

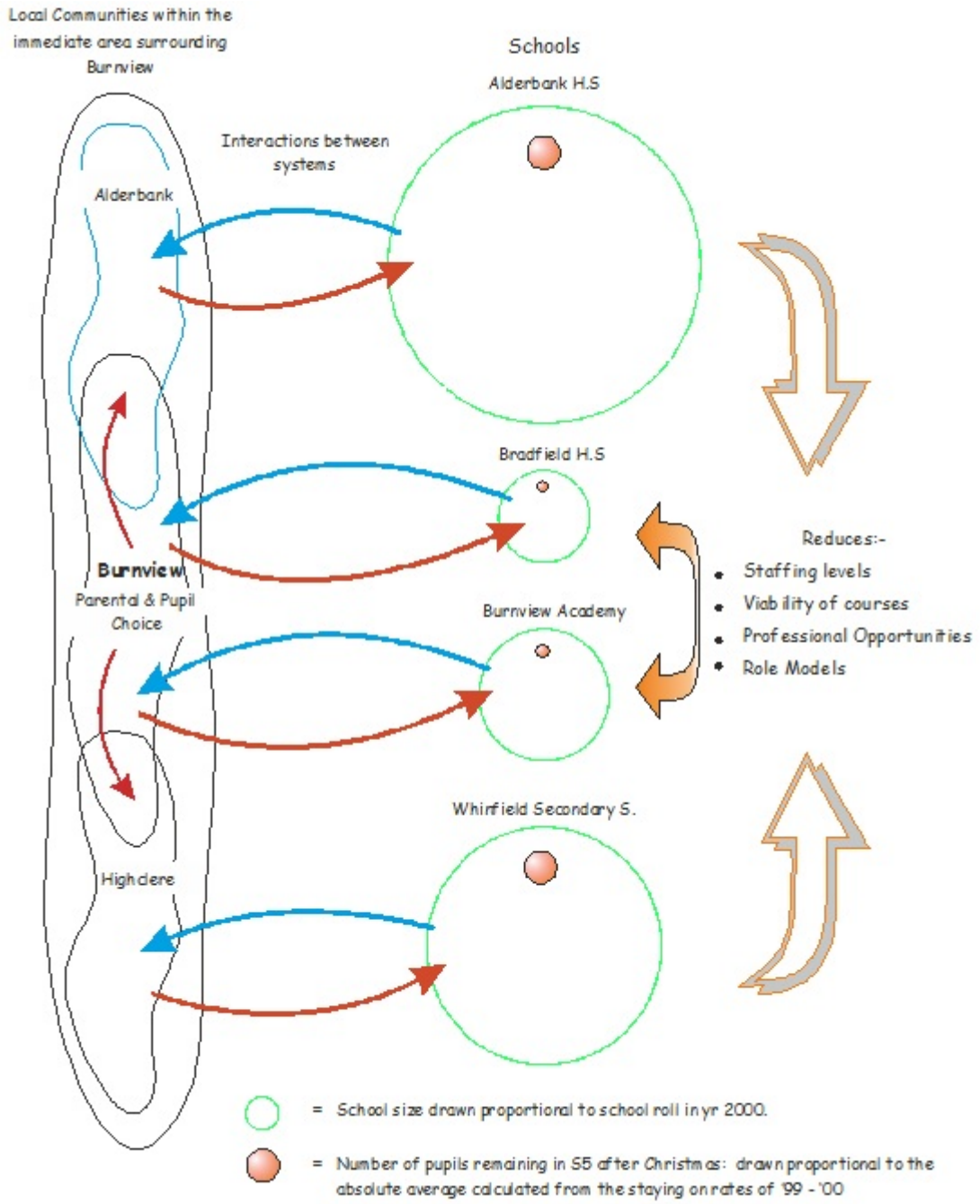
If the roll falls below certain level, determined by prevailing economic and political considerations, then it may be closed or merged with another school. It used to be a moderately large school with about 1,250 pupils but it has declined steadily over the years since the closure of nearby industrial units. The school roll is now just over 500 and the SMT are concerned for the schools' continued future in the medium to long term.

Competition for pupils is fierce. The roll of a nearby Roman Catholic has fallen for the same reasons to less than 400. There are two much larger non-denominational schools in the area with rolls around 1200 and 900 respectively. One of them situated in a prosperous middle class area and is acknowledged as the leading academic school. Tables in Appendix ? show the examination results achieved by these schools in 1999 - 2001. Post 16 courses are particularly effected with the school unable to viable higher courses. Pupils wishing to study subjects at an advances level are only able to do by travelling to larger schools. As a result the staff fear the school is being effectively reduced to a middle school only. They also believe that if this perception of the school becomes recognised in the wider community, then this will deter parents, especially those of the more able or who are more ambitious for their children, from initially sending them to the school. Other effects of this dynamic modelled in figure 26 are:

- De-motivated and de-skilled staff as a result of reduced opportunity to deliver more advanced courses to more able pupils. This is frequently seen as a "bonus" and compensation for dealing with 'challenging classes': - see Annexe 4.
- Re-enforcing a vicious circle by encouraging a further decline in the viability of courses. This reduces the choice in the number of courses available, which in turn encourages pupils to go elsewhere to study their preferred options.
- A reduction in courses creates empty slots or 'slack' in the timetable. Because of statutory class sizes, this can only be sustained through reduced efficiency or through fluctuations in the number of staff. For a small school, this creates particular problems, as there are an insufficient number of staff in each subject area to fully absorb the 'slack' or to respond in periods of even slightly higher demand. To cope with fluctuations, the school is having to make greater use of temporary or part time staff. Approximately for the academic session 2001 - 2002, 16% of the schools' staff are contracted in on this basis.

- A decline in the number of S5/S6 pupils able to act as role models for younger pupils and who can visibly demonstrate the academic opportunities available within the school what can be achieved through academic success.

Figure 26: Effect of changing parental and pupil preferences



The feedback loops in figure 26 show how the effects of parental choice and competition

feedback, to bring about the systemic changes described and how these in turn can set up a *'vicious cycle'* to further influence parents to send their children elsewhere.

For the SMT of the school this places them in a double bind. Breaking the vicious circle means acknowledging that they are in competition with other schools and emphasising other benefits that are necessarily unrelated to economies of scale.

4.3.3.2 At Departmental and Teacher Level

A similar dynamic operates between departments when pupils choose their subjects. Once again, the viability of courses is ostensibly determined by the number of pupils, although the effects of apparent free choice and changing pupil preferences is mitigated by: -

- National Curriculum requirements that pupils study in addition to core subjects, a minimum of a technical subject, a creative and aesthetic subject and a humanities subject.
- The structure of the *'pupil option form'* which places subjects into groups and only allows pupils to choose one subject from each group.
- Guidance staff directing pupils to subjects through recommendations based on their own understanding of the cross-curricular abilities of the pupil.
- Caps on available places in subjects.

As a consequence, subject departments are partially insulated from fluctuations in pupil and parental preferences. So rather than compete for numbers, many departments have the aim to attract the most able or the least troublesome pupils by:

- Making recommendations concerning the suitability of pupil's for the subject report.
- Attempt to exclude academically suitable pupils but are seen as behaviourally unsuitable by avoiding making explicit recommendations in the hope that they will choose other subjects. - see Annexe 5.
- Include possible academically unsuitable pupils through borderline recommendations, presenting it as *'opportunity'* to pupils. Also a strategy of filling classes to their maximum to provide a stronger justification for not including pupils who present more challenging behaviour.

- Actively direct pupils in conversations, either to exclude them through encouragement to explore other options, or to positively encourage them to choose their own subject.

Other clues to staff's orientation towards quality rather than quantity can be inferred from their concerns with: -

- Guidance staff recommendations: - see Annexe 6.
- Structure of the pupil option form: - see Annexe 7.
- The introduction of vocational courses: - see Annexe 8.

Where attempts to *'off-load'* or divert challenging pupils to other subjects, competition to avoid the most 'challenging' pupils is commonly resolved through the creation of *'sink'* groups or bottom sections. Staff take turns with these sections, or promoted members of staff (PT's or AHT's) volunteer to take them on the basis that the pupils' education is least affected if they are called away to meetings, to deal with emergencies etc. which for AHT's is a frequent event.

4.3.3.3 At Guidance Level

It is assumed that parents and pupils make choices according to some rational logic and Guidance staff are often blamed when attempts to attract the best and off-load the worst have failed. However research indicates that the assumption is misplaced with: -

- Pupil's having no clear preferences for subjects or choosing subjects on the basis *"because that's what their friends are doing"*.
- Pupil's having no long term career or academic aims and therefore unable to assess whether a subject is a requirement that would enable them to meet these goals.
- Pupil's having unrealistically high expectations that are beyond their ability to achieve them.
- Pupil's lacking ambition or are unwilling to take subjects that would stretch them.
- Pupil's wanting to do courses or to take a combination of subjects that can't be accommodated by the school.

The situation can be further complicated by parental preferences. On occasion they can diverge from both the pupil's and the Guidance teacher's, at which point, the role of the Guidance teacher moves from advisor to a mediating position. Ultimately however, as Guidance teachers point out, parental choice has priority and if they wish their child to undertake a course for which they may be completely unsuitable then that is their right. The risk they take in these choices, is that after one to two years work pupils attain lower grades that they could have achieved in other courses.

4.3.4 Systemic Issues in Social Inclusion

Under the policy of social inclusion and because of other social changes, there is an increased variation in pupil behaviour and abilities. For staff, this increased variation has wide ranging systemic consequences.

For the SMT, compliance with policy initiatives such as *'Learning for All'* generates an exponential amount of complexity and work that carries with it legal responsibilities. First, *'problematic'* pupils have to be identified, i.e. those that are different from the general *'norm'* and therefore may be classed as having special educational needs. Pupils that fall into this category include those that have: -

- Learning difficulties, e.g. dyslexia
- Behavioural difficulties, e.g. ADHD
- Physical difficulties, e.g. hearing, sight or mobility impairments.

Identifying pupils that fall into any or all of these groups can be problematic in itself. For some it's obvious. For others it can be difficult, as pupils develop coping strategies that can mask learning or even physical problems. They can also be missed due to the different rates of development that occur in individual or problems only emerge when pupils are presented with more challenging work.

Second, having identified these pupils from the general school population with its already wide variation, the SMT is responsible for developing support systems and education plans that are appropriate to their needs. Support may include the provision of specialised support

through specially trained teachers to support from educational psychologists. Creating additional support systems can be complex when considering pupils that have multiple difficulties (for example, learning difficulties and behavioural problems) and require a range of support systems. Furthermore, development of education plans need to be agreed with parents and in some cases where pupils have been identified as falling into a group that requires additional support, parents can be extremely reluctant to have the difficulties of their child acknowledged.

Finally, the SMT are responsible for monitoring the development of pupils and the maintenance of accurate records throughout the pupils time at school. Some information is used for reporting to parents. Most information though, has no further use. It is archived and merely forms a record in case of any future dispute to demonstrate what was done by the school to support the pupil's education.

Increased variation in the behaviour and abilities of pupils, add to the burden of complexity dealt with by teachers in the class room leading to:

- Increased customisation of materials and resources appropriate to each pupil need.
- Provision of extended personal support to pupils who find difficulty with basic tasks or struggle to behave.
- The expectation that the more able pupils are more self-reliant in directing their own learning.

Resolving these issues is becoming increasingly urgent, according to those who were interviewed, as the proportion of pupils admitted under the policy of social inclusion increases.

Teachers have to spend an increasing amount of time recording and providing information to others. Most information concerns those pupils that have been identified as having special needs for those in core subjects, the information has to be extremely detailed describing, for example, whether they can use ful stops and capital letters. For the occasional pupil, teachers find it reasonably manageable, but as the numbers increase the workload this process generates becomes a real problem. Adding to the bureaucratic overhead, is the

increasing use of *'round robin'* enquiries from Guidance either in response to a parental enquiry, a need to gather evidence prior to a parental interview or be stimulated by concerns raised with Guidance by another teacher. Once again, the occasional report is generally manageable for most teachers, but where classes contain a number of pupils on whom reports are regularly required, it becomes a time-consuming process.

Many teachers regard this constant demand for information as a major distraction from their proper role, a perception re-enforced by the one sided or asynchronous nature of the process. Further enquiries revealed that the low regard and priority given to the sharing of information by most staff is because of: -

- A lot of information is a logging exercise: it is merely part of a recording process and it has no effect on the teacher or the pupil.
- Volume of information: the teacher as the information provider is the tip of an iceberg. One report or piece of information on one pupil provided by a teacher, multiplies on the downstream side so that it becomes eight or more by the time they gather at the information user. Generally, the collation and management of this information leaves little time for feedback. .
- Inconsistent information: users receive conflicting information and producing feedback reports with a unified viewpoint takes considerable tact if it differs from the providers view.
- Separation in time and space between the provision of information and action creates discontinuities with situations changing in the time between the request for information, collation and reporting, so that feedback is seen as out of date.

Guidance staff are among the key users of information supplied by others: bearing the largest load in requesting, collating and managing the information they receive. With the increase in the number of pupils with varied backgrounds, experiences and needs, Guidance staff now receive information from a wider range of sources and on a wider range of topics. Previously the majority of information would be derived from teachers, now however, they receive information from parents/carers and other official external bodies such as social workers or child psychologists. Some information can be extremely sensitive and using it can require considerable care and diplomacy. For example, it has been known for a few

pupils to be unknowingly related directly through shared parentage to others in the school. Pupils too, are also encouraged to be more forthcoming by national and regional policy initiatives such as those on bullying, racism etc. Guidance staff therefore are having to extend their legal knowledge and range of counselling skills.

4.3.5 Systemic Issues Arising from Prior Educational Experience

Education has a high profile and because everyone has experience of going through the school system, nearly all has a view on what should be taught and how it should be done. Though informed by current debates, opinions expressed by parents, politicians and even teachers, are often prefaced either metaphorically and sometimes literally with *'When I was at school …'*. However people's past experience often bears little relationship to today's 'reality' being based on historical out of date, frequently rose tinted experiences. Nevertheless, because similar concepts are involved - teaching, learning, exams, school buildings - they believe that their own past experience equips them with a unique insight into how education should be managed today.

Some changes include the legal obligation for the school to provide specific information, for example performance statistics (exam pass rates, education costs per pupil etc.) and the need to consult to the local community on how the school should be managed. Parental and pupil rights have been formalised and whereas they used to seen as broadly passive consumers/participators in the education system they are now encouraged through the effects of legislation to get involved.

For the SMT, attempts to develop systems to involve the community in the management of the school been accomplished with various degrees of success. The formation of the school board has been particularly challenging. Parents are preferring to deal with the SMT directly. So rather than dealing with the community on a 'one to many' basis, they are increasingly having to deal with parents in 'one to one' situations, which for them, is less efficient and more time consuming. Year heads (AHT's) recount that at intervals throughout the year, up to 40% of their time can be spent in meetings with parents. They also comment that in a small but increasing number of cases the tone of these meetings are negative and confrontational.

SMT and Guidance staff are noticing differences in the way meetings are instigated and their purpose. Previously, parents would be invited to the school. Now however, parents/carers are increasingly requesting meetings on their own account, asking for special provisions to be made with respect to their own children, for example requesting/demanding additional learning support to be provided or to dispute decisions such as why their child has been excluded from such things as school trips, or why the school has adopted a particular support strategy rather than other possible alternatives, or even why their child has been placed in a particular class and not in others. It appears that a subtle shift in responsibility is slowly taking place. Before, the situation could be characterised as the school holding the parents accountable for their children's behaviour and performance and seeking their assistance to tackle the causes of concern with the children at home. Now, the situation is changing to one where the parents hold the school accountable for their child's poor performance and behaviour and it is up to the school to develop strategies/methods that remedy their concerns.

The shift in responsibility for pupils performance and behaviour is also being noticed in the class room. Teacher's frequently comment that increasingly parents are disputing decisions they make, especially with regards to any sanctions used against their children. Teachers interpret this tendency of parents of automatically accepting their children's viewpoint as a lack of parental support in helping them to maintain standards of behaviour and work. It is a perception that is further reenforced by the increasing number of minor complaints made about teachers often directly to the Guidance staff or to the SMT.

Parents are strongly encouraged to use Guidance staff as the first point of contact as they often know the pupils best. However, when parents complain, this can place them in a difficult position. They have to investigate the situation which can set them at odds with teaching staff, who frequently believe there is nothing to investigate and regard enquiries as implying some form of criticism. Then if they discover grounds to the complaint, there can be further difficulties if the teacher takes a contrary view. Conversely, if the Guidance teacher finds that there are no grounds to a complaint, parents sometimes accuse them of closing ranks or of the school as a whole *'picking on their'* child. Consequently as a result of this shift in accountability from the parent to the school, Guidance staff are having to expand their mediation and diplomatic skills to deal with parents, pupils and staff.

Principal teachers as departmental managers are partially insulated from the effects of parental interference by the work of the SMT and Guidance. Nevertheless, decisions they make are still scrutinised carefully by parents, often reported to them by their children. One effect is that decisions have to be made using criteria which can argued as valid. However it is clear from observation and participation in decision making, these criteria are arrived at through a method of post-rationalisation. Essentially the process can be characterised as *'We have these limited resources or places available and we want these pupils to use them. How can we justify choosing them to parents?'* Sometimes the latter part of the process might be addressed to arriving at a justification for the SMT, but ultimately parents remain the intended audience.

One of the main areas where parents can become more involved with departmental decisions, is at the critical stage of option choices. While pupils have many reasons for choosing subjects, parents emerge unsurprisingly from discussions with pupils, as a major influence on their choices. Comments such as *"... I'm choosing computing, because my mum told me you can't get a job without knowing about them.",* are typical amongst S2 pupils. In some cases parents encourage their children to choose subjects on the basis of their own previous experience or alternatively not to do certain subjects because they had difficulty with them when they were at school. As these examples show, departments and Guidance staff often have to struggle against parents influencing pupils to choose courses on basis of their own experience, without recognising that there have been dramatic changes in the curriculum and the way that pupils are now assessed. Against this, parents and pupils need to be sure that the advice they receive is fair and impartial, but ultimately though, if parents and even the pupils' on their own account insist on taking a subject, then the school can't refuse them.

4.3.6 Systemic Issues Arising Increasing Legalisation

Education is almost unique in the extent that responsibility is transferred to an organisation with the school becoming *in loco parentis*. These are outlined in the Scottish Education Act; the most recent version of which was introduced as The Standards in Scotland's Schools Etc. Act in 2000. As legislation, the Act specifies all the things the school must do, but it is also added to and amended at irregular intervals through *'circulars'* which are issued by the Scotland Office and Regional education authorities.

Changes in education law along with other legislation like the Health and Safety at Work Act have a significant impact on the work load of the SMT. All members of the SMT indicated that they have to spend a considerable amount of time in management meetings and external conferences trying to understand the implications of legislation, interpreting it so that it can be understood by other members of the school and then translating it into systems that enable operational delivery of the legislative provisions. Each stage can be extremely problematic, as it can highlight apparently contradictory aims which the SMT have to reconcile within limited resources. For example the inclusion of *'problematic'* pupils or pupils who have special educational needs within mainstream education without affecting normal class room activities or diverting attention away from the education of the majority.

Although each new piece of legislation when considered in isolation, creates interpretational and implementation issues for the SMT, there is the cumulative complexity arising from separate pieces of legislation, for example the Child Protection Act and Special Educational Needs and Disability Act 2001, that builds on and augments provisions covered by other acts. Initially, some legislation is directed at local authorities. For example, The Standards in Scotland's School Etc. Act 2000 which states the right of a child to education for the first time, is addressed in the first instance to each local education authority. It defined education as: -

> *"... it shall be the duty of the authority to secure that the education is directed to the development of the personality, talents and mental and physical abilities of the child or young person to their fullest potential"*

Interviews with Education Officers and Deputy Directors of Education in Education Authorities shows that they believe that they can only exercise this responsibility by becoming intimately involved in the management and development of each school. Most of the time though, their responsibilities are discharged through the issue of detailed blanket policies and the specification of targets. The role of the SMT then is to implement the policies and conform to the targets specified.

The increasing legalisation of education has made the SMT aware of how vulnerable they are to litigation making them very defensive and concerned with the maintenance of accurate

records. Many of the school's systems are orientated towards the collection and exchange of information, often on the *'just in case'* basis and becoming concerned with supporting the rights of pupils and investigation of any concerns.

Legislation and authority policies has led to redefinition and expansion in the scope of undesirable behaviours. The issue of bullying is one example, having once been considered as involving only forms of physical intimidation and abuse but has gradually been redefined in recent years to include verbal and other forms of non-physical intimidation and so bullying has become a generic term which can be used to describe almost any form of grievance that a pupil may have towards other pupils or even staff. Guidance teachers emphasise that straightforward cases of bullying are relatively rare. When the reasons are examined, it often the case that blame can be attributed to both sides but investigating and recording each step them consumes a disproportionate time.

Supporting the rights pupil and parental can affect the ways in which staff relate to pupils and bring the SMT into conflict with staff. Increasingly parents are judging what schools do, from within the context of how they treat their own children, with differences seen as possible grounds for complaint. The SMT report that it's difficult to strike a balance between the rights of the individual and the effective control of large groups of unpredictable pupils and that with an increasing diversity of pupils now entering schools, each of which having their own complex backgrounds and problems, it is a problem that it is only going to get worse.

A defensive stance where risk is avoided wherever has lead to less interesting work. In the science subjects for example, many of the experiments that used to be completed by pupils, are now omitted altogether or done as demonstrations because of the potential risk presented t to pupils. It has also led to reduced flexibility with only qualified teachers being able to deliver lessons in their subjects and only providing basic cover in other subjects. Legislation has also had an impact on how teachers relate to pupils. Teachers are warned not to be alone with pupils behind closed doors and encouraged to have witnesses when having possibly controversial discussions with individuals.

Avoiding risk has impacted on extra curricular activities and trips away from school. For

any activity out with normal school hours, even extra tuition or after school classes requires consent forms to be completed by parents to grant authority to the school to have the children during the times specified. The increasing bureaucracy involved in obtaining these, especially from pupils who have poor organisational skills and therefore need to be constantly encouraged to bring them, is one aspect that deters staff from getting involved in extra curricular activities. The principal obstacle though, is the personal liability that staff feel exposed to, should anything go wrong.

4.3.7 Systemic Issues Arising from Extended Relationships

One of the distinct features of school education is the extended relationship that pupils have with the school and teachers. The SMT try to create a positive atmosphere where pupils feel a sense of belonging and pride in the school and where they are willing to come to work in order to fulfil their potential. This atmosphere is often referred to as the school *'ethos'*.

4.3.7.1 Defining Ethos

Attempting to define a school's *'ethos'*, nearly all teachers initially referred to a formal declaration used in the school's handbook, which is perhaps unsurprising given the high profile awarded to *'ethos'* in the educational literature, by the school's SMT and being one of the main areas assessed by the HMIE. So Staff knew what the school's *'ethos'* should be, but when they were asked how they assessed and by extension recognised the nature of a schools *'ethos'*, most teachers began by remarking how indefinable it was. On further questioning, teachers and the members of the SMT emphasised that a schools *'ethos'* could not be identified or associated with one particular feature. Instead, when giving an opinion as to the nature of a school's *'ethos'*, they discussed a number of indicators which provided clues, all of which, fell into one of the following categories: -

- How pupils congregate in spaces and whether they appeared threatening.
- How pupils moved around the school and whether they carried bags.
- How staff moved around the school.
- How staff converse with one another and how they related to pupils.
- How the buildings and the entrance in particular, looks.

These discussions revealed that although staff know what *'ethos'* is, and what it should be, they could only recognise it and discuss it in terms of symptoms revealed in the relationships between the school buildings and its occupants, as well as the relationships amongst staff and between staff and pupils.

4.3.7.2 Espoused ethos and reality.

The school was praised in its last HMIE report (1998) for having a supporting and caring *'ethos'*, but when teachers were asked whether the schools' *'ethos'* espoused in the school's handbook was supported in reality, many all felt it was only partially true. The majority believed that the pupils lacked pride in the school there wasn't a general expectation of high achievement or academic success. Those that felt the *'ethos'* was partially true considered it said more about the schools location and size. For example, the reason that most pupils liked coming to school was because the was little else in the area. Others considered the generally relaxed atmosphere of the school was due to its smallness or because pupils were to apathetic to do anything else. The discussions showed that staff saw a real difference between the *'ethos'* espoused by the school and the *actual 'ethos'* of the school. They also revealed a difference of opinion as to the causal relationships that underpin the *'ethos'* of a school.

4.3.7.3 Changing the ethos

Teachers were asked what could be changed to transform the schools current *'ethos'*. Perhaps, unsurprisingly, there was a considerable difference of opinion on this.

Some considered that there was nothing concrete could be done to alter a schools *'ethos'*. For them, a schools *'ethos'* was a natural outcome of having a large number of people working together and sharing a common space. In any situation like this, an atmosphere of some type is inevitable and its nature would depend predominantly upon the history of pupils and staff who had gone before and stories, myths and legends that circulate the school. As nothing could be done about the past, there was little that could be done now to affect its development. Essentially the *'ethos'* of the school would continue to evolve regardless, being constantly reinterpreted by new pupils and staff in the light of a developing history.

Of a similar view, others considered that the *'ethos'* is predominantly determined by the schools context in the local community and by social attitudes to such factors as unemployment, academic achievement, vandalism, drugs, single parent families etc. For these teachers, any attempt to change the schools *'ethos'* is going to be vastly outweighed by happens beyond the school gates.

Of those with a less pessimistic or fatalistic view, there was a difference according to the role in the organisation. Some Guidance teachers, perhaps typically, proposed that the main way to alter a schools *'ethos'* was through the pastoral care system, by promoting equality and fairness in relationships between staff and pupils would encourage pupils to attend school and equip them with a sense of community. Subject teachers believed that by improving discipline or by obtaining clear parental support in pupils education, then the overall educational attainment of the school would be raised thereby enhancing a sense of academic success.

However when either group was asked about the causal relationships between their viewpoint and changing *'ethos'* things became less clear. Staff who promoted pastoral care could not explain how this translated into high a regard for educational achievement, where the notion of a few being recognised for achieving something out of the ordinary (i.e. being singled out from their next door neighbour), appeared to contradict the idea of equality and fairness. Similarly subject teachers could not explain how becoming more severe or less tolerant of indiscipline, would make the school a more welcoming place that would encourage pupils to attend.

There were also a number of staff who believed that changing the school *'ethos'* was limited to the position in organisation's hierarchy. Non promoted staff and some principal teachers generally believed the *'ethos'* developed from the tone set by the management ie the SMT. Changing a schools *'ethos'* simply requires the SMT to set a clear examples and redefine the methods and procedures they use to relate to staff and pupils. The tone established in these relationships would then permeate downwards through staff and pupils, who would then respond in a like manner. In contrast to this *'top down'* approach, the SMT staff with some principal teachers had the obverse view. They considered that *'ethos'* developed *'bottom up'* through class room practice. A school's *'ethos'* grew from the relationship between subject

teachers and pupils operating within a framework set by the SMT. Essentially teachers would set clear boundaries and standards and provide an example to the pupils. Pupils on observing this behaviour would follow this example and respond, and through this *'do as I do'* approach, the attitudes set in the class room would spread throughout the school.

While appearing very divergent, all agreed, it is a complex feature of school life that does not reside within easily identifiable variables. Instead, *'ethos'* appears to be an emergent property of a complex system and generated by numerous interacting and interrelated factors working together. For the SMT trying to create a positive whole school *'ethos'*, this creates significant issues as it requires a more sophisticated model than they have at present.

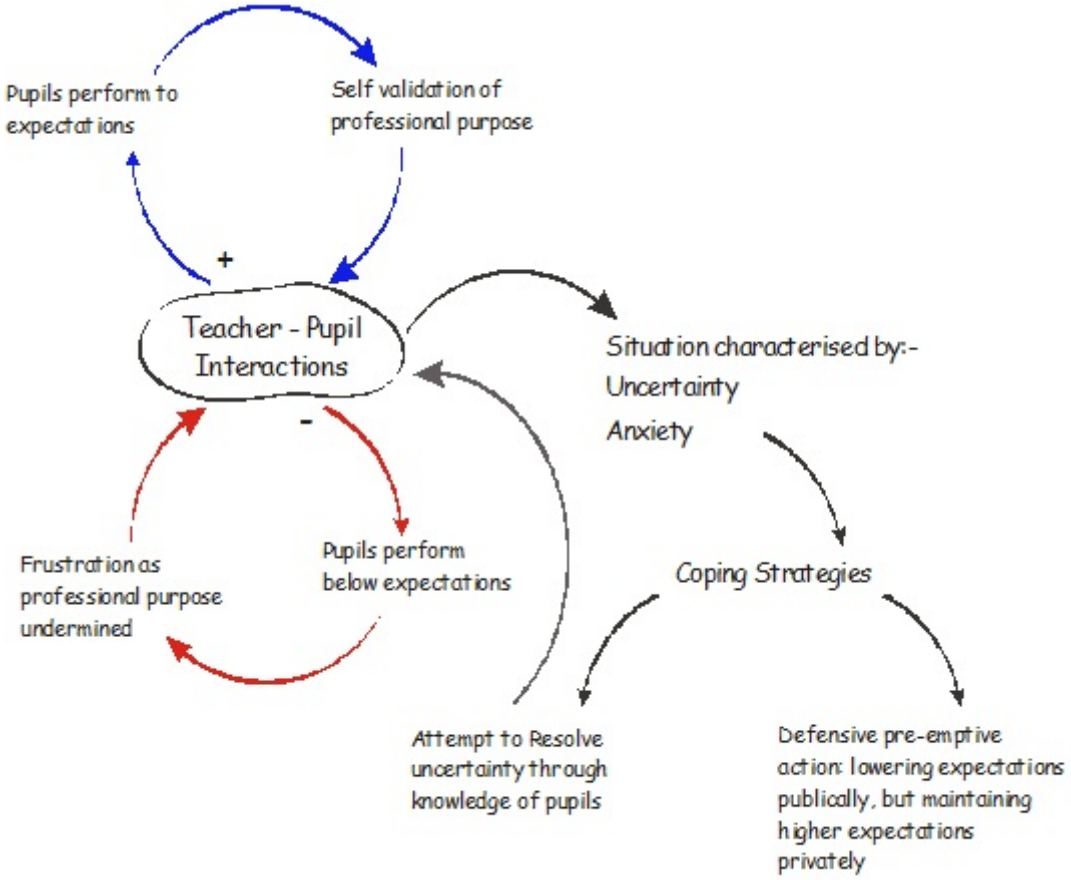
4.3.8 Further Systemic Issues

One of the distinguishing features of education is the length of the relationship between the staff and pupils: up to six years for some and can cross generations with ex-pupils sending their children to the same school. When the nature of this relationship is investigated further, it emerges that the focus of concern in this relationship varies according the position within the organisational structure.

4.3.8.1 Teacher Uncertainty

In a relatively small school, it is not unusual for a subject teacher to teach the same pupil for their entire school career. Partly this is because the size of the school and partly deliberate policy on behalf of school management, who attach a high value on maintaining continuity of teaching. Maintaining continuity is considered significant because it avoids unsettling pupils through changes. Each teacher has their own style and methods of working and changing teachers involves *'training'* new classes to unfamiliar work routines and patterns. Pupils will additionally test boundaries so part of the work of the class teacher is setting boundaries on standards of behaviour which requires a realignment of pupil expectations. These are factors closely related to, but distinct from the process of education and have to be established before effective education can begin. The SMT also believe maintaining continuous contact increases the accountability of teachers. If judgements are to be made about a teachers ability according to how well pupils do in exams, then it difficult to know whom the credit or

Figure 27: Tensions underlying the role of the teacher.



otherwise belongs if they have multiple teachers.

Teachers also believe in maintaining teaching continuity. Changing classes can be a major disruption and they generally welcome the opportunity of taking classes through to the completion of courses. Seeing pupils do well in their final exams is a significant contributor to their feelings of job satisfaction. The converse of this, is that classes can also be a major source of personal frustration that builds on the already stressful work of being a teacher.

Figure 27 shows that in any class based situation, teachers develop a set of expectations of how well the pupils will perform. These expectations, developed in the light of past experience, includes approximations as to the amount of work that will be completed against the course requirements together with ideas of the level of progress that will be made. The teacher also has some expectations as regards standards of pupil behaviour, although to some

extent these are less important to the learning process, as teachers are determined that their own, rather than pupils standards of expected behaviour will prevail. From this point, if the pupils match or exceed the expectations of the teacher, then this validates and reenforces the teachers judgments and professional expertise. Teachers can see they've actually made a positive difference through their own set of activities and nearly all the teachers interviewed, reported that success in this area is one of the few times that they get a sense of achievement that increases their own feelings of sense of self worth as a teacher and recognition by themselves of their own teaching ability.

If pupils fail to perform to expectations then this creates within the teacher a deep sense of frustration arising from a failure to complete planned work or failing to get pupils to master concepts at sufficiently an advanced level. Behaviour emerges as the main factor that prevents pupils from achieving as expected and teachers report that pupils are becoming less responsive to any sanctions that they might impose - see Annexe 9. If teachers continue to experience the same level of frustration, then their initial reaction appears to firstly blame the pupils and then the *'system'* - parents, pupils and school management - that created the situation in which this failure is occurring. Eventually though the situation it leads teachers to doubt their own professional competence.

Figure 27 shows that from the teacher's point of view, any formal class based situations are characterised by uncertainty and anxiety, with the teacher never being sure as to which of the two states pupils are going to occupy relative to their expectations. In this uncomfortable position, teachers have developed a number of coping strategies.

- Reduce uncertainty by getting to know the strengths and weaknesses of each pupil. With increased knowledge of the pupils, teachers are able to form a more accurate set of expectations and therefore are less likely to follow the negative feedback loop in figure 27. There appear to be two distinct approaches

    - Establishing prior attainment by canvassing other teachers favour by those with a low tolerance of uncertainty.
    - Providing a fresh start avoid having their judgments tainted by other teachers opinions of the pupils in advance to the start of courses.

Some of the relative merits to each of these approaches are shown in table 18.

This approach at reducing uncertainty involves dealing with Large amounts of information, With teachers responsible for over 100 pupils, it is not surprising that on occasion important details are missed.

Table 19: Methods of reducing uncertainty

Method & Characterisation	Advantages	Disadvantages	Assumption
Gathering prior information (Low tolerance of uncertainty)	• Quick start with well developed expectations.	• Judgements coloured by others opinions • Embedded opinions can be hard to shift	Past performance is linked to the future
Reliance on own judgments (High tolerance of uncertainty)	• Fresh start for the pupil.	• Slow start while teachers build model of pupils abilities. • Greater influence of personal bias.	Past performance may or may not be linked to the future.

- The defensive *'public'* broadcasting of low expectations to provide some protection against future poor outcomes in staff rooms and departmental meetings, following a pattern where the ability of classes is compared unfavourably to ones in previous years - see Annexe 10. Making disparaging global and public statements about pupils abilities, also fulfill the equivalent function of *'flying a kite'* seeking validation of their views gain general acknowledgement that they are indeed difficult to teach, through feedback from their colleagues.

At face value, these statements can be misleading, giving an impression that the majority of teachers hold pupils in contempt and that there exists in school, a form of institutionalised pessimism about the future prospects of the pupils. When questioned further in private,

teachers are generally much more positive and forthcoming about how well pupils are doing in their classes and how well they are likely to do in the future. Nevertheless experience in the action research project, which in part was aimed at making these expectations explicit, showed that teachers were extremely reluctant to formally record their expectations in a publically accessible format. From work undertaken during the action research, this reluctance stems principally from the fear of the expectations being held against teachers, if the pupils failed to achieve them.

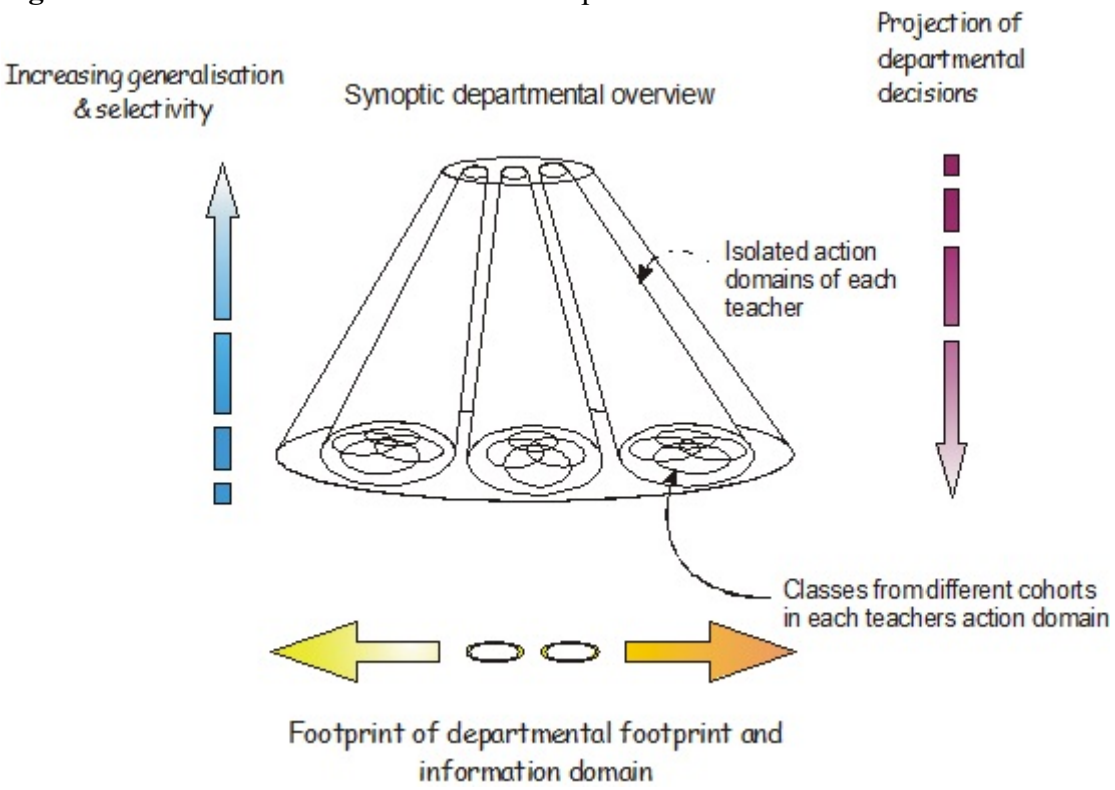
4.3.8.2 The Role of Departments

Only in small departments can teachers have knowledge of an entire year group. Generally teachers takes classes across a range of year groups. As figure 28 illustrates, teachers can only partially understand what's happening on a larger scale from the knowledge gained through the pupils they teach in their own action domain. Furthermore, this knowledge is limited to how the pupils perform and behave within the subject area of the teacher.

Figure 28 shows that it's only at the departmental level that teachers can gain some overall understanding of year groups where teachers can bring their knowledge gained through their own classes to debates within the venue of departmental meetings. Of necessity each teacher has to condense their own experience with abstracted groups in their own action domain. Suggested by the cones in figure 28, much information is lost as teachers select and condense their knowledge of their pupils into a presentable form, so that the total collective knowledge of pupils at the level of the department, is considerably and inevitably less than that available in the total action area of the entire department. While clear from the diagram it is often unrecognised by PT's, members of the SMT and in particular the HMIE, which make the assumption that everything important in a department is knowable and can and should be known.

Experience showed that considerable time is spent exchanging information and experiences in an attempt to reach a global understanding of what's happening within each teacher's action domain. Departmental meetings, however, fulfil an additional but unrecognised function of re-enforcing and validating a teachers professional purpose. Conventionally, departmental meetings are seen as forum where information is exchanged and the activities

Figure 28: Interrelated overview obtained at Departmental Level



of teachers in a department can be co-ordinated, but it is through discussions on what is taught, how it might be taught and when it is taught that a teacher comes to understand what, when and how they have got to fulfil their role. And as the cones in figure 28 show, departmental meetings become the start point of how departmental decisions are projected and realised in the separate action domains of each teacher. The effectiveness of how well this is done is dependant to a certain extent to how each teacher agrees, understands and translates these decisions into action.

4.3.8.3 The SMT Overview

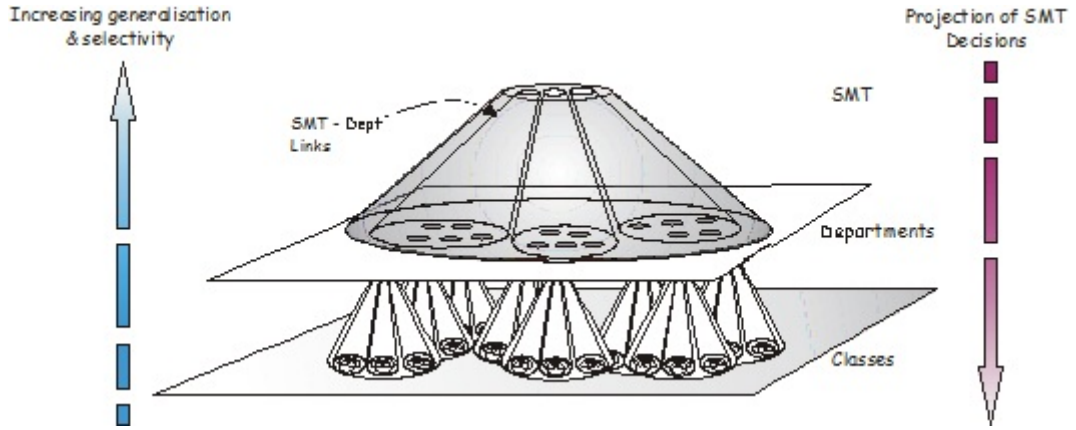
Departments only get to know the pupils from within their subject area through the class teachers. Paradoxically members of the SMT obtain a broader view of the pupils, despite being at a stage further removed from the class room. This is achieved through either curriculum links or through the pastoral care system.

4.3.8.3.1 Curriculum Links

Members of the SMT act as *'link'* managers between heads of departments and the SMT as a whole. Figure 29 shows groups of departments falling within the responsibility of different members of the SMT. This provides them with position to appreciate: -

- how pupils perform or behave in the different departments for which they are responsible
- detecting concerns that might be common between departments such as work load, resource or assessment issues that surround post 16 education

Figure 29: SMT Curriculum Links



However, just as teachers cannot appreciate all aspects of their department from within the class room, members of the SMT cannot obtain from within their cluster of departments an overview of the complete school. This can only be achieved by the exchange of information between SMT members who each see part of the overall picture. As the tapering cones in the top level of figure 29 show, this involves dealing with information that becomes increasingly generalised and selected according to the perspective of individual SMT members.

Consequently, when plans are being made the SMT are dealing with information that represents a fraction of the overall amount available and at a stage further removed from the reality of the class room. This process explains why members of the SMT can remain surprisingly unaware of significant developments occurring in other areas where to heads of department they appear obvious. For example, the head teacher mistakenly believed all first

and second years were graded according to 5 - 14 criteria. In reality a number of different systems were used.

Decisions are projected downward to departments linked to each SMT member and then on down through teachers to pupils. As the diagram suggests, how decisions are translated across the interface between the SMT and departments, become important to their successful implementation. The translation is necessary because: -

- The SMT have arrived at decisions through the use of global information that is inaccessible to PT's and teachers, due to their structural position in the organisation.
- Departments are focussed on the delivery of their courses, while the SMT are dealing with groups of departments and therefore have to generalise.

The resistence to moving to a 5 - 14 reporting system after almost 10 years since its introduction by some departments, is one example where this translation system has broken down.

4.3.8.3.2 Pastoral Care

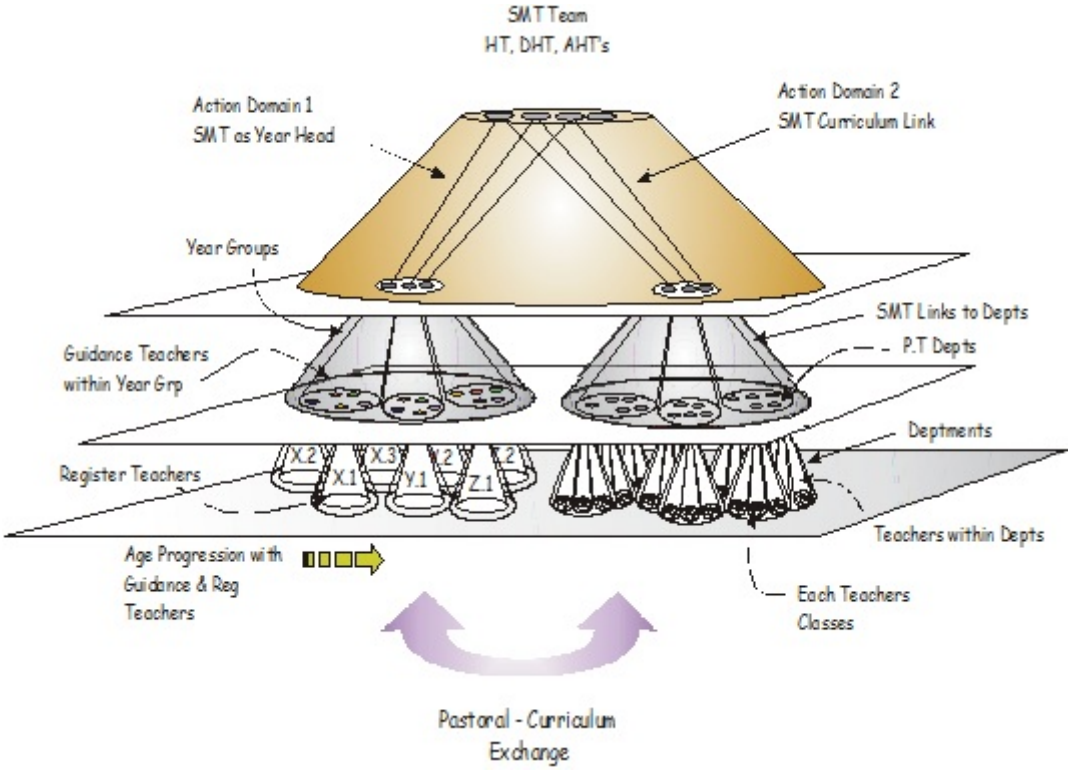
Members of the SMT have the additional role as Year Heads within the pastoral care or Guidance system, in which they are accountable for the academic and personal development of pupils within their respective year groups, together with the responsibility for dealing with major indiscipline incidents. In the role they have the tasks of developing and organising plans, policies and events that affect their year groups and operating as the main point of contact for parents/carers after Guidance teachers. The relationship between the two action domains of pastoral care and curriculum links, is shown in figure 30.

The right-hand side of figure 30 repeats figure 29. The left-hand side, shows each SMT member connected to their respective year groups via the Guidance staff and Register Teachers. Priority is given to the maintenance of contact with Guidance staff and Register Staff who remain with the class as they age. In contrast, the position of the Year Heads remain static, so that as pupils pass from one stage to another (ie from Lower to Middle to Upper school), they pass from the authority of one Year Head to the next. The coloured

circles show that Guidance staff operate in parallel under all Year Heads taking responsibility for classes within each year group.

Their position at the apex shows that Year Heads are the only ones who can appreciate the character of their respective year groups. However, following the structural logic being developed, they can only obtain a partial view of the whole school's pastoral character which is defined principally through their allocated year groups and to a much lesser extent by information they gather of other year groups whilst acting in their curricular capacity. A global understanding can only be achieved at this level through the exchange of information between the year heads.

Figure 30: SMT Curriculum and Pastoral Care Links



The tapering cones once again illustrate that the SMT understand the world in their action domains from partial information abstracted from whole set of available information, starting with Register Teachers, then Guidance teachers and finally themselves that select information of interest. The risks in this situation are: -

- Year heads get a distorted view of the school as their attention is constantly attracted by the increasing number of problematic pupils who are referred to them through the Guidance system or through subject departments and occupy a disproportionate amount of management time.
- Discontinuities in understanding with developing and implementing plans and policies that impact on the responsibilities of other Year Heads.

Some risk can be offset by the rich exchange of information through the venue of SMT meetings, the only point where a global view of the school can be obtained. However, the success of this process is dependant on whether information is gathered in a consistent manner and gathered to supply similar needs and aims.
Research though, revealed this wasn't always the case. For example the Head of Middle school, who is the SQA coordinator, relies on accurate course information from S5/S6 pupils being promptly gathered by the Head of Upper School in order to register them with the SQA. In contrast, the Head of Upper school had a different set of priorities with a bias towards pastoral care, placing a much higher value on personal development programmes. The difference in approach produced some conflict

Aside from the issues that surround the sharing of information at SMT level, SMT members have the difficulty in creating and implementing plans that differentiate between Year Groups. As figure 30 shows, plans are projected onto year groups pupils that *'rotate'* under Year Heads as they age, carrying with them, the consequences of initiatives launched under one Year Head to another. These may include how they deal with discipline or initiatives to raise attainment. Staff can be highly critical in particular, of differences in approach to disciplinary matters, often recognising that the overall discipline is affected considerably by how different Year Heads tackle disciplinary issues.

4.3.8.4 Guidance Staff

Figure 30 shows that Guidance staff occupy a difficult position within the organisational structure. They form lengthy relationships with pupils, amassing a wealth of knowledge about pupils and their family, but lie outside the formal organisational structure reporting to different Year Heads. This matrix like structure is summarised in table 19.

Table 20: Register class relationships with Guidance Staff and Year Heads

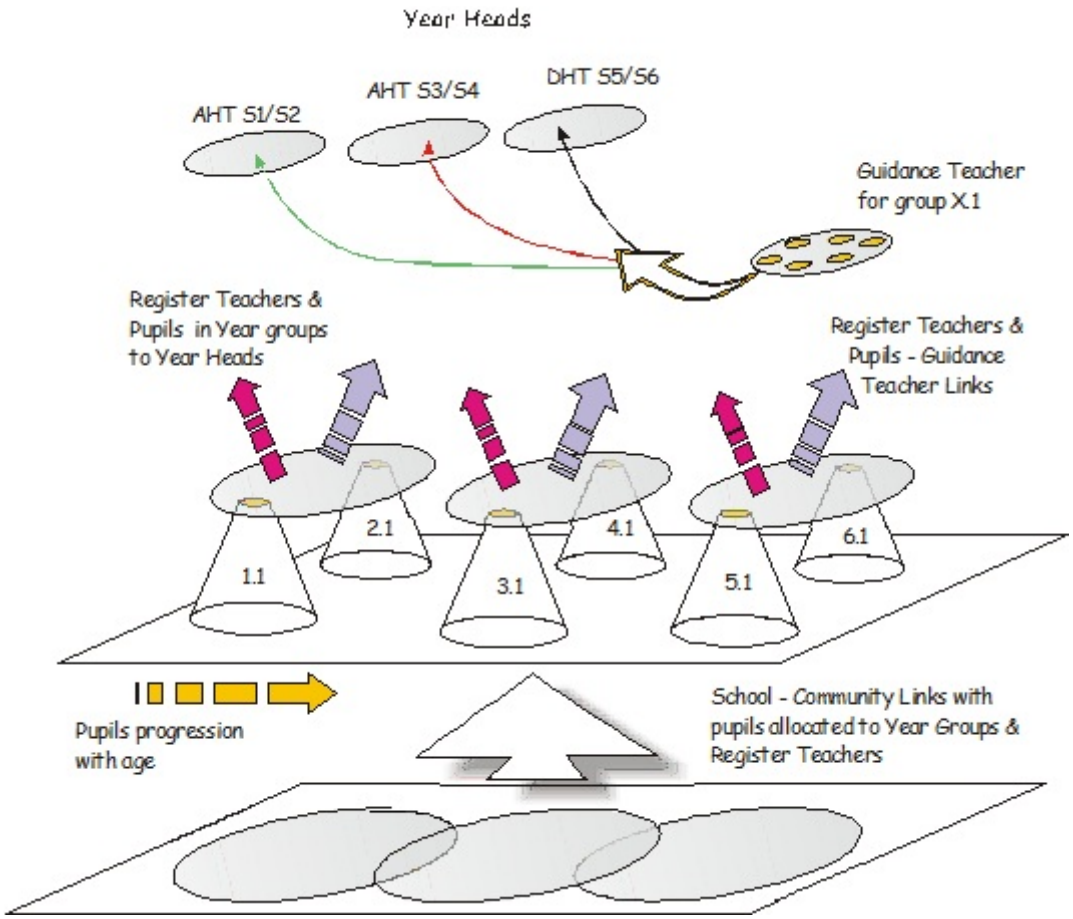
	AHT Lower School Year Head (S1/S2)		AHT Middle School Year Head (S3/S4)		DHT Upper School Year Head (S5/S6)	
APT Guidance Teacher	1.1	2.1	3.1	4.1	5.1	6.1
PT Guidance Teacher	1.2	2.2	3.2	4.2	5.2	6.2
APT Guidance Teacher	1.3	2.3	3.3	4.3	5.3	6.3
PT Guidance Teacher	1.4	2.4	3.4	4.4	5.4	6.4

Table 19 masks considerable complexity showing Guidance Staff have to maintain multiple relationships horizontally and vertically. Figure 31 illustrates the position for one Guidance Teacher.

Pupils from the local community are grouped according to age and placed within register classes contained in a year groups under the responsibility of an SMT member. Selected register classes from each year group are assigned to particular Guidance Staff for the duration of their time at school. Under this arrangement, Guidance Teachers never manage to obtain a whole year perspective of a year group. Like subject teachers, they only see parts of year groups and a whole year perspective can only be obtained through a combination of Guidance Teacher viewpoints, duplicating the process followed by Year Heads.

The broader arrows in figure 31 indicate that most personal information known about pupils is gathered by the Guidance Teacher over time, collecting information directly from the pupils, parents and from register teachers who assist in gathering in information through collection of absence notes, data check forms, permission slips, acknowledgment returns and such like. They also have to gather performance information from the subject teachers of individual pupils requiring extensive information exchange with teachers in the curriculum domain. The register classes though, remain under the authority of Year Heads and are subject to any initiatives implemented through the Register Teachers. Guidance Teachers have to frequently supply information on pupils to Year Heads which change as pupils move

Figure 31: Complexity underlying Guidance in the organisational structure.



from lower to upper sections of the school. This information is broadly of two types.

- Generally proactive raising issues of concern that arise from pupils, perhaps centred on bullying or unusual forms of behaviour that may be indicative of more complex factors.
- The larger category of information is generally reactive and frequently provided as mitigation for some behavioural or performance deficiency.

At present the system is reliant on the Guidance Teacher knowing that it is needed and required by the Year Head, or the Year Head recognising that Guidance Teachers may have in their possession information that may be relevant.

4.3.9 Changing Social Expectations

Ongoing modification to the purpose of education and increasing accountability are among some of major developing trends affecting school management.

4.3.9.1 Utilitarian principle in extending the purpose of education.

Successive governments have claimed that they have been attempting to be more accountable, transparent and responsive to the needs of society. One consequence is that schools are becoming increasingly constrained, with their own priorities and developmental needs being determined elsewhere.

Teachers have seen the purpose of education slowly change. The current model regards the purpose of education from a utilitarian viewpoint, where education is the means to achieve something wider, beyond the individual and school: education should be more than imparting subject knowledge to pupils or even preparing them for the world of work, it can be the means to bring about *'politically desirable'* changes, first in the individual and then via them, in society as a whole. Economics and the recognition of what is considered as undesirable behaviours in society appear to be driving this process.

Teachers too, have been leading participants in its subversion. Since the connection was made between success at school as determined by number of qualifications and access to higher education or better job prospects, teachers together with parents have been using the following basic economic argument to motivate pupils and to connect the *'pain'* of hard work now to later benefit.

> *"... work hard and you will get better qualifications: get better qualifications and you will get a better job: get a better job and you will get more money: get more money and you will be able to have that house, car, holiday etc."*

Although increasingly questioned by the young, under this idea, success at school can be seen as gateway from poverty and an opening to broader opportunities through sheer intellectual effort. While introducing a utilitarian aspect to education, it is nevertheless focussed on the

individual, in that it is only the individual that benefits from their own effort. Recent developments have seen this argument appropriated and modified for use at a higher political level to emphasise the wider social significance of improved education. Paraphrased as follows:

> *'... improved education leads to a better educated work force: a better educated work force attracts investment: more investment leads to more jobs which leads to an economically sustainable and viable community.'*

This modified argument shifts the benefit education can make to the individual to the economic contribution a better educated individual can make to society and led to measures that in effect attempt to determine the economic contribution made by schools through higher exam attainment. And recognition that education can bring a wider economic benefit through changes in the individual, has meant an extension of the utilitarian principle to tackle emerging socially undesirable behaviours. For example, teenage pregnancy is seen as undesirable, so sex education is seen as means of reducing the incidence of this occurring in the wider community. Similarly, drug addiction is seen as a bad thing, so teaching drugs awareness can be a means of prevention.

The economic rationale for including for including these topics within the curriculum appears to be problems in these areas have a subsequent cost. If these problems can be alleviated at school at marginal cost, then the cost of education can be discounted against the later cost arising from these subsequent problems. In this way education becomes more than current expenditure, it becomes a more effective investment in the future.

The difficulties created for school management include:

- Time has to be found within the timetable in competition with traditional subjects and the vested interests of teachers who see their professional interests and development tied in with their subject.
- Being held accountable for areas, over which they have little control.

The inclusion of these separate topics has generally been in response to developments in wider society, with schools being used as a tool to promote *'social goods'* such as racial and gender equality. Recent government initiatives however, are seeking to extend the utilitarian principal even further, using schools to promote other politically acceptable *'social goods'* such as social justice, inclusion, life long learning and citizenship in a more pro-active way. Accordingly schools have become much more than just places of education: they have become the front line in politically acceptable social engineering and where teaching staff are responsible for enacting government approved policies in the community.

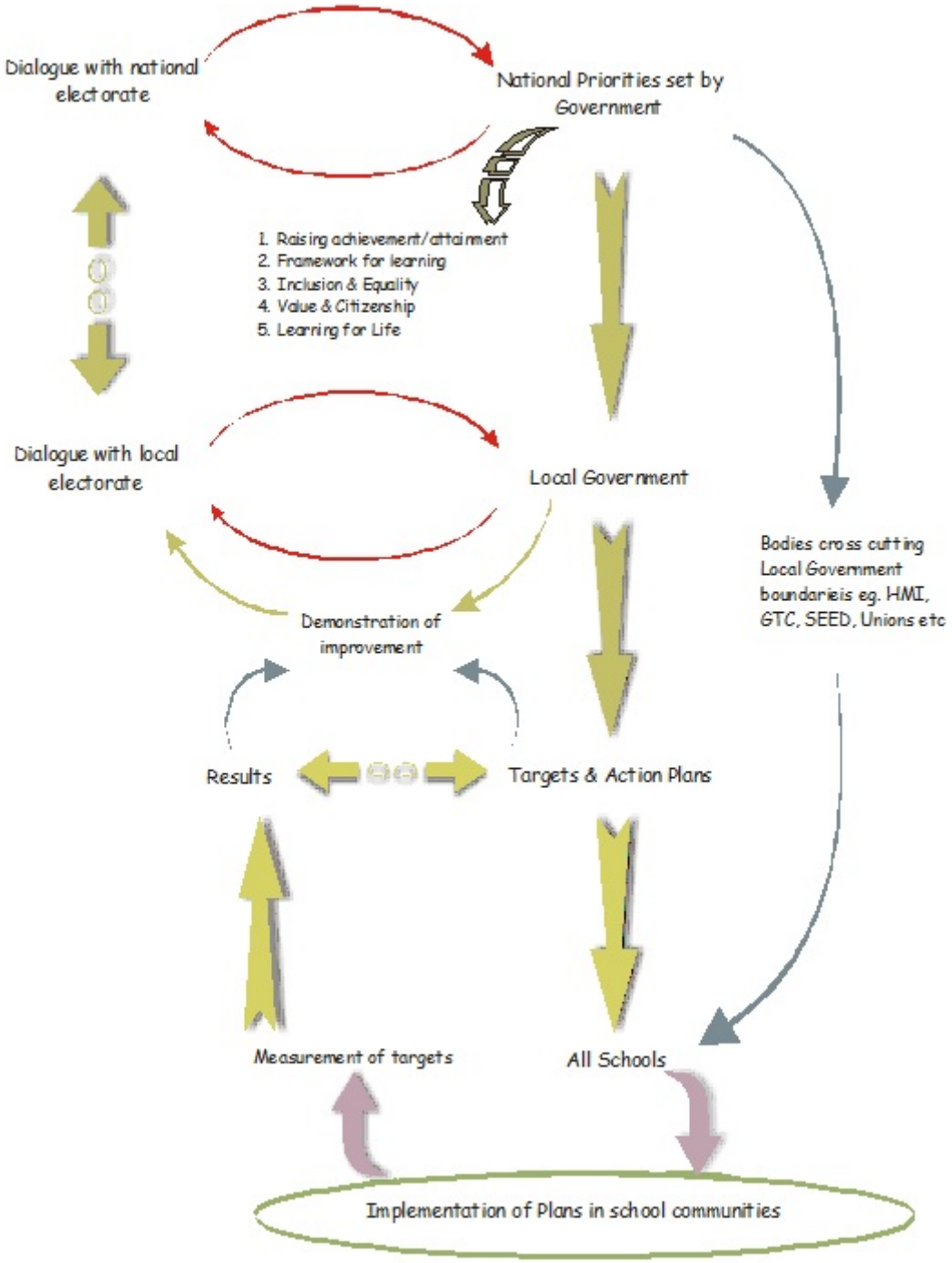
4.3.9.2 Accountability and linking social expectations to education policy.

Figure 32 illustrates the process of how social expectations and political aspirations come to constrain the freedom of schools in determining their own priorities and needs. Social expectations enter debates on education through dialogue between government and the electorate: an encompassing descriptive term, that includes voting private individuals and any alliances formed with others through which their opinions may be expressed, for example trade unions, research groups, pressure groups etc. Leading and following public opinion, government prioritises on areas in its educational policy that it believes will receive majority support and help it achieve electoral success.

The issue of delinquency helps illustrate the process. Increasing concern about rises in youth crime has led the government to address the issue through its educational policy and teaching the rights and responsibilities of individuals under the heading of citizenship, in an attempt to reduce youth crime has now extended to all parts of the school curriculum. Citizenship has in fact become one of five areas of development within education, that the government recently decided are national priorities. To emphasise their importance, these have been incorporated into the most recent educational legislation: the Scottish Education Act 2000 etc.

As part of discharging their responsibilities under the act, local education authorities develop their own plans to support the implementation of government policy, taking into account issues arising from debates with their own local electorate and include considerations of such contextual factors as available funding, existing resources and demographic composition.

Figure 32: How social expectations impact on schools



With planning priorities established at national level the focus at local level is centred on the production of implementation or action plans and the identification of performance measures by which they can demonstrate to their own local electorate and national government,

progress towards meeting the intended planning outcomes. Any priorities that emerge in the debates between the local electorate and the council are treated as additions to the national government's policy objectives. The action plans with targets for each of the performance measures identified by the council are presented to schools leaving them to develop their own plans in order to meet the specified targets in the policy areas initially identified by national government. Various cross cutting bodies to check upon the implementation of its policies at local level by national government.

Figure 33: Contribution of departments to national priorities

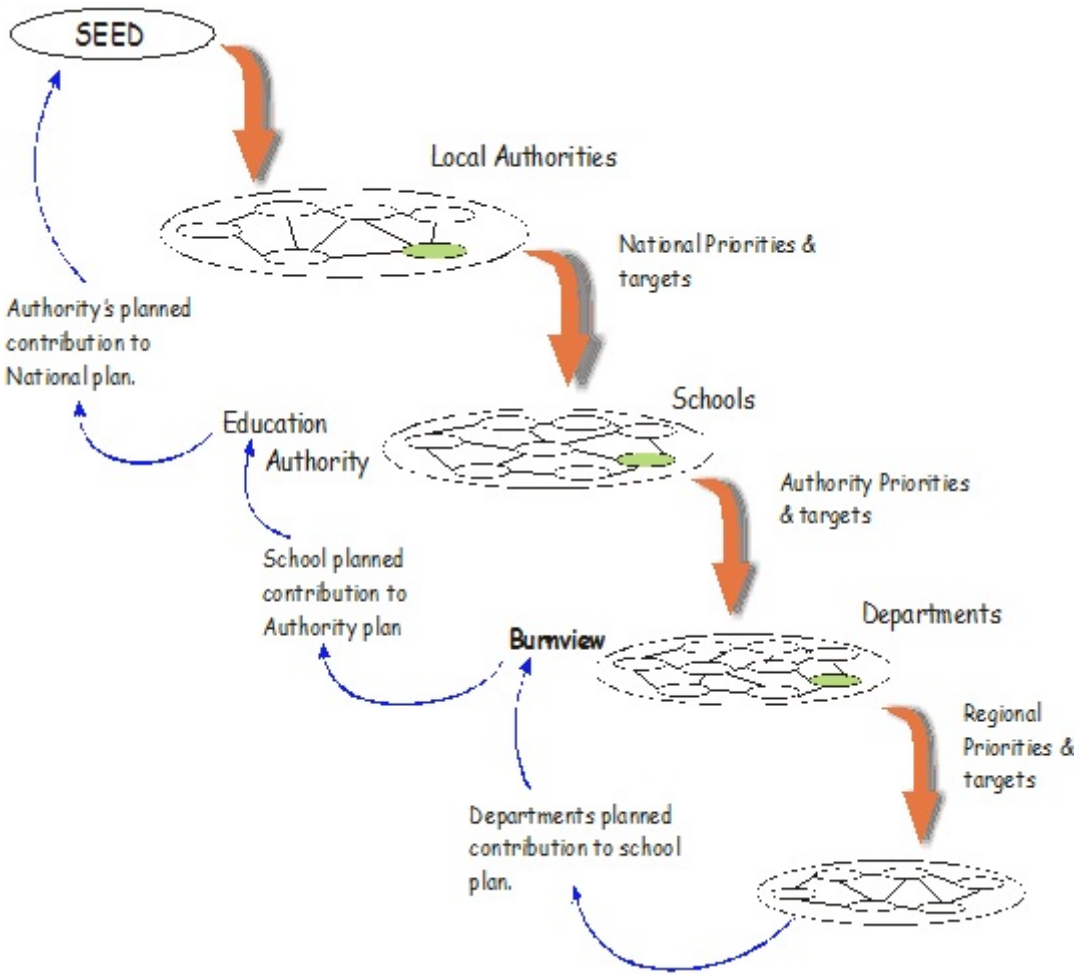


Figure 33 shows how these plans cascade down from the national level. In the school departments have to develop plans in an annual planning review that show how they are supporting the regional council's action plan objectives. Collectively, all the department's plans are organised into the School's development plan. Similarly, all the schools

development plans constitute the authority's response to SEED demonstrating how they, as an authority, are contributing to the government policy objectives.

From the national government level this top down imposition of planning priorities and objectives and bottom up accountability, may make sense in terms of getting its policies implemented. From the perspective of the school the situation is different.

Schools are denied the possibility of deciding themselves as to what's most important for them and are instead, reduced to responding to what others perceive as their problems. For example, while attendance is seen as important, it is less of an issue than with other inner city schools, having always been relatively high, but the SMT is being forced to consider the implementation of an expensive electronic registration system, in order to demonstrate they are tackling a problem identified as being important elsewhere. Whereas they would much rather use the funds for the provision of other resources in areas where clear needs have been identified.

The top down planning process assumes that all mainstream schools are alike. So normative values and strategy established at national level are equally applicable to all schools, regardless of context and local conditions. Historically, this has been the case for some time. Under the Strathclyde Authority, before its division into separate autonomous councils, all schools were expected to conform to the same *mission statement* or identity, which outlined aims and objectives of the school and which had to be broadcast in school handbooks. Since its fragmentation, most schools have retained this *mission statement* as a descriptor of their purpose.

The separation between strategic plan development and the site of implementation, gives rise to a number of issues concerning school managers and staff generally. With no collective way to reaffirm the purpose of the school through discussion and participation in their own strategic planning process, staff fail to engage or take ownership over the policies and ideas developed elsewhere. This creates implementation issues for managers, and it engenders a certain degree of disillusionment and cynicism. When questioned further, most staff generally agreed that there was nothing intrinsically wrong about the strategic objectives behind the imposed plans. Instead their objections centred around a combination of factors.

- Decisions made elsewhere distracts them from their job.
- The strategic plans and the development of policies appear irrelevant to their work and fail to connect with what happens in the class room.
- Government and authorities fail to appreciate the realities of teaching. - see *Annexe 11*
- Aims of plans are seen as temporary and faddish.
- Strategic plans and objectives overlap systems over which staff have inadequate knowledge or no influence.
- Council plans lag behind developments so staff are having to make commitments to something they believe is going to be irrelevant to what they are doing because of changes in context.
- Strategic plans deal in mismatched time scales.

In combination, these factors operate as a powerful disincentive for staff to engage enthusiastically with the aims and objectives underlying the development plans emerging at authority level. Furthermore the increasing centralisation of the planning process has been matched by an increased frequency and complexity in the reporting process to the authority. Departments and the school have to report on the progress being made towards implementing the operational plans. These plans have had to gain prior approval by the authority as being suitable for meeting the authority's targets and strategic objectives. The 'disconnection' this creates encourages a trivial approach to planning and having observed a number of departmental meetings devoted to school progress reviews, it is clear that a less than rigorous approach is taken - see *Annexe 12*. To an extent, as the next section will show the head teacher partially colludes in this process, but also leads to other issues surrounding the realisation of planned objectives.

The lack of scope to participate in and determine their own strategic objectives and norms, combined with the pressures of meeting existing targets centred on pass rates, loads the burden of implementation on the diplomatic and leaderships skills of the SMT. - see *Annexe 13*. Shared to various degrees by all members of the SMT, many of the modes and means by which they publicly demonstrate their leadership skills to assist in the implementation of strategy are exemplified by the head teacher.

- Decisions are presented as a fait accompli.

- The use of empathy and shared experience.
- Operating as a leading teaching professional and guardian of the teaching profession.
- Setting a personal example.
- Operating as a leading troubleshooter and problem solver.
- Providing scope for staff to exercise initiative and pursue their ideas.
- Openness and transparency:

Despite these techniques, many staff remain unconvinced and resistant to change. A noticeable omission in the list is any attempt by the SMT to give expression to any idea of personal vision for norms or the long term direction for the school. They are almost exclusively related to the short term implementation of tactical plans rather than long term ideas generation or development, because as the discussion on the process made clear, these are determined elsewhere.

While the SMT attempt to persuade and cajole staff to develop policies and initiatives aimed at satisfying the needs of higher authorities and their inspection agencies (e.g. the HMIE), discussions at departmental meetings remain predominately focussed on the problems of the present. In other words their discussions centre on managing the operational efficiency and effectiveness of their own teaching within existing resources. Any aspect of the future or of *'what could be'* in discussions, revolves on anticipated curriculum developments within their own subject area. When the reasons for this concern were investigated, as opposed to considering longer term issues arising from the strategic planning process, teachers and principal teachers expressed the view, that they could see a clear connection between the decisions taken in departmental meetings and with what happened in the class room. They felt responsible for decisions taken to commit resources of one kind or another (staff, funds, time) and believed that they were ultimately focussed on pupils, assisting them in fulfilling what they perceived as their primary purpose, which was *'providing the pupils with the knowledge and skills to achieve the highest grades possible'.*

Another reason for their bias towards the immediate rather than deal with *'what could be'*, was a recognition that their own plans and decisions could be amended quickly in the light of experience. Sharing experience emerged as one of the key features of departmental meetings and in the light of these discussions, resources, methods and approaches are often amended

which in turn lead to a reallocation of future resources. This happens not on a regular periodic basis but more a less continuously and as problems or benefits emerge.

4.3.10 Systemic Issues in establishing Organisational Success

The government as part of its educational policy aims to *"encourage and stimulate all schools in Scotland to achieve excellence by enabling them to focus on standards and the drive for improvement." (Raising Standard in Schools, Scottish Office, 2000)* To achieve this, the government places considerable importance on the use of target setting, principally in the areas of exam performance together with improvement through self evaluation.

4.3.10.1 Raising attainment through target setting

Since 1991, following the introduction of the Parents Charter by the then Conservative administration, schools have had to publish information relating to the attainment of pupils in public examinations. Initially introduced with the aim of assisting parents to make informed choices about the education of their children, this information quickly became the basis of the national school *'league tables',* compiled and reported on so assiduously by the national press. Parents, together with the broader public were invited to draw the conclusion; that the higher the position in the league tables, the better the education the school delivered. Under this approach, there exists the assumption that market pressures exerted on the supply side by the need for schools to remain with viable school roles, together with parental choice on the demand side, would encourage an overall driving up of standards.

Essentially the same system with its emphasis on outputs continues under the current administration, albeit in a slightly modified and refined form. The new approach still acknowledges that education represents a considerable expense, for which schools should continue to be held publically accountable whilst continuing to satisfy parental needs, but addresses what was seen as a significant flaw at the heart of the Conservative approach. This flaw primarily centres around market failure. It quickly became apparent that schools hadn't the flexibility to change their capacity sufficiently quickly in line with fluctuations in demand. Schools instead, had a finite number of places and could only take placement requests up to that number. Above this number, parents expressing a preference for a

particular school were met with disappointment with the capital costs of adding additional capacity being too high. Freedom of choice therefore, didn't really exist except for a limited few and paradoxically, some parents didn't care enough to exercise a choice. Consequently, concerns were expressed by teaching unions, politicians and parents over what happened to pupils in so called *"failing schools"* - those lower in the *'league tables'* - and disappointed parents. It was seen by many, that children in *'less successful'* schools as determined by parental choice, were to be condemned to a substandard education as a result of a *post code lottery*.

Tackling this issue, the SOED[1] decided to retain the concept of *'league tables'* but refine it through a system of target setting. All schools were to be given targets on outcomes, which schools had to strive to meet. In this way, standards for all schools would rise for the benefit of all pupils. However, a number of other issues had to be tackled revolving around how the targets were to be set and how to make them equitable between schools in order to enable fair comparisons to be made between schools with similar *'clienteles'*.

Initially, the performance of schools was seen to be independent of context, so that school performance was entirely due to the efforts of the staff and how the school was managed. Unions and other commentators argued that this suggested that the quality of staff and management was of poorer quality in schools lower in the *'league tables'* and maintained that environment had a much greater impact on how well schools performed in the measured outcomes. For example, schools that drew their pupils from largely middle class areas, whose professional parents had high educational attainment and expectations, would be at a distinct advantage when compared to inner city schools, where for the majority of parents, educational attainment and expectations, possibly due to their own experience at school, were much lower. Significant areas where inner city schools were felt to be at a particular disadvantage, was in the complexity and extent of the vocabulary used at home together with breadth of life experience and general knowledge. Teaching Unions indicated that advantages in these areas, gained as a natural consequence of greater wealth and better educated parents, overlap into other parts of the curriculum, so it would not be at all surprising that schools in wealthy suburban areas would perform much better than other

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[1] Scottish Office Education Department now renamed SOEID (Scotland Office Education and Industry Department)

schools. They also emphasised the fact many professional parents have the commitment and the means to pay for extra tuition outside school and this in itself, would have a bearing on any judgments made about the quality of education offered by schools and which were not adequately reflected by positions in the *'league tables'*.

The current method used by the SOEID aimed at tackling these issues in setting targets, uses a combination of bench marking and an attempt to contextualise the information through the use a School Characteristics Index (SCI).

4.3.10.1.1 Schools Characteristics Index (SCI)

In order to equate schools of similar pupil intakes, the SOEID use a Schools Characteristics Index. This index is made up of the proportion of pupils entitled to free school meals (%FME). As a measure, it is used as a proxy for a range of school characteristics which cannot be currently measured directly. The type of factors the %FME has been associated with are shown in tables 20 and 22 (Croxford, 1998). Thus, the SOEID treats schools with

Table 21: Association between FME and school area characteristics

Higher levels of FME in schools associated with: -	**Lower levels of FME in schools associated with: -**
High level of area deprivation	Low level of deprivation
High unemployment	Low unemployment
Intake from areas in middle range of population density	Intake from most rural or urban areas.

similar %FME measures has having broadly similar pupil intakes and located within broadly similar environments. This information is then used as part of the target setting exercise for each school.

4.3.10.1.2 Setting targets and bench marking

As part of the Government's strategy to raise standards for all schools, the Government with advice from a Ministerial Action Group on Standards[2], has settled on the framework or categories shown in table 21, in which the performance of schools will be measured and targets established.

Table 22: Framework and key target areas for schools

Standard Grade Measures - as a percentage of the S4 Roll	**Target**
Standard Grade English 1-6	National target 96%
Standard Grade Maths 1 - 6	National target 96%
5 or more Standard Grades at levels 1 - 2	Subject to Benchmarks - see below
5 or more Standard Grades at levels 1 - 4	
5 or more Standard Grades at levels 1 - 6	
Higher Grade Measures - as a percentage of the S4 roll	
3 or more Higher Grades A - C	Subject to benchmarks - see below
5 or more Higher Grades A - C	
Other	
Attendance	Minimum according to context

Within each category, schools have to establish in *'negotiation'* with their local authorities appropriate targets and demonstrate in their development plan, how they are going to achieve them. Both targets and plans have to be approved by the education authority.

In setting targets on outcomes, schools have to contend with a variety of methodologies and rely extensively on the information supplied by the HMIE Audit Unit. The skills of reading, writing and mathematics are considered so important that national targets of having 96% of

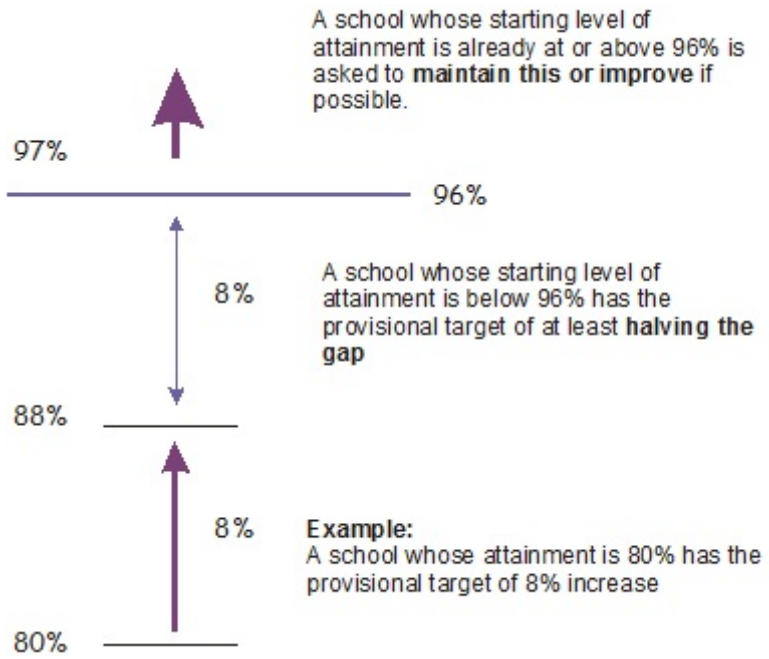
[2] Established on instruction by Brian Wilson, the then Minister of Education in September 1997

Table 23: Association between FME and pupils home background

Higher levels of FME in schools with: -	**Lower levels of FME in schools with: -**
High % living in rented homes	High % living in owner occupied homes
High % with mothers who left school at earliest opportunity	High % with mothers who had some post compulsory schooling
High % fathers unemployed	High % fathers in work
High % fathers and mothers in skilled manual occupations	High % fathers or mothers in professional or intermediate occupations
	High % of fathers or mothers in unskilled or partly skilled occupations.

pupils attaining a Standard Grade in these subjects has been set for all schools. The method by which schools establishes their targets is outlined in figure 34[3]. Schools above the level of 96% should aim to improve. Those below, have a target established by halving the gap between their current level of performance and the aim of having 96% of pupils leaving school with a Standard Grade pass in English and Maths.

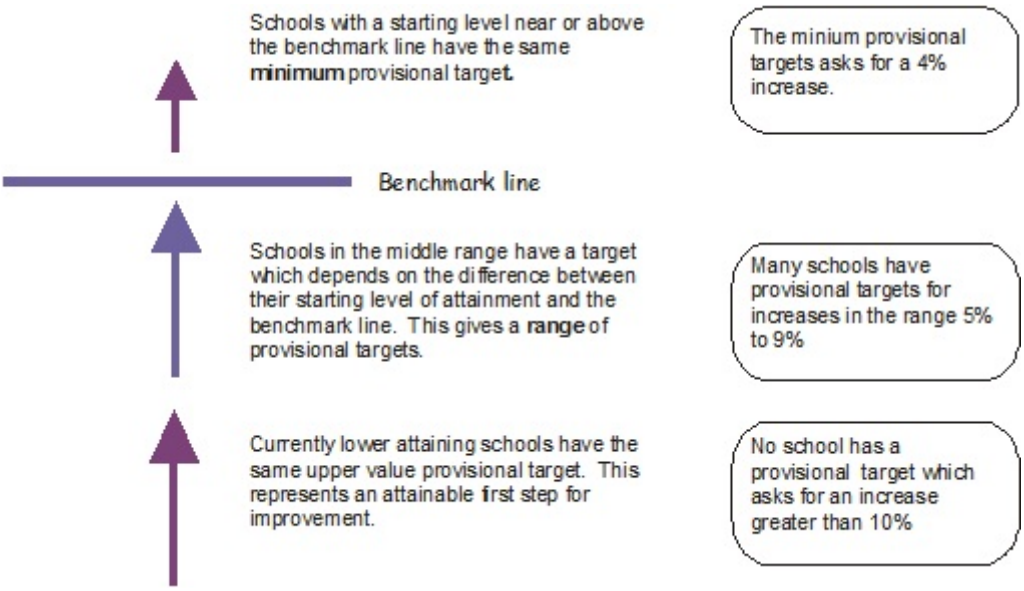
Figure 34: Setting English and Maths targets



[3] Figure 34 and 35 from Audit Unit HMIE (1998): Raising Standards - *Setting* Targets: SOEID

For the other targets, the HMIE Audit unit averages each schools attainment for the previous three years which becomes the starting level of each school. Schools are rank ordered according to the SCI and ten schools immediately above and below the school are examined to identify the higher attaining schools. The average attainment of these schools are plotted against the SCI and smoothed to produce a benchmark line which is taken as an indication of expected levels of performance of schools sharing similar pupil intake and environmental characteristics. Summarised in figure 35, the distance from the starting level and the benchmark line are used by the HMIE Audit Unit, to establish provisional targets in each category for any examined school.

Figure 35: Setting Standard Grade targets with benchmark information



Targets for higher level grades are calculated in a similar manner and attendance target levels are negotiated separately with the local educational authority. There are a set of further targets missing from table 21, principally because no decision has yet been made on how the information should be made publically available. These targets relate to the 5 - 14 programme covering primary level education and the first two years at secondary level. Essentially, the Government has specified that 80% of pupils should attain Level E or better in reading, writing and maths in national tests, by the end of S2. According to SOEID guidelines, schools are permitted to set their own targets relative to this prescribed 80% level.

They can do this through either the *'halving the gap'* approach described above, or set a target relative to other schools with similar characteristics.

Setting targets is one part of the government's strategy to raise education standards and pupil attainment and table 24 reveals issues about the strategy compared to key principles used by the SOEID for deciding on the targets.

Table 24: Issues involved with target setting principles

Target Setting Principle: *(Raising Standards - Setting Targets, 2002)*	**Issues**
"Targets should be set in a manner that is consistent across Scotland"	The methodology of target setting is consistent, but difficulty of reaching the target is disproportionate depending on the size of the school role - see below. Exceptions are only made in cases of schools with very small roles.
	Targets are derived from the use of school aggregate data masks differences in attainment between pupils with different characteristics
Targets should be simple, clearly expressed and quantifiable"	Targets are set on outcomes only without reference to prior attainment or inputs into the assessed target system.
	Apparently clear and simple, the targets mask relatively complex statistical techniques used in their derivation.
"Targets should be set, evaluated and reported on by schools, education authorities and the SOEID, working in partnership"	Targets are negotiated with their educational authority with schools taking *'ownership'* of the target, but responsibility for producing provisional targets for negotiations lies with the HMIE Audit Unit and deviations from targets are only permitted within the limits set out in the methodology or in *"exceptional circumstances"*. Accordingly targets are seen as imposed rather than arrived at in a true spirit of negotiation
"Targets should be set at realistic and achievable levels taking account of the school's current performance and, where appropriate, the performance of schools with similar characteristics."	Targets for future performance are derived from historical data with an implied assumption that pupils ability and levels of attainment is somehow consistent from year group to year group.
	Moving averages by even 1% can represent a considerable challenge and therefore may not always be realistic or achievable

Above all, the target setting methodology assumes that %FME is a suitable measure for capturing contextual information which enables *similar* schools to be compared and it's a reliable predictor for determining what a schools level of performance should be. However as Croxford (1988) shows, the relationship between %FME and schools performance varies according to which group is analysed.

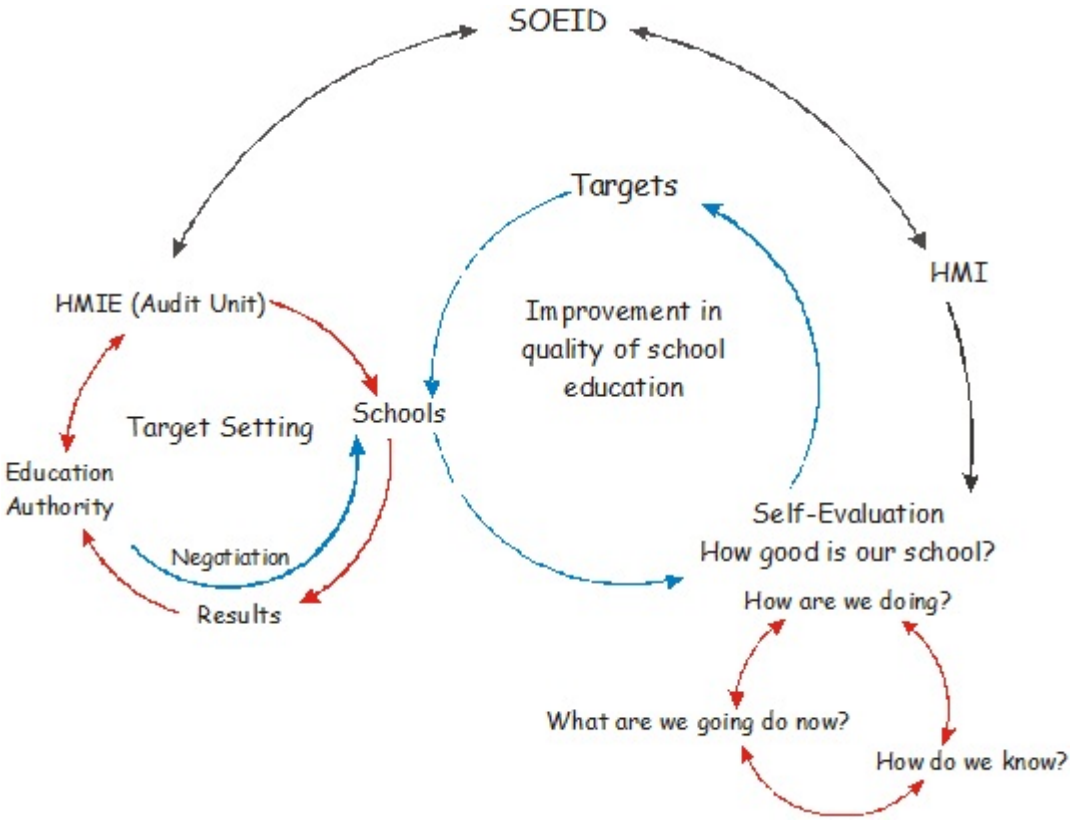
- It is less good at 5 - 14 than at Standard Grade. (SOEID)
  - The relationship between %FME and 5+ outcomes at Standard Grade levels 1 - 4 appears close, but,
  - the relationship between %FME and 5+ outcomes at Standard Grade level 1 - 2 and at post 16 levels of study appears not to be an adequate measure.
- The relationship between %FME and 5+ outcomes at Standard Grade level 1 - 2 and at post 16 levels of study appears not to be an adequate measure.

Some targets can be unobtainable depending at the level at which they are set. For example, a target of 96% of pupils obtaining a Standard Grade pass in English and Maths between grades 1 - 6, is virtually impossible for small to medium sized schools, when there are regularly small groups of pupils who are non - attenders at exams.

The SOEID have repeatedly claimed that the targets are not an end in themselves, but rather a means of focussing on raising attainment and standards for all. Given the targets, the SOEID strongly encourage the use of *'tools'* in self-evaluation programmes, to develop plans in the school planning process to meet the targets. The relationship between the two processes and the role of the HMIE are shown in figure 36.

Figure 36 shows the Audit Unit of the HMIE developing provisional targets through the analysis of results. In negotiation with each school, final targets are agreed, although as the results of a 1998 survey by the Ministerial Action Group on Standards in table 24 reveal, most provisional targets are accepted as the final target, involving little change as far as the schools are concerned. The School then tries to meet these targets through the use of self-evaluation tools, thereby raising the quality of education the school delivers to its pupils.

Figure 36: Raising Attainment.



The self-evaluation process is monitored and used as a framework by the HMIE to assess schools and to ensure the school is making efforts to reach their targets.

Table 25: Variation in Provisional targets set by the HMIE (Audit Unit)

Category	% Difference in negotiated targets
1	3% of provisional targets were increased to give higher targets.
2	62% were adopted directly as the final targets
3	13% were adopted after downward adjustment within 1% flexibility

4.3.10.1.3 Self-Evaluation: How Good Is Our School

Offered by the HMIE and recommended by the SOEID as a self-evaluation tool for schools, is a manual entitled *"How good is our school" (HMIE, 2007)* - HGIOS. First published in 1996, it contains a set of quality indicators - originally described as performance indicators - used by the HMIE in inspections. As a result HGIOS has become the de facto framework for self evaluation.

HGIOS contains a list of 33 quality indicators incorporating 97 themes covering seven key areas - see **Appendix B**. Each indicator or theme can be assigned a level from one to six - with small vignettes based on HMIE experience.

4.3.10.1.4 Using 'How good is our school?'

In the scheme laid out in HGIOS, the key to self evaluation revolves around providing answers to the following interrelated questions.

- How are we doing?
- How do we know?
- What are we going to do now?

Emphasis is given to the fact that the answers to these questions should be based on evidence and the questions may be applied at a number of different levels.

1. *"Taking a broad view"*: Applying the questions to **all** indicators and themes, perhaps at a superficial level, before: -.
2. *"Taking a closer look"*: Applying the questions to **some** of the indicators and themes in relation to either the whole school, department or class.

HMIE and the SOEID argue that the stimulus for any self evaluation process should be intrinsic to the school. Good schools they imply, want to get involved and the reason why they are good schools, is because they routinely participate in this process: which provides them with the knowledge of their own strengths and weaknesses relative to their aims and objectives.

At one level, this appears logical. Schools have to know what they are aiming to do and whether they are meeting these aims before deciding what needs to be improved and whether any changes are working. This suggests an element of freedom for schools to decide their own aims and priorities for development. Yet, as the discussion on the link between social expectations and education policy made clear, the future directions that schools can take, is becoming increasingly constrained by government and local education authority priorities.

Even the HMIE in HGIOS acknowledge that self evaluation may be externally driven, either because of having to deliver National and local education authority priorities or because of a forthcoming inspection. Table 25 is a list of current government and local authority education priorities. Between them, they cover all the key areas outlined in the self evaluation form - see **Appendix B** - leaving the school very little choice in deciding their own aims and priorities for development. Naturally in the cascading top down imposition of aims and objectives previously described, the priorities in Table 25 become the school's priorities and subsequently, to maintain the audit trail looked for by the HMIE, the priorities of each department.

Table 26: External priorities impacting on self-evaluation

Government Priorities	**Strathclyde West Education Authority Priorities**
Raising attainment	Raising attainment
Framework for learning	Learning and teaching
Learning for life	The curriculum
Inclusion & equality	Ethos
Value & citizenship	Resources
	Management, leadership and quality assurance

The idea of setting targets combined with the use of self evaluation procedures to generate plans to reach the set targets as a means to improve educational standards, is apparently simple. In practice however, it becomes increasingly complex due to: .

a. The consequences of using targets,
b. the practical application of self evaluation, and;
c. the interaction between the two.

Consequences of Target Setting

Some limitations of target setting in relation to the principles used by the SOEID in establishing the targets, have already been highlighted (see page 181). The following expands on some of these, commenting particularly on the complexity that underlies simple numerical figures and describes their effect in a practical setting.

1. **Attainability of Targets**: The targets are established from terminal output measures derived from post event historical data.

   a. Knowing how well a current cohort relates in terms of ability to previous years. If the overall ability of the current cohort is below average, then the school will find the set targets unachievable.
   b. The effect of factors largely beyond school control that affect the attainability of targets are not adequately reflected in the setting of targets.

   Driven by externally imposed targets, staff have to reach some conclusion as to whether the ability of pupils is at variance with previous years, or whether changes in external factors beyond the school's influence affect the school's chances of reaching the targets. Reaching the correct conclusion is important, because from each decision flow different sets of consequences and actions. Unfortunately at present, there is no easy solution to this dilemma and most staff including the SMT, consider that the change in the nature of the school intake combined with local societal changes are making it increasingly difficult to reach the targets.

2. **Linking Contribution to Targets:** Exam data is aggregated, analysed and targets set at the level of the whole school so there is no clear link between what teachers do in the class room and how they contribute to the school's progress towards meeting their overall targets.

   A partial attempt to tackle this issue has been made through further analysis and publication of result data. Recently, the HMIE Audit Unit have started to make accessible on CD[4], a detailed catalogue and analysis of results of all schools in Scotland. Extending on their previous practice, they include with the results, various interpretations of the data:

   a. Relative Ratings (RR). This compares the examination results of pupils in a given subject, with their results in other subjects. This comparison takes into account the average national difficulty of the subjects and according to the HMIE, provides a measure of performance of a department, relative to other departments in the school.
   b. Value Added (VA). Used only at Higher Grade, because it requires a measure of prior attainment (i.e. Standard Grade performance), this measure is used to compare the progress pupils make within a subject to the overall national average. From the viewpoint of the HMIE, the difference in grades achieved by pupils that are higher than the national average is due to the quality of teaching and the efforts of the school. In other words this difference is taken as representing the *'value added'* added by the school.
   c. National Comparison Factors (NCF). This method normalises each subjects results to a base line of 100. Values greater than 100 is used to suggest that the school or departments are doing better than the national average and visa versa. According to the HMIE, the resulting NCF value can be used to compare schools or the performance of the same subject between schools.
   d. National Comparison Deciles (NCD). Depending on the target area under consideration (see table 21 page 178), schools are rank ordered and given an NCD value according to which of the ten bands their value falls in. An NCD value of 1 indicates that the school's target result falls in highest 10% of schools while a value of 10 indicates that the school results fall in the lowest 10%.

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4 Standard Tables and Charts (STACS)

As the HMIE (Audit Unit) acknowledge[5], a wide variety of conclusions can be drawn from these performance indicators, which adds to the complexity of drawing useful conclusions. A significant barrier to their usefulness is the lack of clarity between the connection between result and indicator. The indicators represent abstractions from the original results and how they are derived are not always apparent to staff. Another revolves around the connection between each indicator and the future. Knowing how to relate changes in indicator values to possible changes in future results, remains difficult even for statistically literate staff. Without this function, both the results and indicators are limited to describing historical events.

3. **Linking Action to Targets:** In contrast to many other fields of organisational endeavour, teachers deal with pupils capable of showing an almost infinite range of ability and aptitude that can vary through time in entirely unpredictable ways. In many systems, standards in outputs can be maintained or increased by specifying or knowing the quality of the inputs. The properties and attributes of these inputs can be changed in planned ways to achieve a specified standard of output, which is either uniform or falls within a narrow band of tolerances. Whereas in education, teachers have the continuous dilemma of not knowing whether a particular pupil at any particular has reached a level reflecting their true potential. At present this is a matter of professional judgment but given the isolated nature of teaching, teachers can be easily misled, particularly if pupils under achieve from the outsets. Such are the large number of permutations in the *'causes'* possible for any set of outcomes, it is extremely difficult for teachers isolate and relate what they do well in the class room, to a set of final results. The converse situation is also true for what they do badly.

   Making this distinction is essential to re-enforce and to reaffirm good practice by teachers, and to enable effective planning. If teachers and departments cannot see what they do well or badly reflected in the results, then they cannot sensibly plan or assess programmes for raising attainment.

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5 HMIE (Audit Unit), 2000: *'How good are our results'* : HMIE (Audit Unit), SOEID

The relative ratings (RR) and NCF performance indicators represent an attempt to address this issue but again, there is the assumption the level of ability in cohorts remains consistent from year to year and the level of ability of pupils who elect to do a subject also remains consistent from year to year. Statistically, while the overall level of ability of a cohort may be the same, there can be considerable variation in groups of pupils who choose to do a subject. An indication of this variation is illustrated in the RR chart in **Appendix C,** where large swings in values for some subjects can be seen over consecutive years. In a small school many of the subjects are taught by single teachers or by small departments. In each case, teachers maintain that nothing new has been introduced and attribute their relative success or failure to the change in the nature of the pupils for each of the years.

4. **Distortions caused by Targets**: Imposing targets on schools has been promoted by the SOEID and the HMIE as a positive step towards raising attainment. Implicit, is an assumption that the effects can only be beneficial to the school. From the perspective of teachers and school managers there have been some negative effects to target setting.

   a. **Distortions in teacher and management effort towards pupils**. Targets encourages teachers to focus on pupils where they can see the greatest gain, leaving some pupils marginalised. In mixed ability classes, the most able can be left to fend for themselves and those who are the most challenging and in need the greatest amount of help are often neglected or written off as a lost cause.

      School managers also *stretch* the academic school year. Extra time for courses is found in lunch times, homework clubs and supported study. Other time is found in holidays with teachers providing extra tuition, particularly during the Easter break.

      A less benign effect of targets, is the impact they have on internal assessment. Nearly all SQA courses include an element marked by teachers, with the grade contributing to the pupils overall award. Target setting has distorted teachers approach to continuous assessment especially in the degree of teacher assistance. According to SQA marking procedures, only the first submission should be accepted for marking. In practice however, this is often returned with teacher suggestions for redrafting and re-

submission: a process which can continue for three or four times until the teacher is satisfied that a particular preconceived grade has been attained, or the maximum grade for the task. Other ways they can assist, is by providing opportunities for practising answers or giving exemplar answers which pupils then paraphrase. Overall, the effect can be considerable raising the pupils final award by a grade. What moderation procedures there are, only checks that the award given for a piece of work is appropriate not necessarily how the award was arrived at in the first place.

b. **Distortions in teacher and management effort in progression.** Courses associated with targets get priority at the cost of non-certificated courses especially in S1 and S2. Research revealed that often teachers within the same department were teaching slightly different courses, using different resources and assessing pupils using different sets of criteria. Naturally there was very little agreement on how the work in the S1/S2 courses, related to certificated course work. This echoes similar findings of the HMIE who have noted that *"S1/S2 remains a problem of long-standing* [on] *which HMIE have raised consistently in reports over the last 15 years." (HMIE - Standards and Quality in Primary and Secondary Schools: 1998-2001)*. In particular, they have discovered that *"many pupils who perform well in P7, mark time or even regress in S1/S2" (HMIE - Standards and Quality in Primary and Secondary Schools: 1998-2001)*. Many of their concerns have revolved around issues related to those revealed in the research, especially with those dealing with setting appropriate work, pacing of work, expectations and articulation with Primary and Standard Grade work.

A principal reason why, given these long standing and well-known criticisms, that these issues still persist, despite regular departmental planning and use of HGIOS over a similar time span, staff frequently cited the shortage of time together with necessity of meeting targets meant that their attention had to be focussed on the certificated courses. Effectively the targets forced them into giving lower priority and status to S1/S2 courses, even though many acknowledged that a method of improving subsequent attainment was to begin setting more demanding work earlier in the process.

c. **Distortions in the curriculum**. The process of setting of targets, is theoretically is

independent of the curriculum, i.e. it shouldn't have any effect on the combination of the courses offered by the school. Nevertheless, one option open to schools to make reaching their targets easier, is to choose less academically challenging subjects. Indeed, this happened with the school replacing one course with another perceived to favour less academic pupils: - see Annexe 14.

d. **Distortions in perception.** Perceptions of the school given by targets is a major concern of the staff.

i **By what is measured.** Managers and staff see the targets as arbitrarily chosen and applied without reference to their own *'reality'*. One example includes attendance targets. The school was set an attendance target for the years 2002 - 2005 of 90%, however, it is also a base for a special unit established to deal with school refusers. The attendance rate of these pupils are counted alongside those of the main school population so that it was impossible for school to reach its target, re-enforcing the perception the school performs badly when the attendance results are published along side the average for the authority and those of other schools.

The inclusion of the results from pupils in the special unit with the results from other mainstream pupils has a similar depressing in the other target categories.

ii **By how it's measured.** The method of calculation can be seen as obviously inappropriate. For example fluctuations in the school role meant that in 1999 the school had 105% of its S4 pupils attaining five or more awards at level 3 or better and in the same year, 106% of S4 pupils in both English and Maths achieved grades of level 3 or better. And in small schools, changes can have a disproportionate effect. There are always pupils, for example, who fail to attend exams for one reason or another and with cohorts of less than an 100, it only takes a few to mean that it would be impossible for the school to reach its targets - See table 21 on page 178 - irrespective of anything done by the staff.

The head teacher expects that with the current policy of social inclusion, reaching targets are going to become increasingly difficult to achieve, given the range of problems recognised in pupils. Both he and the staff consider that the reputation of the school suffers through the way the current targets are calculated.

iii **By what is left out.** Presently targets are mainly focussed on measuring academic performance, but teachers believe this represents only a small part of their work. No one at the school was surprised that the school performed badly compared to other nearby schools situated in predominantly middle class areas. However, they consider that if other aspects of their work was taken into consideration then the school would perform much better overall. Especially if the measures could take into account the difference on entering and leaving the school. Using input measures would, it was considered, have the additional benefit of showing up the degree of difficulties facing the school.

There was little clarity over what an expanded range of measures could include or how they could be measured but certain themes emerged covering: -

- the development of social skills and cooperative working within pupils and between pupils and staff.
- the development of language and expressive skills.
- the development of moral frameworks and sense of justice
- Interest and participation in the wider community.

It is perhaps no coincidence that these are areas where staff felt that the pupils were most disadvantaged compared to others in more affluent stable areas. Essentially, staff considered that group attitudes and skills in these areas were prerequisites or basic foundations for building on academic success. Given the low relative starting point in the above areas, staff viewed themselves achieving considerable success.

Self Evaluation and using HGIOS

The *"How Good is Our Schools*[6]*"* - HGIOS self evaluation series is strongly promoted as a planning tool. Two recent developments have in effect made it compulsory. One is that the HMIE in an attempt to be more transparent about their basis for inspections, have formally adopted it as their framework for school assessment. Second, local education authorities have begun to use it as a basis for demonstrating improvement in educational standards to their local electorate through public reports[7]. Apparently logical in concept, the weaknesses of HGIOS and the impact of these latest developments only become visible when the process is viewed in a practical application.

The Process

The self evaluation exercise is carried out once a year. Following a heads of department meeting with the head teacher where the importance of the exercise is emphasised, staff in departmental meetings agree ratings to each theme. Once complete, the head teacher collates all the departmental returns and averages the ratings for the themes and indicators. Lowest scoring indicators and themes become weaknesses and the highest become strengths. Results are fed back to departments, where once again staff assist in developing departmental plans to rectify weaknesses and support strengths. The head teacher then forwards the same results to the education authority together with the whole school development plan. The authority then approves the school plan and conducts a similar averaging exercise with the ratings from all schools which are used in their own reports to the electorate.

Causes of Systemic Failure to the process

Throughout the self evaluation exercise a number of factors and biases are introduced to undermine the integrity of the process: -

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6 HMI: "How Good is Our School 2002", HMI was used in the study. It has been since superseded by more recent editions

7 As an example "A Report on Standards and Quality in Renfrewshire Schools 2000/2001" and "Service Plan 20002 - 2005: Incorporating the Annual Statement of Improvement Objectives". Renfrewshire Council, Education and Leisure Services.

1. **Evaluation failures:** Throughout HGIOS, considerable emphasis is placed on having an evidentiary base to any conclusions. Attending a number of self evaluation meetings revealed that little attempt was made to gather or to refer any evidence to support conclusions. Instead, conclusions were reached on the basis of joint impressions and negative associations, i.e. what the situation is not, rather than what the situations is.

   Lack of relevance, cynicism and lack of time were offered as reasons. Staff viewed the exercise as *'... a bureaucratic hoop'* to be jumped through in order to satisfy the demands of higher authorities and could see little to relevance to their work, except in the sense it gave them an opportunity to mark down areas in which they felt dissatisfied.

   The time logistics of having to evaluate 96 themes in 50 minutes makes a superficial impressionistic approach inevitable. Attempts to reduce the number of areas to be evaluated by focussing on national and local priorities has had little effect on reducing the number themes to be evaluated as they cover all the areas of Appendix B. Additional time for self evaluation could be gained from other departmental meetings, but this requires displacing other more, and according to staff, urgent needs. - See Annexe 15.

2. **Self interest failures:** Some biases are introduced into the self evaluation process through self interest and wanting to avoid looking *'bad'* by awarding themselves low marks.

3. **Boundary failures:** Some quality indicators or themes require a knowledge of, or familiarity beyond the experience of the evaluating team. Subject departments, for example couldn't pass judgments on cross cutting aspects - see Support for Pupils, Appendix ? - or beyond their ability to influence outcomes - see Resources, Management and Quality Assurance, Appendix B.

4. **Context failures:** These appear similar to boundary failures and arise unknowingly, because of different perspectives or because the indicator or theme is seen as irrelevant to the departments or schools context.

   One example included a very experienced, long serving and highly regarded Principal Teacher who wanted to evaluate ethos indicators at a low level, noting emphatically that

in his experience, pupils behaviour, attitude and effort had declined markedly over the years. When the same points were presented to the head teacher, he highlighted the differences between the pupils at school with those he saw when visiting other schools. This led to a revision upwards of the original low scores. Essentially though, both were correct. Each were viewing the same indicators, but in different contexts: the Principal Teacher seeing them in an historical context of the school, the Headteacher in comparative context with other schools.

The ability to see issues in different contexts is also contingent upon the position held within the organisation. The head teacher holds a position that necessarily enables him to have a broader overview and experience of issues through visits to other schools and discussions with other head teachers. Lacking this opportunity, middle managers and teachers necessarily have a narrower longitudinal viewpoint: the historical view being their only reference point.

5. **Management interventions:** Some of the most significant distortions in the self evaluation process are brought about through the direct intervention of senior management. Before the beginning of each annual self evaluation and planning cycle, the Headteacher holds a meeting with the Principal Teachers to remind them about the process and the importance of assessing fairly the schools performance in each of the quality indicators. These have often been interpreted by Principal Teachers as *'clear steers'* to the kind of rating that should be given to each quality indicator and have referred to the consequences of ignoring such *'smoke signals'* in the past - see Annexe 16. So rather basing the process on evidence, the system operated by the SMT, is that every quality indicator should get a high grading, unless there is clear evidence to the contrary

   The preselection of areas is another tactic used to control outcomes of the review process. According to the rubric recommended in HGIOS, a first pass or *'broad overview'* is used to identify the strengths and weaknesses of the organisation. Subsequent passes or *'closer look's'* are used to examine in detail the areas identified in the first pass, before the generation of action plans. However this two-stage treatment can be a time-consuming process so to shorten and simplify the work, the head teacher produces a shortened list of indicators.

6. **External influences:** With HGIOS, operating as the framework used by the HMI in school inspections it operates as the agenda to which schools are expected to conform and demonstrate their accountability irrespective of whether it is the most appropriate framework for the school.

   One example is the 5 - 14 reporting process where a number grade based on regular assessment was replaced by a letter grade because the schools progress to the 5-14 system was part of HGIOS framework. For many staff, even including some members of the SMT, reporting through the use of 5 - 14 letter grades was a retrogressive and meaningless exercise where a validated assessment method which correlated to and gave a reasonable prediction of each pupil's future performance was being replaced by an inferior one. Although PT's and staff felt that the school should be more robust in defending itself in the things that they believed that they did better, effective debate was eventually foreclosed through the use of HGIOS by the AHT responsible. With an inspection imminent, it was accepted that a change to the 5 - 14 reporting system was more *'politically'* desirable. In this, the prime driver for change is HGIOS, rather than an identified need within the school.

   The idea of using accountability to an external agenda to influence and drive change in the management processes of schools, has received further impetus by the authority's decision to use HGIOS measures as a means of demonstrating success to their electorate to improving the quality of education. An example by Renfrewshire Council[8] shows how this works. Head teachers have to supply with their school development plans to the authority, the results of their self evaluation exercise. Together with measures from HMI reports these are aggregated and averaged for all schools the overall results are then used to illustrate in bar graphs, the relative performance of the authority in each of their chosen priority areas. The relative differences are then used as the basis for planning in the council's three year planning cycle which have to be supported and implemented by schools. Measuring the extent to which schools conform to the HMI framework laid out in HGIOS, and using these measurements to report in such a public manner to support the *'political'* aims of local and national government, clearly places considerable pressure on

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[8] "A Report on Standards and Quality in Renfrewshire Schools 2000/2001": Renfrewshire Council, Education and Leisure Services

head teachers and schools to conform and ensure high scores in each of the quality indicators. This pressure partially, if not wholly, underlies the *'clear steers'* given by the Headteacher at the preliminary self evaluation review meetings and the subsequent pressure he places on PT's to award high scores to each indicator.

4.3.11 Target Setting Summarized

This section began by outlining the background to the strategy for improving the quality of school education throughout Scotland. Essentially, schools are given targets for improving pupil attainment in exams and are encouraged to use self evaluation and the framework set out HGIOS as an aid to planning their way to attaining these targets. In outline, this strategy appears logical and coherent, but issues emerge when the process is examined in the detail.

Some issues emerge even before the process begins. Table 26 makes a comparison between what the policy claims and how the schools interpret the those claims in *'reality'*.

For the school, the framework outlined in HGIOS has become compulsory and has to develop

Table 27: Issues arising from self evaluation

Suggestion implied by policy	**Reality**
Choice over self evaluation framework.	In the authority HGIOS is default model.
Choice over developmental priorities.	Constrained by:- a. national priorities b. local service priorities.
Results for internal use to aid planning	Use to satisfy external agendas:- a. HMI b. local service

plans in accordance with national and local authority service priorities (see table 25, page 185), regardless of the results of their own self evaluation process. And rather than use the results purely as an aid to their own planning process they have to be used to satisfy the

agendas of external agencies. Other issues emerge in the complexity arising from exercising this twin track policy in practice. Tables 27 and 28 illustrate the effects of this approach in the school.

Table 28: Experience and effects of the Government's strategy to raise attainment

Targets		**Self-Evaluation**	
Issue	***Experience***	***Issue***	***Effect***
Attainability?	Cohort characteristics vary from year to year	Number of QI's and themes.	Complexity in the logistics of managing the process.
	Intrinsic pupil motivations and external factors more important.	Imposed process & structure	Aspects seen as irrelevant *'bureaucratic hoop'*. Reduces ownership & commitment.
Linking contribution to targets? .	Aggregated data make it difficult to isolate the contribution of departments to targets.	Use of averages	Hides & distorts priorities for individual groups. Decreases commitment to change.
	Derivation and statistical indicators of data opaque to average user.	Imposed national & local service planning priorities	Induces powerlessness. Encourages *'pointless exercise'*. Reduces ownership & commitment
	Statistical indicators open to variety of interpretations	Time Pressure	Less time to build to build evidentiary base weakens objectivity.
Linking action to targets?	Targets based on historical outcomes and actions	Work load	Staff take path of least resistence. Weakens objectivity & implementation
	Output targets set with no reference to pupils ability on entry.	Scope of QI's and themes	Requires knowledge & experience beyond that of any group or individual. Weakens evidence base & objectivity.
	Cannot relate class room actions to outcomes.	Organisational Position	Determines perspective & context. Weakens evidence base & objectivity.
	Pupils performance continuously variable and non linear.	Self interest	Choose values that reflect well on group or individual. Weakens objectivity.
	Pupil preferences for subjects can be significant	Accountability to management	Provide values they wish to hear. Only contrary evidence considered.
		Accountability to external bodies.	*'Political'* expediency used to justify positions. Weakens evidence base, objectivity and commitment to change

Table 29: Issues arising from the target setting process

Target setting principal	Issue
Set in a consistent manner.	Disproportionate effect contingent on school size.
	Doesn't account for pupils with different characteristics.
Simple and quantifiable.	Set on outcomes only
	Derived using complex statistical techniques.
Derived in partnership with schools taking ownership of targets.	Provisional targets set by HMI Audit unit.
	Narrow range of variation permitted.
Related to similar schools based on SCI.	Assumes pupil characteristics remain consistent.
	Assumes %FME can capture complexity of environmental factors.
	All targets are obtainable.

Table 27 reveals that targets far from simplifying a situation, inject considerable complexity. While appearing simple on the surface the numbers hide a great deal of uncertainty, are open to numerous interpretations and are difficult to relate to inputs and actions making it difficult for staff to see how a change in inputs or actions will help the school attain its targets. Table 28 also shows that the effects of targets can be far from positive. Targets were found to distort teacher and management effort towards pupils, introduce an element of bias towards courses that are included in the targets, altered the curriculum and perhaps most damaging of all affected the way that the school appears to parents. Certainly in interviews, all staff thought that school was much better than that suggested by the relatively lowly position it occupies in the *'league tables'*.

Self evaluation using the HGIOS framework is promoted as being an objective way of discovering the strengths and weaknesses of a school and developing plans to address emerging issues. Table 29 shows however, a number issues that undermine this alleged objectivity. Perhaps the most important is the perception by staff of dubious targets set through the use of a doubtful and inherently unfair methodology and simultaneously

supported by a self evaluation exercise that generates misleading priorities and plans required to support someone else's external agenda.

Table 30: Distortions induced by target setting

Areas of distortions:	**Effect**
Effort directed at pupils:-	• Maximises on some pupils according to best return, others are marginalised.
	• Steal time to extend courses and teaching time.
	• Compromises teacher integrity and internal assessment.
Effort in development:-	Bias towards courses contributing to target areas.
Changing the curriculum	Loading the mix of subjects on offer towards the academically less able to make targets easier to reach.
Perception of the school.	• Targets unrelated to context and mitigating factors, presents impression of 'failure'.
	• Method of calculation biassed towards large schools with stable populations. Small schools are affected disproportionally, with some targets made unobtainable.
	• Targets focussed on *'hard'* outputs and fail to give credit for other aspects of organisational activity.

Creating and developing a system which was simple to understand, that allowed teachers to genuinely participate in planning for improvement and connected what they did in class rooms to outcomes, became as a result of these findings an aim of an action research project based on cybernetic design principles.

4.3.12 Systemic Constraints on Activities

Flexibility over how tasks are completed, control over how time is allocated to tasks or priorities are among some of the distinguishing features that characterise an occupation as a *'profession'*. Reasons for this, include the highly contingent and context dependant nature of the work which cannot be standardised, specified in advance or expected to run to a pre-prepared algorithm. Instead, work occurs in an unstable action space, requiring the continuous exercise of personal judgment to take into account either, variations in the factors

or variations in the interactions between factors that affect the successful completion of a task. The exercise of personal judgment and responses to a situation is informed by both the technical expertise of the *'professional'* and their knowledge of the situation.

These characteristics are evident in almost everything that teachers do and especially in the act of teaching. Groups of pupils have the potential to be very unstable and teachers can be seen adjusting their responses in real time, to maintain the situation within parameters that they themselves have identified as being conducive to the process of learning. In lessons many of the teacher's responses are relatively minor, principally centring on behaviour modification or altering an exposition to reenforce a teaching point or to correct a misunderstanding. In the longer term, teachers have felt the freedom to alter the pacing of work, its content and even their pedagogical approach to suit the class, i.e. the context in which they act. Increasingly though, teachers have become to feel constrained in what they can do.

4.3.12.1 Flexibility in task completion

Teachers have been used to delivering course content to satisfy the requirements of a set syllabus. Indeed, part of their *'professional'* technical expertise is derived from knowing the syllabus and what pupils have to demonstrate in an exam to merit a pass at the levels available. *'How'* this course content is delivered, has in the UK been traditionally left to the teacher, but this flexibility is disappearing under the cumulative influence of several factors with the result that the *'how'* of delivering course content, is becoming increasingly prescribed.

One such factor is the legal liability of schools and the impact of regulations like the Health and Safety at Work act. Health and Safety regulations have had a particular impact in the sciences reducing the type and number of experiments that can be completed. All science staff have felt that this has detracted from the excitement and attraction of doing practical work.

Less obvious and indirect influences include the planning objectives of local and national government, together with the HMI through inspections and HGIOS. The increased

emphasis on raising attainment has reduced the opportunities of providing courses just for the interest for the less academically able. The Quality Indicators and themes in HGIOS subtly guide teachers, if they are going satisfy the requirements of the indicators, to using particular teaching methodologies and approaches to learning. One issue that arises for teachers is that these methodologies are given a priori *'approval'* regardless of context. Discussing a forthcoming inspection, one science teacher was very disparaging about group working: an approach strongly advocated by HMI - see Annexe 17. Yet the same teacher has been observed using extensive group working and interaction with other groups. From this and other conversations with other teachers, it is clear that teaching methodologies are adapted to particular client groups or classes. Nevertheless, the SMT in order to fulfil the requirements of the HMI, are keen to promote approaches that will meet with approval under HGIOS criteria. This is achieved through the PT's under the guise of quality assurance. PT's are to routinely visit lessons, sample the learning experience of pupils within their subject area and highlight to teachers where their observed practice fails to conform to approved practice. By seeking to constrict teaching practices to *'approved'* approaches, efforts are being made to minimise the significance of context and through this, the extent of teacher's judgment in choosing an appropriate method. In effect, more weight is being given to the greater technical expertise of the HMI at the expense of context knowledge known to the teacher.

4.3.12.2 Time Sensitivity and SQA Procedures

Like other *'professions',* teachers are used to organising their work in order to meet critical time limited targets. Finishing courses to coincide with the fixed start of exams is the most obvious example. However, other changes add to the pressure and are beginning to affect what teachers do. Most revolve around externally determined deadlines such as the shifting criteria of the Scottish Qualifications Authority (SQA) and its increasing demand for data.

In a *'simpler'* age, pupils sat exams and were awarded an appropriate exam grade according to their performance. The main concern of teachers then, was finishing the course in time and the maintenance of correct presentation lists which could be changed almost up until the day of the exam. Since then, there has been a gradual fragmentation both in terms of assessment and in course structure. Subjects have been divided into a number of elements and each element has its own method of assessment. The results combine together to produce

a *'portfolio'* grade to be combined with others to produce an overall grade. Fragmenting assessment like this has added dramatically to teachers work load and transforming the teacher into an examiner by proxy, has created a large bureaucratic process to ensure integrity of the system. Grades for each element have to be sent in at specific times well in advance of the exam to the SQA and moderation is used on a random basis to confirm teachers are awarding the correct grades. Statistical tests are used to check concordancy between teacher's grades and those achieved in final exams to ensure that teachers are presenting pupils at the correct level.

The situation for post 16 courses is even more complex with pupils have to complete units within a set number of hours and distinctions made between unit passes and courses passes. Pupils are also allowed to re-sit unit assessments, take the subject over one or two years, move up and down levels etc. For staff, this structure creates a bewildering array of possible outcomes.

The end result, is that for many teachers. the need to meet the increasing multiplicity of time deadlines set by the SQA for data, is beginning to drive their organisation and pace of teaching. Teachers are often seek to maximise on time available during the course for the completion of *'portfolio'* work, generally at the expense of following topics which are of more interest to pupils.

The increasing number of externally determined deadlines lying beyond school control has effects beyond the class room with departmental meetings used extensively to ensure coordination between classes and SQA coordinator spending considerable time making sure data will be ready for input at correct times.

4.3.12.3 Control over working hours

Teachers are also seeing their personal ability to decide how they allocate their time to various tasks being further eroded. Following the National Agreement[9] between teaching unions and employers, teachers agreed to modify their condition of service in exchange for a pay deal higher than rate of inflation. One significant change, was the agreement to extend the working hours of teachers from 30 to 35 hours per week with tighter control over how these hours should be spent.

Table 31: Core time allocation

Activity		**Hours**
Contact time -	time spent with pupils either teaching or in registration.	Reducing to **21.5** in phased stages.
Non-contact time -	time spent in correction and preparation for teaching	Increasing to **8.5** in phased stages
Total		**30** Hours

Table 30 shows how a core period of 30 hours per week may be spent in school. This time is broken down into further smaller blocks of time table 31.

For the SMT, the breakdown of teachers time into so many categories has made their calculations for such things as staffing levels extremely complex. In deciding on cover for absent staff for example, they even have to take into account the ten and fifteen minute registration periods to ensure there is no infringement onto a teacher's minimum non-contact time. As a further illustration of level of detail to which teacher time is planned, table 32 shows how the flexible portion of 15.5 hours is allocated at the school.

While the agreement satisfies teachers expectations by guaranteeing increased preparation time and specifying exactly what is required of them in terms of working hours, it also acts as

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[9] Known as the McCrone Agreement after Prof Gavin McCrone, the chair of an independent committee of inquiry into the professional conditions of service of teachers. This committee, established in Sept 1999 by Sam Galbraith MSP and Minister for Education, produced a report entitled *"A Teaching Profession for the 21st Century"* which formed the basis of the agreement by the SCNT (Scottish Negotiating Committee for Teachers)

Table 32: Balance of time

Balance	Activity	Duration	Location
Basic	Parents' meetings	30 hours	School
	Assessment & reports	54 hours	Choice
	Additional preparation	7 hours	Choice
	Curriculum Development	10 hours	School
	Departmental Meetings	20 hours	School
	Continuous Professional Development	35 hours	Choice
Flexible	Staff meetings	15.5 hours between these activities	School
	Assessment & reporting		School
	Development & review		School
	Curriculum Development		School

a major constraint. Some implications for the SMT in calculating staffing levels and absence cover have already been highlighted. For Principal Teachers managing departments, the consequences of the agreement can be even more difficult. The twenty hours allocated to departmental meetings are clearly insufficient to provide for a meeting a week to discuss such topics as quality assurance, behaviour management, assessment issues, coordination, reporting and development issues etc.

Table 33: Flexible time allocation

Activity	Duration	Location
Staff meetings	4 × 1 hour	School
Principal Teacher meetings	6 × 1 hour	School
Assessment & reporting - teachers	6 × 1 hour	School
Personal review	2.5 hours	School
Pupil support/class review	2.5 hours	School

Time for allocated for curriculum development is another significant issue for PT's. Producing new schemes of work with new content and assessments to cover a range of abilities, easily exceeds ten hours and can only be achieved at the expense of the goodwill of staff. In the school with many small departments and no economies of scale, this is even more of an issue with fewer people to share the burden of curriculum development.

4.3.12.4 Impact on *'professionalism'* of teaching

Part of what defines a *'professional'* was described as the ability to decide on the *'how*, *what'* and *'when'* to do tasks. That this is a necessary part of being a *'professional'* it was suggested, was because of the highly contingent nature of the work undertaken by professionals. In other words, the work of professionals is not always routine and cannot be expected to run according to a pre-prepared program; something always happens that requires a change in the *'how, what'* and '*when'* of task completion.

Using this concept of a professional, it was argued that teaching as a profession represents the embodiment of this idea, where teachers have to continually adjust what they do according to the highly contingent and volatile environment in which they work. Recent changes though, have undermined that idea of teaching as a profession. It was argued that the framework used by the HMI together with an increasing number of quality indicators, predetermine certain methodologies and approaches to teaching regardless of context. The SMT exert subtle pressure on teachers through middle managers to comply with these methodologies and approaches to ensure that departments and by extension the school, conform to HMI criteria and obtain high ratings. This effective foreclosure around favoured *'hows'* reduces the number of possible options of under takings tasks open to teachers. Similarly, the increasing number of externally time limited tasks that generally originate with the SQA, essentially determines teachers priorities in completing their work or *'what'* has to be done. Finally through the McCrone agreement, teachers have lost some control over the time of *'when'* and to some extent, where work is completed together with even how long should be spent on certain activities essential to their work.

Taken together, the cumulative and systemic effect of these developments that attempt to program and make routine the highly contingent work of teachers, effectively diminishes the

concept of *'professionalism'* of teaching.

4.4 Summary

This chapter has focussed on some of the systemic issues that underlie the day to day *'reality'* of teaching and working in a schools. Attention has been given to showing *'how'*, what on the surface of what appears good intentions and initiatives, gives rise to complexity and increasing instability. Some of these systemic sources of complexity and the areas in which they create complications are shown in table 33.

The next chapter looks again at some of these issues through the lens of the VSM, illustrating how the tendency to *'control'* the situation through greater centralisation in order to effect *'change'* for improvement, is leading to the paradoxical result of making it less likely. It also shows how some of the problems have their roots in the structural and communication relationships of the organisation and an action research project aimed at overcoming some of these barriers to individual and organisational learning is implemented.

Table 34: Summary of the main complexities affecting the school

Sources of complexity	**Trends**	**Issues** (Complications in) **involving:-**
Government policy & Local Government policies	Increasing centralisation & accountability.	Planning, implementation & reporting
Legal Regulation	Increasing regulation	Compliance
Pupil motivations	Increased diversity & focus on the short term.	Attitudes to learning & school
Pupil potential/attainment	External target setting increasing	Assessment/Performanc e measurement
Range of ability	Increasing under social inclusion.	Teaching practice, class and resource management
Parental expectations	Increasing parental assertiveness & willingness to contest decisions.	School - Community links
Social norms	Increasing tolerance & diversity in lifestyles & social relationships.	Internal cooperative living
Organisational structure	Increasing number of relationships internally & externally	Multiple identities, Multiple lines of communication
SQA procedures	Decreasing stability in bureaucratic procedures	Formal recording & reporting of results
Curriculum changes	Increasing speed of change in courses & qualifications	Course development, overlaps & lead times

Chapter 5: Developing Learning Capacity

This chapter is primarily concerned with detailing the results of an action research project undertaken on behalf of the SMT, to address some of the System 3-2-1 issues briefly introduced in the last chapter. It begins by elaborating on some of the obstacles to individual and organisational learning emerging from the case study description in Chapter 4. Overcoming these obstacles, it's argued, is necessary to connect what teachers do in the classroom with planning for improvement, for pupils, teachers, departments and for the school. A model of how teachers determine the potential of pupils is developed, together with how they measure the pupils achievement with respect to their potential. Here, it's suggested, teacher expectations have a significant role to play in raising achievement, but the current model implicitly used by teachers has a major flaw, in that low expectations can feed through to low pupil performance.

In developing a solution, cybernetic principles of feedback, together with Beer's ideas of metasystemic control and on measurement are used to create a *'real-time'* distributed information processing database based on the VSM framework. During its development, particular attention was given to the variety of ways users attribute *'semantic'* meaning to *'syntactic'* information. Furthermore, at an early stage in the development process, the school committed itself to baseline assessment which added considerably to the systemic functionality of the system. Screen shots and examples are included in Appendix D.

The solution was implemented first for the middle school covering the years S3 and S4. Following its success, the system was expanded in two subsequent academic sessions into the lower school (S1 and S2) and then into the upper school (S5 and S6). The introduction of each stage can be described as an intervention helping to bring about change in individual teacher and departmental working practices. Throughout, the Cybernetic Methodology discussed in Chapter 3 (page 113) was used to guide the analysis, design and implementation of the project and very broadly each intervention equates to a complete iteration of the double loop represented in the method in figure 19 (page 113). The explanation makes some comparisons to SEEMIS *'Click & Go'* - a centralised school management information system used by nearly all local authority schools within the former Strathclyde Region - emphasising the difference in approach between one developed and

imposed from the top down and one developed from the bottom up. An argument is made that systems grounded in what teachers actually do and require, considerably increases the chances for successful implementation.

5.1 Individual and Organisation Learning Obstacles

Earlier in Chapter 4 there was some discussion on the effects of target setting and the feedback of information provided by the HMIE (Audit Unit). From the perspective of the school, some of the particular concerns that were expressed were related to:

- The historical nature of the information on which targets were based and it was pointed out that cohorts can vary considerably from year to year.
- The degree of statistical abstraction involved in the analysis that simultaneously makes it difficult for general users to grasp the *'semantic'* meaning represented in the analysis and opens the data to a range of interpretations.
- The separation between the context and the data with the result that while regional or national statistics may accurately describe the situation, their accuracy and descriptive power begins to fail when applied to specific situations. Anomalies like 105% of S4 pupils at Burnview attaining grades between 1-6 begin to appear, or analytical results being disproportionately affected due to the size of cohort - less than 100 - or failure to account for attachment of special units for dealing with school refusers.

Given that the underlying intention in the provision of information is that the school uses the analytical measures to learn and develop new responses to increase performance, then these issues represent obstacles to learning in their own right. In terms of the *'learning failure'* typology presented in table ? (page ?) then these provide examples of:

- Ambiguous learning where inappropriate measures are used at school level to measure the effect of teaching on the raising of pupil attainment. As one result, any conclusions drawn may or may not be supported by the actual data.
- Superstitious learning where the conceptual framework that underlies the analysis isn't understood, shared or relevant at school level. Consequently any action based on the measures will proceed on a *'trial and error'* basis.

Although attempts to judge and manage school performance through HMIE (Audit) measures leads to ambiguous and superstitious learning, there are further obstacles to learning embedded within practices internal to the school

5.1.1 Teacher Level - Recursion 0

In relation to pupil attainment and progress within courses, teachers are in possession of considerable quantities of information. The difficulty is that much of this information is recorded within their own marks books and is inaccessible to others. As described in Chapter 4, one consequence is that teachers, when there is some doubt over what pupils should be achieving, spend considerable amounts of time attempting to *'triangulate'* their information about particular pupils with other teachers. Guidance staff also issue *'round-robins'*, often in response to parental requests to gather attainment data.

Pupils, though can be quite skilled at masking their true potential with a range of behaviours. For example, laziness or assuming skilled incompetence in efforts to avoid challenging work appropriate to their true ability. Other reasons for masking behaviours can be different personal preferences for different subjects and different aptitudes in different subjects. This is in contrast to *'Relative Rating'* measures provided by the HMIE (Audit) - see Appendix C for an example - which assumes that all pupils will perform equally well in all subjects. Also, and significantly, poor behaviour can mislead teachers into assuming a lower potential for pupils. Reasons for poor behaviour are complex, but they may arise through a clash of personalities with teachers or because of issues in relation to the particular gender of the teacher. Additionally, it may be related to the social mix of the class or other experiences acquired outside school. If pupils exhibit these masking behaviours consistently, teachers may never have a reason to seek to cross check their information with others.

So far the working practices of teachers display *'fragmented learning'* in that information is available in the organisation but is distributed throughout the school and is not readily accessible to staff. It also displays with respect to individuals *'superstitious learning'*. This learning failure occurs when teachers are misled through the masking behaviours of pupils

and begin to make teaching actions based either on outdated or incomplete mental models of the pupils abilities or through hidden assumptions about the pupils potential.

When teachers seek to *'triangulate'* their information with others, it is invariably because something has happened with a pupil that contrasts with an established pattern of behaviour. Again, causes for variations can be complex. They can be part of natural behaviour with pupils developing in fits and starts. This is in contrast to assumptions underlying in some programs like 5-14, where it's assumed that pupil's abilities develop at a steady rate in line with their age. Other natural variations can arise from personal preferences for some parts of the course over others or for the simple reason of having an *'off'* few days. Variations can also arise through more profound causes such as bullying, family breakdowns, drink, drugs etc. For teachers, identifying deviations from patterns of performance is significant, because the earlier they can be identified, then the earlier interventions can be made, either through changes to their own teaching responses or through Guidance staff to bring back the pupil to levels of performance expected by the teacher. However, the way that teachers evaluate pupil performance and store information make identifying patterns and deviations difficult.

In practice teachers record the results of assessments in separate class sets and the results from assessments in the different aspects of the course tend to be stored separately. In Science, for example, knowledge and understanding grades are separated from problem solving grades, which are in turn distinguished from practical grades. Arriving at an overall grade requires combining these grades according to different proportions. The proportions depend on the subject and the weightings of each element are established by the SQA. To complicate matters further, elements may be assessed at different times. In Modern Languages, for example speaking tests are held at different times to writing tests. One immediate and practical consequence of this arrangement is that it made arriving at an overall grade very time consuming with a recalculation required after each assessment. With over 100 pupils in different classes, it was noticeable that this calculation was only completed once a year at the time pupil reports were prepared. Additionally, because of the complications required to account for all assessments taken in the year, there was tendency to include only the results of the most recent assessment and these could either be unduly favourable or unfavourable, depending on how the pupil performed in that recent *'one shot'*

assessment. Pupils therefore, received reports from their teachers that were often not accurately reflected in the evidence from their accumulated assessment data. Another significant consequence that flowed from the way teachers stored assessment data, is that it made it difficult to spot patterns emerging within the assessment data from a particular class or between classes. The lack of skills, difficulties and time associated with getting the data into some kind of order that makes it amenable to analysis, nearly always meant it wasn't done. This failure to identify emerging patterns, breaks the link between teacher action and outcomes and in discussing actions taken with classes, teachers ascribed through a series of impressions, certain qualities to classes and results from particular actions that weren't always reflected in the actual data.

In terms of learning failures, the brief description given above of the general way teachers stored and used data, represents in the first instance *'fragmented learning',* but in a different sense to way that it was used earlier. In the first case, the knowledge is known, but distributed throughout the organisation between individuals. Here, in the latter case, knowledge is contained in the data, but is *'lost'* to the individual because of its complexity and the difficulties associated with its analysis. These difficulties in effect provide personal bottlenecks to accessing the information. *'Ambiguous learning'* is another result, where lacking the ability to see the data as whole, teachers make conclusions unsupported by evidence. The inability to connect actions with outcomes also results in '*superstitious learning'* where actions proceed on a *'trial and error'* basis, because teachers are unable to develop appropriate models of what's happening as a result of teacher actions.

5.1.2 Departmental Level - Recursion 1

The problems of *'fragmented'*, *'ambiguous'* and *'superstitious learning'* carried through to departmental level. With one notable exception, the fragmented distribution of information meant that the performance of different classes either taught by the same teacher or between different teachers couldn't be compared to reveal the effect of different teaching approaches. Additionally and more significantly, the inaccessibility of information meant that departments had little idea beyond superficial impressions of how performance in one course articulated with performance in other courses within the same subject. This had consequences in two main areas, planning to raise attainment and the provision of

information and advice to pupils.

Raising attainment at one level, Standard Grade for example, depends on to a large degree, the extent of learning and knowledge acquired prior to the start of the course. The more clearly this is known, the more precisely plans can be made to take into account the extent of prior learning. In other words knowledge of pupils performance can be fed forward in plans to make changes in the following course. Equally, the more clearly the extent of final outcomes are known in relation to prior achievement then more clearly plans can be made to for next cohort pupils entering the course. This method of feedback regulation was used by the Science department: the only one to have coherent model for making decisions and the only one to make a determined attempt to overcome *'fragmented learning'*.

Some departments had experimented with centralising measures of pupil attainment. However, these were paper based and teachers would supposedly update these records after each assessment. However, for nearly all departments, the bureaucratic burden of completing the records and time pressures often meant that it wasn't done, or in the case of English and Maths departments only completed with respect to 5-14 National Test results. The Science department had a uniform set of tests which it used in S1 and S2. Periodically throughout the course, the results would be transcribed from the teachers marks book and passed to the Science PT. The PT entered all the results into a simple spreadsheet which took considerable time and based on their average percentage result, a rank ordered list was produced towards the end of S2. The pass mark percentages of previous cohorts together with their known final Standard Grade outcomes were compared to the list and from this comparison, the department could predict with a reasonably high degree of accuracy (between 80% - 90%) the final Standard Grade outcomes across the Sciences, of the current cohort of S2 pupils. Depending on the anticipated numbers of the current S2 cohort falling into each Standard Grade band (1 to 7) plans could be made with respect to resource allocations, to teaching methods, curriculum changes and so on. While this approach represented a reasonably systematic approach to analysis it is important to note that it only occurred at departmental level for S1 and S2 and it was only here, that the problems associated with *'fragmented'*, *'ambiguous'* and *'superstitious learning'* dissolved. At the level of the individual teachers, they still remained.

In other departments, the problems associated with *'ambiguous learning'* in S1 and S2 were compounded by the fact that different teachers used different methods for assessing pupils. In the Modern Languages department, for example, some teachers used their own simple tests while others made judgements based on achievement in homework tasks and yet others used the results from speaking tests. Other subjects like English assessed pupils through the use of letter grades and were naturally unable to easily use approach adopted by the Science department. For these departments assessing the progress of year groups towards targets and planning on the basis of evidence was extremely problematic. Research showed that ideas on departmental performance with respect to attainment were arrived at through negotiation between the different appreciative viewpoints of member teachers. Some of the conclusions drawn as a result of this process may or may not have been accurate but they revealed that plans developed at a level of *'superficial learning'*, where they developed either from practice without an adequate explanation or theory of what was happening, or imagined theories about what was happening but not reflected in the data.

Apart from planning for improvement, the other area affected was the provision of information to pupils. At significant break points in their school career, pupils had to make important choices. Towards the end of S2 pupils had to make choices for subjects to study at Standard Grade and after S4 pupils had to consider choices for subjects to study post 16. If one of the aims of the school is to ensure that pupils achieve their potential, then it becomes part of their responsibility to indicate the areas or subjects where they stand the best chance of success.

Undoubtedly, one of the drivers behind the approach used by the Science department in S1 and S2 was the need to provide to pupils advice on their chances of success in choosing one or two of the three Science courses on offer - from Biology, Chemistry and Physics - or whether they would be better off in opting for Standard Science. As previously described, the method used was quite accurate in predicting final outcomes and although the ultimate decision lay with parents, most pupils followed the advice provided. In other subjects, the *'rational'* basis for decision making known both to pupils and Guidance staff was entirely lacking. In core subjects like Maths or English pupils had no choice, while non-core subjects competed with one another in order to remain viable. For these non-core subjects, all pupils were effectively automatically recommended to study the subject at Standard

Grade and departments operated a negative reporting system in an attempt to exclude pupils either on the grounds of challenging behaviour or where it was felt that particular pupils would clearly struggle with the course content. Only the latter of these conditions were made apparent to pupils and as the basis for these decisions was fairly opaque to pupils and Guidance staff responsible for negotiating subject choices with pupils, departments would often find themselves with the very pupils enrolled on courses they wished to avoid. In making their subject choices, the only basis that pupils had aside from their own personal preferences was information provided in their most recent report and perhaps personal encouragement from teachers. However, because of the issues associated with *'learning difficulties'* at departmental level, these may or may not be based on evidence.

The situation for choosing courses post 16 was even more problematic, both for teachers and pupils. As described in Chapter 4, SMT and Guidance staff held interviews with pupils to negotiate course choices. However, none of the departments had a clear model of how Standard Grade performance related to post 16 courses beyond the simplistic heuristic rules that clever Credit pupils could do Advanced Higher or Higher, less able General ones do Intermediate 2 and so on. And this only related to pupils who had taken the subject at Standard Grade level, but post 16 courses were available to all, regardless of prior experience and subject teachers would frequently find pupils enrolled into courses who had no experience of the subject since S1 or S2. Even with pupils known to teachers within the context of their subject, without a model, recommendations were based on their own experience or *'superstitious learning'*. Apart from time constraints, one of the unspoken reasons for retaining the responsibility for course choice interviews within the SMT and Guidance staff was the *'fear'* that subject teachers would be reluctant to enroll pupils on courses who had insufficient prior knowledge gained through study in S3 and S4. Consequently, in the interviews both sides negotiated from positions of relative ignorance: the interviewing staff from inevitably knowing very little about the subject course and pupils from knowing little about their prospects for success in the subject at their chosen level or about their potential success in other subjects or levels.

One result was that negotiations generally collapsed into discussions about commitment and possible future careers, with little attention given to whether the pupil had the ability to succeed or might have better chances of success in other subjects or at other levels of

presentation. Another result, was that departmental staff often disagreed with the levels that pupils were accepted on to courses and some evidence to support their view could be found both in the numbers of pupils who had to be re-registered in courses at lower levels or failing the final exam. For example in one year, 70% pupils enrolled in Higher Biology had to be subsequently re-registered at Intermediate 2 level. Of the remainder, 10% failed the final exam. Interestingly, while teaching staff perceived the high failure rate as a consequence of pupils being accepted onto courses inappropriate to their ability, SMT and Guidance staff saw the problem as one of commitment and a result of other distractions external to the school, i.e. opportunities for part time employment. The difficulty was, with the state of information available to departments at the time, it was difficult to distinguish between these competing theories.

The varied and often inconsistent approach to accepting pupils onto post 16 courses also affects planning. Without having to have prior experience of the subject in S3 and S4, Departments found it difficult to plan in advance, taking into account a known range of abilities entering the course. Similarly, they found it difficult to measure the impact of any plans in raising attainment. Instead they were left to develop theories like the one above on the basis of *'superstitious learning'* where they were unable to test and see the results of them through class practice.

5.1.3 School Level - Recursion 2

Because of the fragmented approach used in gathering and storing data, arriving at an understanding of how the school was progressing towards targets was problematic and time consuming. *'Round-robins'* were issued by the SQA coordinator on which teachers recorded the overall current grade attained by pupils. On their return the grades were collated and transferred manually into a large grid which was used as the basis for a simple counting analysis. Lacking confidence and expertise in the use of IT, the SQA coordinator used to complete this process by hand. Naturally, mistakes could be easily made in the transfer of the data into the large grid and in the totalling up of the number of grades achieved at each level. The AHT responsible for SQA coordination estimated that up to 10 hours could be spent transferring and then checking the data in the large grid. Overall, the whole process from the issuing of *'round-robins'* to knowing the number of grades attained

at each level in each department and across the year group as a whole, could take between three or four weeks. Such was the labour intensity involved, that the process was completed was only once a year with S4 pupils after the S4 prelim exams in January. This was the only time when the AHT as the SQA coordinator could rely on obtaining a full set of data generated from assessments in all themes of each subject. As the final exams began towards the end of April and the results of the process was only available late February, early March departments had very little time to act, if at all, on the information generated.

In terms of obstacles to learning, the late arrival of the information to departments represents a form of *'ambiguous learning'*, where information arrives out of synchronisation with the teaching process, leaving teachers no time to adapt their behaviours in response to the information gathering process. During staff meetings where the results of the process was presented to staff, it was apparent to the SQA coordinator that his concerns over the results was not always appreciated by other staff. The SQA coordinator was a Chemist and for him *'hard numbers'* had real meaning. But it was clear from questions that some departments, and while it might appear as stereotyping, although true in this case, the English department represented an extreme example of teachers that had real difficulty in accessing the *'semantic meaning'* in the figures and connecting them to action. For these staff their limitations in understanding the information represents *'superficial learning'* and the AHT in his role as the SQA coordinator was always looking at alternative ways of presenting the information to enable staff to access its meaning.

Figure 37: HGIOS Planning Cycle

It was directly because of the difficulties associated with monitoring school progress towards meeting Standard Grade targets (bureaucratic burden, labour intensity, timeliness of information delivery and accessibility) that led to a request to develop a solution. However, the situation for other parts of the school was even worse. There was little attempt to monitor the progress of either pupils and departments in S1 and S2 or S5 and S6. With reference to the HMIE recommended self evaluation process (*'How Good is Our School'*) and improvement planning cycle shown in figure 37, the school had real problems at all levels (teacher, department and whole school) in establishing with reference to attainment both in answering the *'How are we doing?'* question and getting evidence to support the *'How do we know?'* question. Plans generated in answer to the *'What are we going to do now?'* question were established on the basis of *'fragmented, ambiguous, superficial and superstitious learning'*.

The SMT recognised that a problem existed, first in negotiations with the authority and the HMIE, where the HT argued that despite contextual features of the school (size, social mix, low educational attainment and expectations of parents, high proportion of single families, high unemployment, high proportion of parents with mental health and addictive problems, etc.), the school performed very well and deserved additional funding. The inability to satisfactorily demonstrate the value added by the school, led the HT to invest in Cognitive Ability Testing (CAT) provided by Nfer-Nelson, and commit to the solution being developed. Second, departments couldn't held to be accountable because there was no measurable connection between plans and outcomes. Investments in departments above the per capita funding and which developed through the departmental bidding process, therefore occurred through the goodwill of the SMT and the Headteacher's aim of supplying what was asked for.

To some extent the SMT attempted to compensate for the lack of an adequate tool to relate plans to outcomes, through strong encouragement to use alternative procedures for quality assurance. For example class room observations, jotter sampling, cross marking were all methods the SMT strongly encouraged PT's to use in order to discover the *'How we are doing?'* and *'How do we know?'* questions. However, because of time and work load pressures these practices were often not completed or only attempted in a trivial way. Departments in this respect demonstrated *'audience restricted learning'*. Here, departments

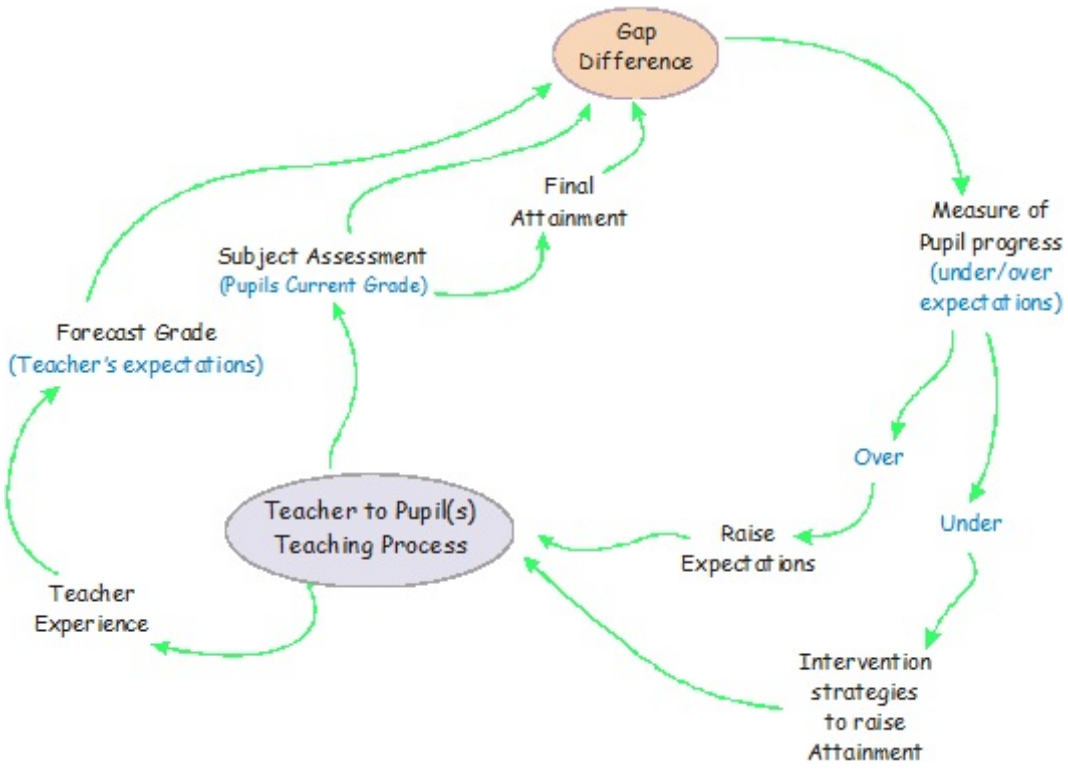
had the knowledge as to what to do and why to do it, but didn't follow it through with action.

5.2 Modelling Teacher Measurement Processes

Many of the issues discussed in the previous section began with the fragmented way in which teachers stored and used information gathered about pupils, both as part of the teaching process and in assessments. Clearly, an IT based shared resource could go a long way to resolving these issues in terms of collecting the raw data but it would still leave open issues of interpretation. A starting point therefore, was to discover how teachers arrived at ideas about a pupils potential and what they did with assessment data. The result is shown in figure 38

Influenced by ongoing outcomes of the teaching process (figure 14 page 74) - pupil's

Figure 38: Monitoring pupil progress



written work, homework, questions answered, questions asked, behaviour etc. - and experience of teaching similar pupils, teachers develop a set of expectations about each pupil's potential. Expressed as a forecast grade, the teacher mentally compares this with grades actually attained in subject assessments. Depending on the difference, the teacher draws certain conclusions:

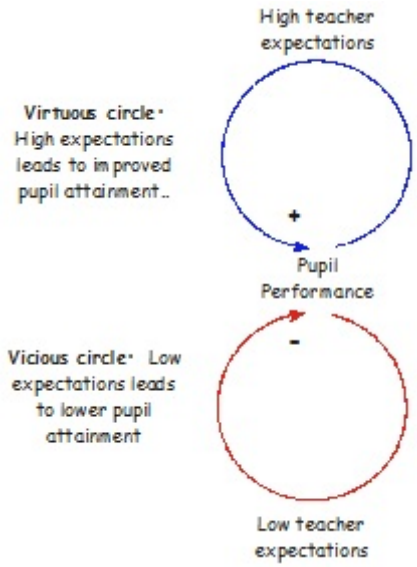
- Where the pupil's assessed grade is the same as the teacher's expectations, the pupil is making good progress and the teacher continues as before.
- Achieving grades above those expected by teachers, may trigger teachers to raise their expectations of what the pupils can achieve in the future.
- Pupils attaining grades below teacher expectation lead to judgments that the pupil is performing below their potential and trigger interventions, change of teaching methods, style, providing additional practice, reenforcement etc. to raise attainment.

The final grade attained by the pupil is used to add to accumulating experience of teachers

of teaching similar pupils.

The relative dimension in the process, reveals how different interpretations - *'soft facts'* - can be arrived at from the same *'hard'* data. An able pupil achieving, say a General Grade 3, could be described as under achieving or performing below their potential. The same grade for a less able pupil can represent a considerable achievement, attained through much hard work and effort. One difficulty with this process though, is that teacher's expectations are rarely made explicit and at Burnview were never gathered in a systematic way. Consequently a lot of information is lost to others, and without knowledge of the particular pupils involved like the two pupils achieving Grade 3 in the example above, there is the risk that they can be treated the same, even though they arrive at the same grade from different ends of the ability scale and with different amounts of effort involved.

Figure 39: Self fulfilling prophecies



The cyclic aspect to figure 38 shows how teacher expectations can change. On encountering a pupil for the first time, teachers begin to develop a loose set of expectations. At the beginning these might be more influenced by their own personal preferences and biases. For example their expectations might be based on the way pupils present themselves, the tidiness of their work or their behaviour. Over time and as experience of the individuals in the learning process develops, the teacher acquires additional information about the

potential of pupils and as a result of this steadily accumulating knowledge, may change their expectations of what pupils can achieve in assessments. By the end of a course, the feedback loop that operates between the teacher and pupil whereby the teacher forms a set of expectations depending on what the pupil can demonstrate in class, and then subsequently have them tested by pupils performance in assessments, should lead to a state where they're in close alignment.

Figure 38 shows that teachers expectations are critical to teachers judgments about whether pupils are making progress and their potential for future attainment. Interestingly, discussions with teachers revealed a reluctance to be explicit about their expectations and would only discuss them in terms of broad generalities. This reluctance appears to stem from a fear of being held accountable both by parents and senior staff, and blamed if pupils failed to achieve the expected grade. The dependence on teacher expectations to drive learning also reveals the flaw in the process. Cotton (1989) and Tauber (1998) show how teacher expectations can lead to self fulfilling prophecies and as seen in figure 39, these self fulfilling prophecies may be either *'virtuous'* leading to better performance or *'vicious'*, leading to poorer pupil performance.

How teachers act on their expectations is a significant factor in determining the path pupils follow. If expectations are low and teachers act by setting work appropriate to that level, then pupils can only achieve at the level set by the teachers expectations, irrespective of whether they could achieve more. Effectively, teacher expectations become a barrier to achieving at higher levels and the HMIE (1999) identified low teacher expectations as a limiting factor to many pupils making faster and further progress in Science. While high expectations develop confidence in pupils and encourage them to achieve more there comes a point where pupils are performing to the very best of their ability and potential. If teachers continue to expect them to achieve more, above their potential and accordingly set work at this higher level, then this can also become a barrier for pupils. All teachers agreed that setting work above a point at which pupils can access in terms of understanding and succeed is one way of turning a *'virtuous'* cycle into a *'vicious'* one as they constantly fail and loose confidence in their abilities.

Setting appropriate expectations, which effectively become targets for pupils to satisfy, must

therefore be neither:

- Too low, becoming a barrier too further progress, or;
- Too high, representing unattainable and unachievable targets.

One way the HMIE (1999) recommend for setting appropriate targets is to take into account prior learning and achievement. But as earlier sections showed, teachers at Burnview had no method of accessing this information in a clear, systematic way and had to spend time *'triangulating'* their expectations with others or starting with a *'clean sheet'*.

The other difficulty with the process concerns the validity of assessments themselves and how they relate to teachers expectations. *'Easy'* assessments can lead to situations where pupils attain grades above their potential leading teachers to overestimate their ability. Similarly, *'difficult'* assessments can underestimate pupils ability where they attain grades below their true potential. In S3 and S4, this is less of an issue as many of the assessments are based on past exam questions, portfolio or practical work established by the SQA or questions written to Standard Grade criteria. They are however an issue in S1 and S2 where with the exception of the Science Department, there is little evidence beyond an intuitive understanding in the minds of teachers of how performance in assessments relate to future attainment. This was particularly true in departments where teachers used different methods of assessing pupils ability.

5.3 Developing System 3-2-1 Capability

Looked at through the lens of the VSM, some significant deficiencies can be identified: -

- System 3 with respect to raising attainment in System 1. System 3 cannot make appropriate regulatory or control responses to pupils learning as measurement is based on *'fragmented, ambiguous, superficial and superstitious learning'*. These exist at all three levels: teacher, departmental and whole school.
- **System 3 star** with respect to evaluating pupil, teacher, departmental and whole school performance. The fragmented knowledge contained within teacher marks books and heads is inaccessible to others and feeds through to enclosing recursion levels.

- **System 2** with respect to achieving improved coordination between teachers at Recursion 0. Teachers have no formal methods of validating their expectations or of discovering whether a pupil is performing well or less well in their subject compared to the performance levels they may be attaining in other subjects.

These deficiencies effectively decouple planning from the events in the classroom and developing system capacities in these areas, in the light of how teachers evaluate pupils progress, became a major aim in the following work.

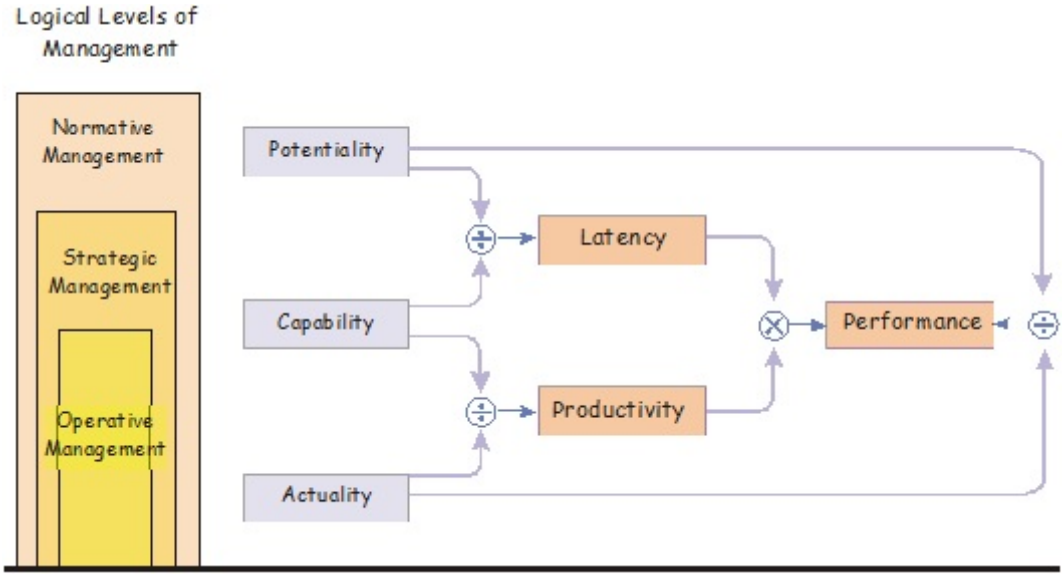
5.3.1 Relative Measurement and the Model of Systemic Control (MSC)

The relative method used by teachers to make judgments on pupil progress, whereby they continually compare pupils performance in assessments with their own expectations developed by continuous contact with pupils, mirrors ideas on measurement developed by Beer (1981). For Beer, absolute values have no intrinsic meaning. Most people he argues, ascribe meanings to values through an implicit comparison in their own understanding of a situation. For example, a value can be perceived as good or bad, little or large depending on the context defined by the observer. Other observers may define the context differently and therefore ascribe different meanings to the same absolute value. To develop a common understanding in the meaning of measures, Beer advocates making this relative comparison between measures explicit though the use of ratios, and in this way much of the *'variety'* contained in absolute raw values can be reduced. This relative method of measuring achievement and it relationship to the Model of Systemic Control (MSC) is shown in figure 40

Based on a common metric, three measures of capacity are shown alongside their respective level of management. These are defined as:

- *Potentiality*: Set at the Normative level of management, this value describes what the organisation *'ought'* to be achieving if constraints were removed and resources developed to help the organisation achieve it. The set value is still grounded in what is known to be feasible.
- *Capability*: Handled at Strategic level, this value describes what the organisation

Figure 40: Measuring achievement and the Model of Systemic control (MSC)



'could' be doing at its best now, within existing resources and constraints.

- *Actuality*: Handled at the Operations level, this is a measure of what the organisation *is* doing right now with existing resources and constraints.

The relative difference between the three raw capacity measures is revealed in the three ratios of achievement.

- Latency: the ratio between the normative value of potentiality and its strategic capability.
- Productivity: the ratio between what the organisation is doing in actuality and its strategic capability.
- Performance: the ratio between the normative value set by the organisation and what it is currently achieving.

These ratios, Beer maintains can be used to monitor and track the progress of the organisation towards the fulfilment of its plans, make explicit the role of different plans and integrates the three logical levels of management.

- Normative planning focussed on raising the *'potential'* of the organisation.
- Strategic planning focussed on increasing its capability and reducing the latency gap.
- Operational planning tracked by the productivity ratio focussed on raising its actual performance to Normative set values.

5.3.2 An Educational Solution to Relative Measurement

The initial approach by the SMT concerned the development of some computerised shared resource to tackle the problems of fragmented knowledge and associated learning obstacles in S3 and S4. This provided the common metric of Standard Grade outcomes. However, there remained two significant issues involved in the transfer of Beer's method of relative measurement.

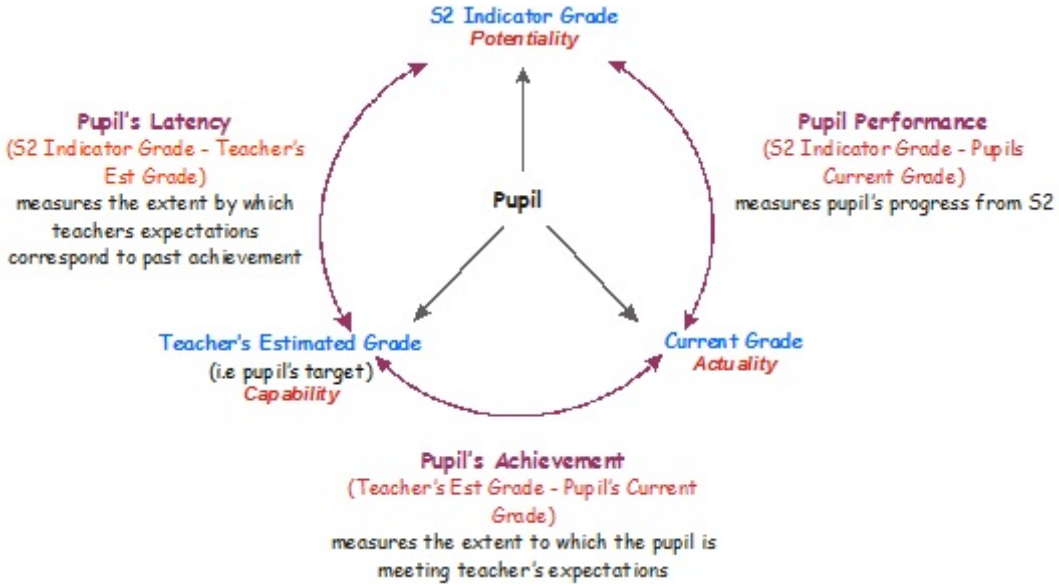
The first of these concerns the establishment of *'potentiality'*. In Beer's measurement model, *'potentiality'* values are an outcome of the normative planning process set on an agreed scale. These are always better than capability, which in turn, are better than that being achieved in actuality. In teaching though, *'potentiality'* values, if they are to be grounded in what is known and feasible, cannot be established independently from each pupils ability: and each pupils ability and therefore *'potential'* will vary from pupil to pupil. Although the initial problem concerned S3 and S4, the issue was resolved through the use of the terminal *'S2 Indicator Grade'* expressed in Standard Grade terms achieved by each pupil in each subject. This grade takes into account their prior learning and expresses for each pupil, their Standard Grade *'potential'* for each subject based on their performance in assessments throughout S1 and S2. This indicator grade exists independently of any teacher-based expectations and implied in the generation of this measure is that:

- All subject departments develop a common and consistent approach to assessment in S1 and S2.
- Staff in subject departments develop a common understanding of how S1 and S2 assessment performance relate to Standard Grade outcomes. Explained in later sections, a simple methodological framework was provided to assist departments to achieve this.

Accordingly, in the *'new'* developing interpretation of Beer's system of measurement, the;

- *'S2 Indicator grade'* represents the potential of each pupils future Standard Grade outcome based on prior attainment or historical performance in S1 and S2.
- *'Teachers Expectations'* represents the best expected future final outcome of each pupil in Standard Grade terms given the teachers current understanding of each pupils

Figure 41: Triangulating on pupil capacities



capabilities. As explained earlier, this can change as teachers develop their understanding of the pupil's capabilities in the teaching learning process.

- *'Current Grade'* represents what pupils are achieving in current assessments.

The relationships between each of these measures is shown in figure 41. In combination they provide three different views of each pupil's capacity in each of their subjects, bringing together their past and current performance with their expected future performance. Following the indices enables teachers to triangulate on the pupils *'true'* capacity and monitor their progress throughout the duration of the course.

Figure 41 also reveals the way the second issue with Beer's method is resolved. In Beer's original framework, indices are calculated as ratios. Here the choice, for example in calculating latency, between *'potentiality'* or *'capability'* as the numerator or denominator depends on what's being measured, i.e. where more is better as in profit or whether less is

Table 35: Possible Standard Grade outcome scenarios

Measure	Pupil 1 ***P > C >A***	Pupil 2 ***A > C > P***	Pupil 3 ***C > A > P***
S2 Indicator grade (potentiality)	1	3	3
Teacher's expectations (capability)	2	2	1
Pupils current grade (actuality)	3	1	2
✶ Smaller the number the better the grade			

better as in time to manufacture. Standard Grade courses however, measure performance on a scale of 1 - 7 with 1 representing best performance and 7 worst performance. Where under Beer's rubric, values of *'potentiality (P)'* are always set at better level than *'capability ©'*, which in turn better than *'actuality (A)'*, in Standard Grade courses it is possible to attain similar situations with one pupil, the exact opposite with another and various other combinations with others - see table 34

Using ratios in such situations isn't feasible because of the disproportionate effect of division and the inconsistency in the combination of possible outcomes in the three measures. Consequently, the difference method shown in figure 41 is used bringing with it the advantages of:

- Using the same relative method used by teachers to evaluate pupil progress shown in figure 38.
- Using a simple mathematical operation which reduces the degree of mathematical abstraction from the raw data and makes it easily accessible to both staff and pupils.

There are a number of other differences between the new model in figure 41 and Beer's method of measurement that deserve further examination. One concerns the behaviour of the indices. In Beer's model, ratios tend towards unity as both measures become more alike. Within the new model, indices tend towards zero as they become similar and increase in value as they become more dissimilar. Another is the key driver to the system.

In Beer's model, the normative *'potentiality'* value represents an aspirational value which the organisation strives to meet by increasing its strategic *'capability'* and operational *'actuality'*. In the new version, the S2 Indicator Grade of pupil *'potentiality'* becomes the target grade which pupils have to exceed in *'actuality'*. The larger the difference, the greater the degree of pupil progress, which can also be interpreted as the amount of *'value added'* both by the teaching and the effort of the pupil. So for example looking at table 34, Pupil 2 has improved by two grades and Pupil 3 by one grade. By contrast, Pupil 1's performance has deteriorated by two grades. While the Pupil performance index remains unaffected by teacher expectations, the way as described earlier during the discussion of figure 39, teachers connect their expectations to teaching is critical to raising pupils *'actuality'* or Pupils Achievement.

As a general rule, with teaching and learning being a transformative process, teachers would expect pupils to achieve higher grades *'now'* than those they have achieved in the *'past'* shown by their S2 Indicator Grade. Here, the aim is to increase pupil's latency while still being grounded in what is feasible with each pupil's ability. The example results in table 34 show that for Pupil 2, the teacher expects the pupil to improve by one grade and for Pupil 3 by two grades. However, this is not a hard and fast rule. There can be occasions where teachers can expect pupils to perform less well in the *'future'* compared to what they've achieved in the past. For example, the teacher expects Pupil 1 to perform one grade below their S2 Indicator Grade. Reasons for this expected decline can be complex and could be related to behavioural issues, attitude or the amount of effort being made by the pupil.

The extent to which teacher's expectations are grounded in what is feasible, is shown by the difference between the teacher's expectations for the future and what the pupil is currently attaining in the present. In table 34, the teacher expects Pupil 1 and Pupil 3 to achieve higher grades in the future compared to what they are currently attaining. Where, for example with Pupil 2, the pupils present grade exceeds that of teacher expectations of future performance this is warning to teachers to raise their expectations. The relationship between teacher expectations driving pupils actual achievement, combined with the aim of exceeding their potential works against the onset of vicious circles shown in figure 39, where low expectations can lead to low pupil attainment. For example in table 34, Pupil 3 shows the best possible outcome. The pupil's current grade, exceeds their potential grade

attained in the past, but the teacher still expects them to improve in the future.

5.3.3 Evaluating Group Performance.

The other advantage to the method in figure 41 is that it provides a simple method for evaluating groups. This is matter of aggregating the grades for each pupil in each of the three measures and examining the resulting indices. Table 35 shows the aggregated results for table 34.

Here, the group is currently attaining one grade better than that indicated by their past group potential and as a group, are working close to teacher expectations. Nevertheless, teachers expect the future final group outcomes to exceed their past performance by two grades. The closeness in the match between teachers expectations show that teachers are setting feasible and attainable targets, but still expect the group to improve in the future. As shown in later sections, with larger groups the indices are shown as percentage differences.

In terms of creating some shared IT resource, the approach implies a systematic method for aggregating group results to reduce or attenuate the enormous range of possible groupings to a simple few. This method was based on the framework indicated by the organisational VSM, which was in turn is based on the way complexity was unfolded through the organisation. - see figure 21 page 126. At the various recursion levels, this provides:

- **Teacher level Recursion 0**: the facility to group pupils by their classes or registration group within the subject.
- **Departmental level Recursion 1:** the facility to group pupils by teacher, registration group or by year group within the subject.
- **Whole School level Recursion 2:** the facility to group all pupils across all subjects by year group or registration group

The systemic nature of the framework would allow the SMT at Recursion 2 to examine the indices at whole school level and the facility if they wished to *'drill down'* through departments at Recursion 1 and teachers at Recursion 0 to see what is expected of particular individuals and what they are currently achieving within a single subject or across subjects.

Similarly, teachers can develop *'upwards'* from their expectations and performance of a particular pupil to the set of whole school results. However, just as the three measures can be used to *'triangulate'* on the capacity of a single pupil, their aggregated results allow the higher recursion to *'triangulate'* on the performance of the next lower recursion. So, for example it is expected that the SMT at recursion level two to use the measures and indices to monitor and track the performance of individual departments. Likewise PT's can monitor

Table 36: Evaluating Groups

Measure	∑ **Grades** (from table 34)		
S2 Indicator Grade *(Potentiality)*	7		
	Group Latency	**2**	
Teachers Expectations *(Capability)*	5	**Group Performance**	**1**
	Group Achievement	**1**	
Pupils Current Grade *(Actuality)*	6		
✶ Smaller the number the better the grade			

the performance of individual teachers and teachers in turn, use them to assess the effectiveness of their teaching strategies on complete classes.

The significant advantage to using this method for assessing the performance of groups, is that regardless of the recursion level being examined, the measures and indices always remain anchored in what teachers and pupils are actually doing in the classroom.

5.3.4 Links to Planning and the Model of Systemic Control

The new relative difference method provides measures and indices for tracking performance that resolves many of the issues associated with fragmented and other barriers to individual and organisational learning. In terms of pupil attainment in the HGIOS planning cycle for self improvement - see figure 37 page 218, they provide answers at each level of recursion to the questions of:

- How are we doing?
- How do we know?

Answering the question of *"What are we going to do now?"* involves a reexamination of how the measures relate to the MSC.

- **Normative planning**: For S3 and S4 normative values are produced as outcome of S1 and S2 teaching and learning. This transfers the emphasis for normative planning for S3 and S4 to earlier in the learning process, where the intention is to achieve highest possible grades in Standard Grade terms for S2 pupils. This emphasises the need for prior learning and creates a link in a department between the different levels of courses: a link which for most non-core subjects has been seen as relatively unimportant.
- **Strategic planning**: Here the emphasis is on the development of plans to get group performance at S3 and S4 to exceed group *'potential'* grades.
- **Operational planning**: Planning is focussed on raising pupils current performance to meet teacher expectations.

Theoretically, it is possible for a department to achieve good performance measures by underestimating each pupils ability at the end of S2, I.E. their *'potential'* S2 Indicator Grade for final Standard Grade performance is below their true ability. This would produce an artificially inflated Group Pupil Performance or *'value added'* figures. The effect of such an approach is mitigated by the fact that the department would be seen to perform poorly in relation to others with the same pupils in getting them to achieve high S2 Indicator Grades.

5.4 Development and Design Considerations

The preceding sections have outlined a measurement system to overcome individual and organisational learning obstacles. This system is grounded in the actual process used by teachers to make judgments of pupil progress and has been informed both by the VSM and the needs of the HGIOS planning cycle for school self improvement. The final choice of using a database program, FileMaker Pro, as a platform for a shared IT resource application to contain and automate the process was informed by technical and user considerations.

5.4.1 Technical considerations

The choice of the relational database program FileMaker Pro as the platform for the application over alternative solutions driven by spreadsheet programs like Excel or custom solutions created from scratch using programming languages like Javascript was driven by pragmatic consideration of the following.

- **Mixed platforms**. Burnview Academy had mixture of platforms. A few departments like Science, Business Studies/Computing and Technical had PC's but predominately, teacher computers were Apple platforms of various ages and operating systems. Consequently any application would have to work on both platforms. FileMaker Pro originally developed for Apple computers has a good record for working across mixed platforms.
- **Cost**: As the work at the beginning was experimental in nature, the SMT were keen to keep the development and implementation costs to a minimum and work within existing resources. With most teachers familiar with Apple-based programs like AppleWorks, the school lacked site licenses for Microsoft Office or similar PC-based packages. By contrast, the school was already in possession of FileMaker Pro licenses and the FileMaker Server programme used to deliver FileMaker Pro databases across the school intranet was available at minimal cost.
- **Rapid application development**: FileMaker Pro is well suited for quick application development. The flexibility of SQL is contained within built in functions obviating the need to learn a dedicated database query language and it also comes with its own scripting language which can be used to automate many tasks.

5.4.2 User considerations

In developing software applications, there is an extensive range of software design methodologies to choose from, for example Structured Design (SD) (Stevens, Myers and Constantine, 1974), Structured Analysis and Design Technique (SADT) (Ross & Schoman, 1977), Jackson Systems Development (JSD) (Jackson, 1992) and Structured Systems Development (SSD) (Pressman, 1992). The majority of these methodologies emphasise aspects of programming which is less important here, with the application being built on top

of an existing program and in their analysis they also cover similar ground to that covered by the VSM and Espejo's (1989) Cybernetic Methodology for problem solving. Consequently, a decision was made to use principles of variety engineering to inform the development process, paying particular attention to the reduction of complexity and *'transduction'* or the way data and meaning passed between the user and the application. On this basis a number of design aims were established prior to the start of the application development. These included:

- **Congruence** with existing working methods of users. It was acknowledged that designing the application to support existing methods was more likely to result widespread and early adoption. By making the application in support of *'real world'* practices, rather than making the *'real world'* fit the application, would also meet the design objective of making its use as intuitive as possible and thereby reduce the training overhead required for its implementation.

  Implicitly this suggests creating custom forms and reports, each using *'language'* -, i.e. terms commonly understood - appropriate to the needs of identified user groups. The VSM modelling of the organisational structure provided easy recognition of the different user groups and the levels of aggregation in the data. They corresponded to: -

  - A combined group of Principal Teachers and Subject Teachers. As PT's work as class room teachers they need to access the application as:
    - Subject Teachers working from within **System 3 at Recursion 0** in order to evaluate the effectiveness of their own teaching both with individuals and classes. And also to see how particular pupils are performing in other subjects relative to their own. Additionally, because creating a shared understanding of the department as a whole in terms of expected standards of attainment is important to planning, Subject Teachers were given access along with: -
    - Principal Teachers and Subject Teachers in working from within **System 3 at Recursion 1** to enable joint evaluation and comparison of year groups and classes.

  - Guidance Staff in **System 3 at Recursion 1** with access to individual pupil details across all subjects.

- SMT Staff working in **System 3 at Recursion 2** to obtain global views of all pupils across all subject departments in order to evaluate the progress of the school as a whole.
- Office Admin Staff working as key coordinators in **System 2** working across **Recursions 2 and 1**. In this role, Office Admin Staff were responsible for managing pupil records and assigning them to their chosen subjects. With the automated production of collated pupil reports generated by the application they benefited considerably from its introduction.
- Learning Support Staff as **System 2** coordinators working mainly within **Recursion 0** providing information directly to subject teachers. The relational structure to the application enabled this information to be maintained up to date in *'real time'* as opposed to producing a *'new'* yearly report at the start of each academic session.

Separating out functions and user reports into different access points for each user group, reduces the complexity that each group has to deal with by *'flattening'* menus and option lists. '*Click & Go*' by contrast has options four or five levels deep within cascading menus which are themselves quite extensive. This increases the complexity and difficulty of using the program, where the user has to know where within the complex structure a particular function resides.

- **Minimise** individual learning loop obstacles by accounting for variety in the complexity of understanding. Despite the lack of evidence found by Coffield et al (2004) review of 71 different theories on learning styles and their impact on learning, experience during the research revealed that individuals had preferences for particular types of information. For example some teachers could grasp the meaning entailed in numerical data, while it remained opaque to others: this was particularly true of STACs statistical data. Implied in the minimisation of individual learning loop obstacles and the maximisation in the *'transduction'* of meaning from the application to the user, is that data is presented in a variety of ways to cater for a range of different preferences. In practice this meant presenting information in:

  - Numerical format.
  - Text format, and;

- Graphical format. The intention was to make this the default option for viewing both collected data on individual pupils across subjects and selected groups of pupils within subjects. In follow up research after the systems implementation this indeed proved the case, and was an especially popular method of presenting collected information to pupils. Subsequent research with pupils found that they had no difficulty in appreciating the meaning within this method of presentation.

- **Exception reporting** and systemic access to information to reduce the complexity in the monitoring and tracking of pupil attainment. Teachers could continue to enter assessment data with little thought. The system itself would alert them to the possibility that the gap between current pupil attainment and their expectations might be getting too large for which there may be two possible causes.

  - The teacher may have unrealistic expectations whether too high or too low.
  - The pupil is underachieving.

  Systemic access to information about the pupil across subjects would enable them to compare their own expectations to those of other teachers. This would enable them to check the validity of their expectations and provide them with the ability to compare the pupil's attainment in their subject with others to discover whether the underachievement is confined to their subject or shared with others. Teachers would also be able to access learning support information to discover whether the pupil had a particular difficulty or ability that might explain the disparity.

  It would be left to the teacher's own professional judgment to draw the appropriate conclusions. It's worth emphasising that it's not the intention of the system to provide absolute answers, but provide the teacher with starting points for further enquiries. The complexity of drawing the conclusions is left with the teacher.

  The same approach is used at higher aggregations of data, where departments at recursion one are left to investigate differences between group expectations and group current attainment. Similarly, at recursion two, SMT can examine whether expectations are appropriate with current attainment at whole school level.

- **Reduction** in overall teacher workload and complexity through the replacement of existing manual systems and automation of particular tasks. Interviews had indicated that successful implementation could only be achieved if the system provided tangible benefits to users and was seen as a replacement of existing manual systems rather than an *'add on'* to existing ones. It was also acknowledged that there had to be incentives to move from a manual privately owned well-understood system to an unfamiliar shared open automated information system.

    - Using the *'single entry multiple use'* principal was one benefit which avoided the tedious and repetitive double information handling involved in the production of class lists, pupil reports etc. This was of particular benefit at higher recursion levels who no longer had to spend considerable time checking and collating paper-based information into a usable form.
    - A reduction in Guidance work was also achieved, particularly in requesting information via *'round robins'* as much of the information could be accessed directly.
    - Absorbing the complexity involved in the calculation of overall grades from assessments in each element of the course and updating this grade on each new assessment.
    - Assist and spread the load involved in the production of pupil reports for parental use. Research had shown that the production of pupil reports formed a major bottleneck. With the manual system teachers were reluctant to begin writing reports until close to the publication date because of changes. Guidance staff and Year heads couldn't begin writing their reports until all staff had written their reports, had them checked by Principal teachers and after they were collated by Office Staff. Within this system, delays early in the process, possibly caused by teacher absence, had a subsequent and disproportionate effect further down the line.

      Within the system current pupil attainment in all the subject elements were linked to a reporting section. Reports could be completed either through the use of standard comments selected from a number of *'drop down'* lists or through the use of an extended custom comment. A choice was provided, because some teachers were reluctant to use standardised comments as they considered it lost the personal touch. However, the facility was developed that allowed departments to easily create their

own standard comments lists and it was apparent later that when teachers had to report on large numbers of individuals at the same level, the use of standard comments was more popular.

Producing the reports through the system allowed teachers to complete their reports much earlier and amend them at the last moment. Reports were also carried over to subsequent years so teachers could view what had been written about them before, possibly by a different teacher and amend these in many cases only slightly. Year Heads and Guidance teachers could also start their reports much earlier and were less dependant on the prior completion of all reports. Being able to view completed reports in *'real time'*, they could write their reports basing their comments on the majority of completed reports. Collation was completed at the time of printing and late reports could even be produced separately.

In line with the principles of variety engineering, the production of reports was seen as perhaps the most important way that schools can amplify their complexity to parents in the environment with the intention of bring about hoped for change in pupils effort, attitude, behaviour etc. To help parents understand the meaning of information contained in the reports, it was considered essential to produce them in a standard format or style, so that once they could transcribe the meaning of one into a form that they understood, the same process of *'reading'* could be applied to all others. Until the system's introduction, the layout, style and method of presentation of subject reports were all remarkably different as they had evolved in different directions over previous years. Naturally, this imposed an additional effort by parents to understand the implications of the reports.

- **Self management** or the provision of localised problem solving capacity to increase flexibility and reduce the complexity managed at a higher level of recursions. Under the previous system, considerable delays could be incurred while permission was sought from *'higher levels'* of management to make minor changes, in response to minor local problems and often required the involvement of a third party, for example a change in teaching section. Consequently, in line with the principles of the VSM, the system was designed at the outset to give as much control and responsibility for as many parameters

as possible, that were both consistent with each recursion level and the integrity of the system overall. For example departments could transfer pupils between teaching sections, set the threshold at which alerts were generated in group reports, configure their own reports, titles for assessments and so on. These parameters were extended in later interventions as the system was extended to cover other year groups. Only Office Admin staff could add or delete pupils from the school role or from subjects.

- **Openness** and trust in the professional conduct in teachers. Teachers are encouraged to be open in their conduct and a conscious decision was made to reflect this in the systems design as a way of reducing complexity, particularly as a lot of complexity in management information systems like *'Click & Go'* is focussed on preventing staff from seeing certain parts of information, restricting the changes they can make or forcing staff to make them only at certain times and so on. Teachers in one subject area, for example cannot view the grades attained by pupils in other subject areas. Rather than exclude staff from particular areas, the new system laid emphasis on inclusion, encouraging departments to see how other departments were set up and the results they were obtaining. The only areas staff were to be excluded from were those that threatened the integrity of the system as whole under the control of Office Admin Staff and the confidential information contained within the learning support section.

  In practice, subject staff made little attempt to see how other departments established their assessment programmes or comments in pupil reports made by other teachers. And over six years or so, there were no reports of teachers changing the marks of others, changing the parameters of any other department accidentally or maliciously or of any pupil records going missing.

Taking all the design aims together, the intention was to develop an application that helped reduce complexity, was intuitive to use with a low training overhead, reduced teacher workload and offered positive incentives for use. It would also be relatively self sustaining, reducing demands on support and requiring little in terms of maintenance.

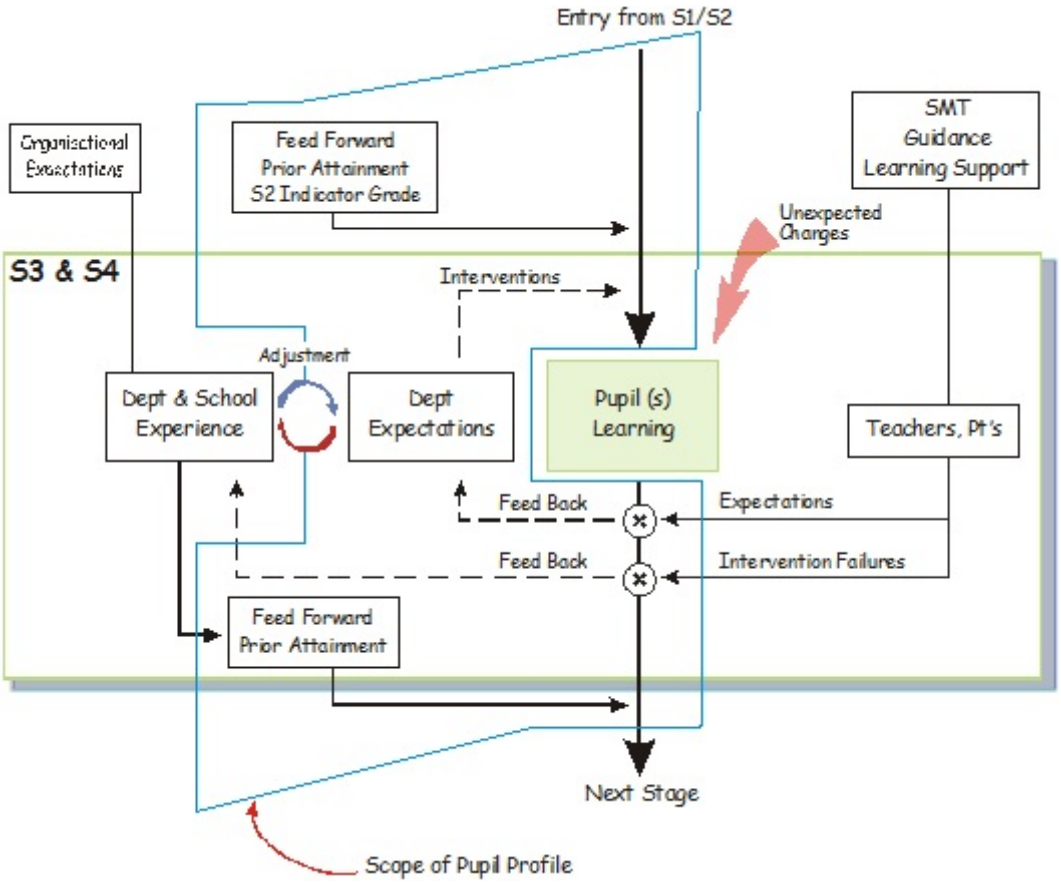
5.5 Intervention One: S3-S4

Following agreement with the SMT to build the application early in the 1999 - 2000 academic session, the SQA Coordinator and AHT responsible for S3 and S4, passed a questionnaire to all departments asking for details of their Standard Grade subjects, including the number and titles of any assessments completed during the course. Sets of sample pupil data were also obtained.

Over the next six months periodic progress review meetings were held with the AHT and HT and by early February 2008 the application was completed. The scope of the application for a single subject department is shown in figure 42. In broad outline, S2 pupils enter the system with an indicator grade that shows their potential for final Standard Grade Performance. Teachers as a result of direct contact with the pupil develop a set of expectations of how the pupil should perform. The grade attained by each pupil in each assessment covering each element of the subject is entered into the database and the application automatically calculates each pupil's current grade and compares this with the S2 indicator grade and the teacher's expected grade. Significant differences with the teacher's expectations are alerted to the teacher who can then begin to investigate other sources of information, those of other teachers, learning support etc. and make inferences as to possible causes. Working within methods expected by the department and the SQA, the teacher makes interventions to restore the pupil(s) to their expected level of attainment. Where interventions fail to restore the pupil(s) to a point of *'stability'* as defined by the teacher expectations, the experience adds to and should trigger a search for possible solutions within the broader field of departmental and school experience contained within other staff. The willingness of staff to engage in this process is influenced in turn by organisational culture, mores and expectations and results in organisational learning. Possible solutions are used to adjust departmental methods of how teachers manage to deal with similar pupils in the future. Additionally, through the combined experience of teachers, departments develop a set of expectations of how pupils will perform in subsequent courses, Higher, Intermediate 2 etc.

By way of contrast *'Click & Go',* the authority's preferred MIS developed by SEEMIS, only held one grade in each element and these were entered at the time pupil reports were

Figure 42: Boundaries of the application



produced. As these are produced once a year, the points at which underachievement could be identified within or across subjects was discontinuous with early intervention: another example of *'ambiguous learning'* caused by the late arrival of information (Espejo et al, 1996). Additionally, the failure to include a teachers expected grade or an indicated grade on entry to the course, makes identifying underachievement difficult. Furthermore, the burden of work was still left with the user, leaving teachers to calculate a representative grade in each element from a number of assessments. Conversations with users in other schools revealed that in many cases teachers avoided this by either entering grades from the most recent assessment or use *'guestimate'* grades from the list of assessments. Both approaches lead to other forms of *'ambiguous learning'*. In the first case, through the omission of

information and in the second using distorted information (Espejo et al, 1996). Even now *'Click & Go'*, only holds a grade one grade for each element, despite its original aim to operate like an electronic marks book. And it's only relatively recently, possibly as an outcome of a short secondment with SEEMIS that arose after the second intervention with school, that *'Click & Go'* has the facility to record the teacher's expected grade, although in *'Click & Go'* it's currently referred to as a negotiated grade: a grade arrived at through a negotiation between the teacher and the pupil. Only when pupils have been awarded their final grade after their exams, can teachers access information from other subjects. *'Click & Go'* also retains compatibility issues with Apple computers, a problem that was to be resolved in 2000.

In late February 2000, during planned activity time, the application was introduced to the staff with a view to going *'live'* in the following month for the production of S4 pupil reports. The logic in the relative difference method underlying the database was explained using figure 41 (page 228) and a method introduced for generating S2 Indicator Grades. After a brief demonstration, staff had an opportunity to try the application for themselves and since its introduction to the present day, this has been the only formal *'training'* session given to the whole school staff.

During the following week, the SMT consulted with PT's and the decision was made to go *'live'*. This decision was significant as it required the agreement of all teachers involved in Standard Grade subjects to abandon their private manual paper-based systems, agree to share data and make their expectations of pupils public. The only source of difficulty for departments was the generation of S2 Indicator Grades for the then current cohort of S4 pupils. As only the Science department could reliably provide these for Biology, Chemistry and Physics Standard Grades, S2 Indicator Grades were omitted for the S4 pupils but created for the S3 cohort.

Figure 43: The method used by the Science Department for producing S2 indicated grades

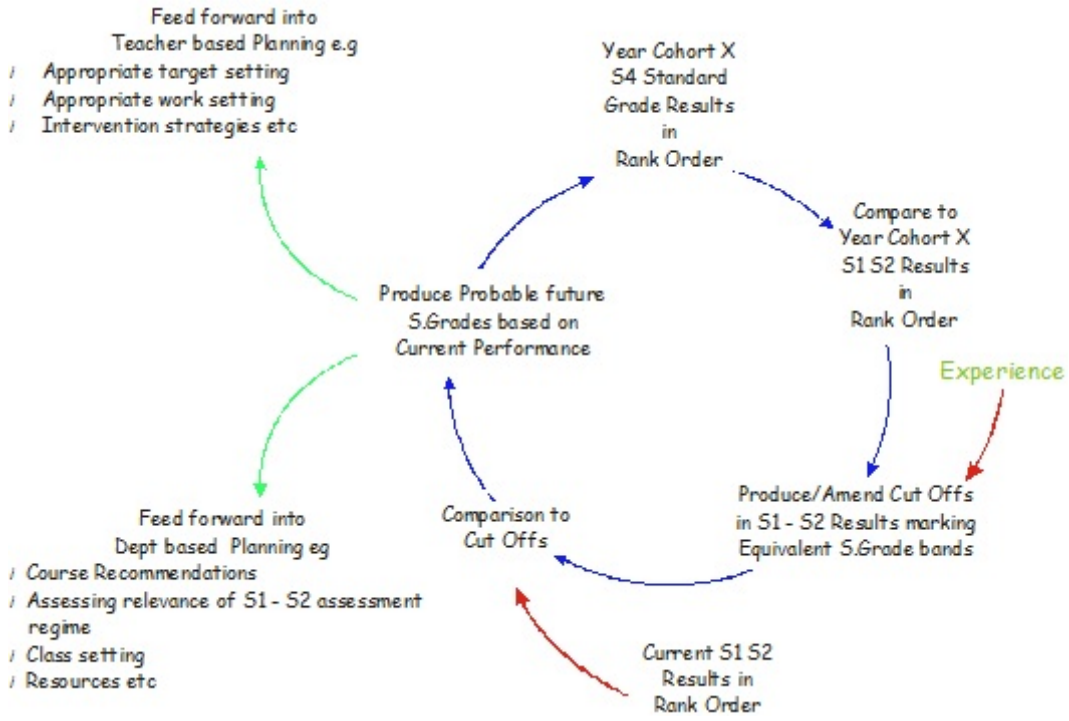
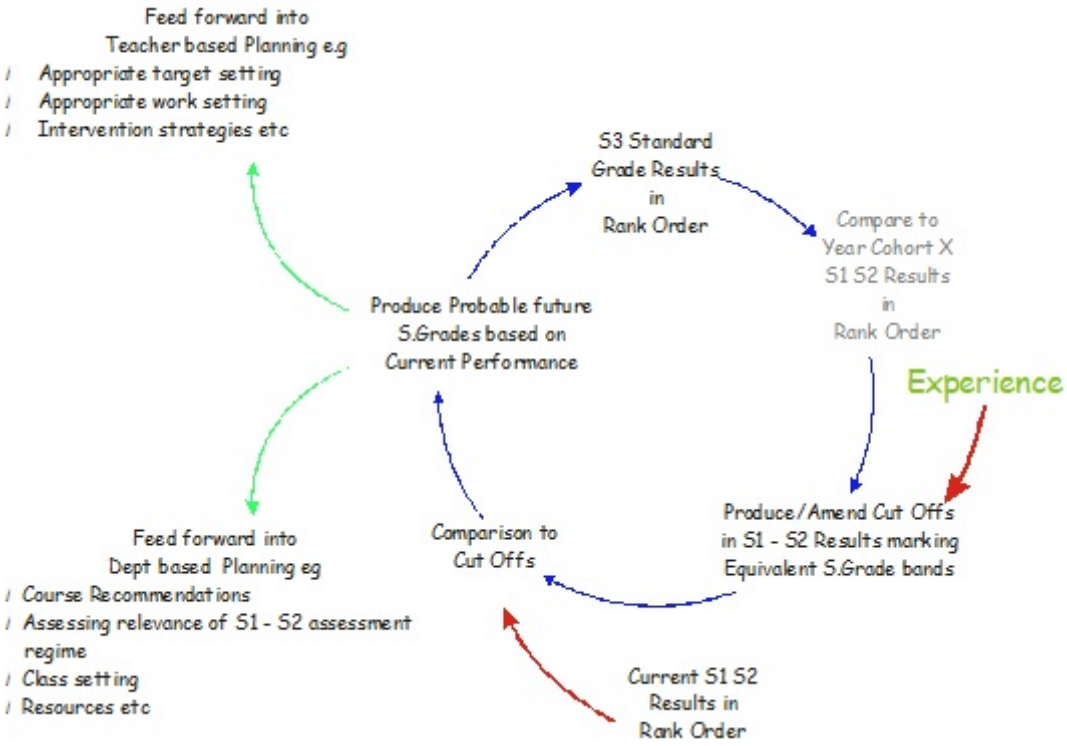


Figure 43 illustrates the heuristic method used by the Science department for producing the S2 Indicator Grade. The final Standard Grade results of the previous S4 cohort are listed in rank order. This list is compared to a rank ordered list of their aggregated results attained by the end of S2. From observation, the pattern of final Standard Grade bands are used to decide band *'cut offs'* in the S2 rank-ordered list. Historical data has shown that although the two lists don't match exactly, they correlate fairly well with exceptions (i.e. pupils performing better or worse than their predicted grade) explainable in terms of changes in effort or attitude which can in turn be understood through other changes in their lives, for example changes in peer group, family circumstances etc. Collective discussion between departmental members with knowledge of that year group can result in slight changes to the *'cut offs'* and these are overlain on a rank ordered list of the current S2 pupils to produce probable future grades, the results of which are used for teacher and departmental planning.

In contrast to the Science Department, most departments lacked a systematic method of relating S1 and S2 performance to Standard Grade outcomes. Consequently generating S2

Indicator Grades for the first cycle of the application was very much a rough and ready affair. The approach presented to staff as a possible method is shown in figure 44. Here the process begins with rank ordering the current grades of the S3 cohort. Without being able to rank order on their aggregated S2 result, collective departmental experience plays a much greater role in *'guesstimating'* possible *'cut offs'* which are then compared to a rank ordered list of S2 pupils. Combined knowledge of levels attainment between the two sets are used to produce an initial set of S2 indicator grades for the current S3, although the cycle for the retrospective fitting of S2 Indicator Grades from a current rank ordered list of S2 pupils may have to be repeated until the best fit is found. Once they begin to accumulate data as cohorts move through the system, departments can move towards the method described in figure 43.

Figure 44: Producing S2 Indicator Grades without historical data



Accordingly the decision to go *'live'* with the application in S3 and S4 had implications for how departments organised their assessment regime in S1 and S2. These tests had to provide some realistic indication of how well pupils could be expected to perform at

Standard Grade, and not as it subsequently transpired with the PT of Modern Languages, use easy tests in S1 and S2 to generate high S2 Indicated Grades as a way of motivating and encouraging pupils in S3 and S4. Despite these concerns, the introduction of the application went well. For the first time departments and the whole school could begin to anticipate levels of performance in the final exam and be able make suitable interventions identified as underachieving. Feedback from PT's and teachers was extremely positive and departments running non Standard Grade courses like Religious Education and Home Economics who delivered their courses as modules wanted to be involved. The only areas of concern as this time were first over the number of computers available for staff to access. This was resolved in the following year as more computers were brought in. And second, the issue of whether to manually sign reports. Some staff, strongly believed it was necessary to handwrite their signatures to retain an element of personalisation with the report. Although, this disrupted the automatic collation and printing process for the Office Admin Staff, it was agreed by the HT that each department would print their own reports, sign them, collate the reports into Register Groups and return them to the office for final assembly with the other departments. The amount of work discovered to be involved in this process after the production of the first set of reports soon persuaded staff to abandon handwriting as a way of personalising school reports.

The final area of concern involved the central flaw in the heuristic method used by the Science Department to generate S2 Indicator Grades. It is a method that is quick and works well provided the S2 assessment regime remains constant. Changing assessments and making them different to those sat by S4 pupils undermines the process of generating *'cut offs'* from final Standard Grade outcomes to which are later applied to a current cohort of S2 pupils taking different tests. And it's possible, as the PT of Modern Languages demonstrated, to manipulate the assessment regime wittingly or unwittingly to their advantage. In contrast to Modern Languages, a department could for example, set unduly high *'cut offs'*. This would have the effect of depressing the S2 Indicator Grades, which pupils could later easily exceed in the Standard Grade course allowing the department to claim credit for greater *'value added'* in their Standard Grade courses, i.e. the difference between the grades pupils start with and their final grade. Although a comparison between departments at whole school level in the levels of S2 Indicator Grades attained by the *same* pupils would tend to mitigate this (i.e. they would be much lower or higher compared to

other departments) the resolution to this manipulation issue is the subject of the next section.

5.6 Refining the Solution

The HT and the SMT had for some time been looking for an objective way to demonstrate to the Authority and the HMIE that the school actually performed quite well, despite appearing to do badly in league tables. They also had doubts about the quality, reliability and relevance of attainment information passed by Primary Schools. Most of this information concerned 5 - 14 attainment grades produced as a result of National Tests in Maths and English. In contrast to Standard Grade, these are expressed in letter grades A to F and contrary to Standard Grade where low numbers represent high attainment and high numbers low attainment, *'low'* letters (A, B, C) in 5 - 14 assessments show low attainment and *'high'* letters (D, E, F) show high attainment. Under 5 -14 guidelines Subject Departments other than Maths and English had to assume a starting 5 - 14 grade of C, but they found little value in using these grades as a gauge for measuring prior attainment. An obvious example was French, where Staff had to assume a starting level of C with pupils where their native English Grade was the same or lower. Even in parts of the 5 - 14 curriculum where Primary School teaching was supposed to articulate well with secondary courses, teachers at Burnview found the extent of prior learning inadequate for their courses. As a check, the Science department for example used confirmatory tests to determine the extent of pupils prior knowledge of topics *allegedly* covered at Primary School before building on this knowledge with *new* work. In every case *'re-work'* was necessary to correct mistaken concepts or forgotten concepts before the teaching the new topics could begin.

At the start of the 1999 - 2000 academic session, the SMT contracted into Nfer-Nelson's Cognitive Ability Testing (CAT) programme. The advantages of CAT are shown in figure 45. The cognitive ability tests provide a measure of reasoning ability in three dimensions which Nfer-Nelson argues are independent of prior teaching experience. The relative performance in each dimension Nfer-Nelson maintains, can be used to infer preferences for particular learning styles or identify particular learning difficulties. For example low Verbal test scores can indicate dyslexic type issues or perhaps English as a foreign language. Conversely, high Verbal scores show an aptitude for language and favour learning through discussion or reading.

The other advantage is that Nfer-Nelson on the basis of statistical comparison with large data sets, claim to have found a correlation between mean Standard Age Score (SAS) to final Standard Grade outcomes for a range of subjects. In other words, the same average score across the three tests can lead to different predicted outcomes across a range of subjects. Rather than express outcomes in deterministic terms, these forecast grades are presented on the grounds of probability, so that if a pupil works as expected they stand 80% probability of achieving their forecast grade. If they work hard, they stand 15% chance of achieving one grade higher or 5% probability of attaining a final grade, two grades higher than that forecast and visa versa.

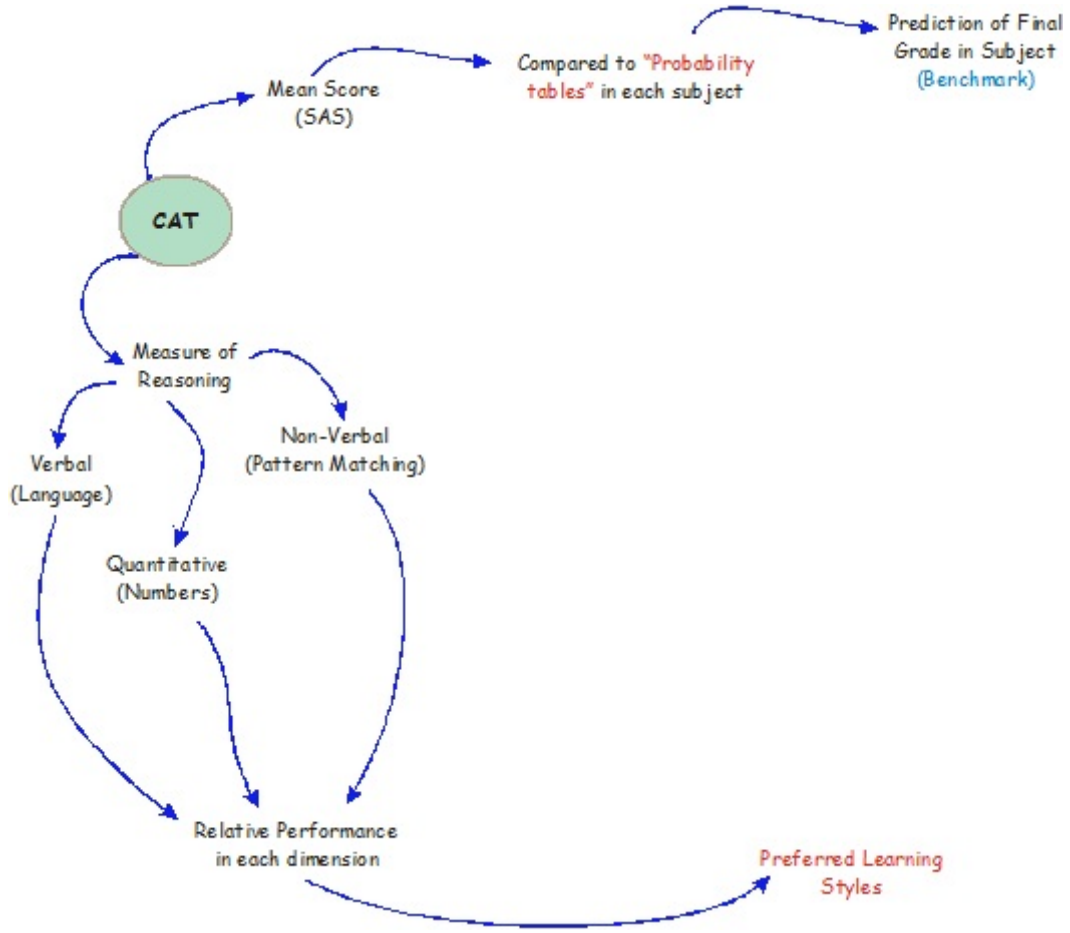
Based on the relative and independent *'objectivity'* of the tests, a decision was made to replace the S2 Indicated Grade with the CAT forecast grade being used to show the *'potentiality'* of the pupil. Within the MSC framework, getting pupils to exceed their CAT forecast grade becomes the tactical objective of teachers and exceeding the group CAT forecast grades is the strategic aim of departments.

Figure 46 shows how the CAT programme fits within the process used by teachers to monitor progress. In the application and continuing with the card index metaphor shown in the screen shots of the application in Appendix D, access to information provided by CAT is via another tab. This reveals the scores attained in each dimension of the CAT tests. Nfer-Nelson who mark the test papers provide the results in tabulated form and so in line with the design objectives of the application a text-based interpretation of the results are provided together with some written implications for teaching strategies. These are contingent upon the scores and vary for each pupil. A simplified graphical interpretation of the results is also shown. Again as with Learning Support information, teachers are only expected to consult the information if the disparity between teachers expectations and actual current pupil attainment generates an exception alert.

When the idea of CAT tests were introduced by the HT at the beginning of the session, many staff were initially sceptical about the tests and associated them with IQ tests.

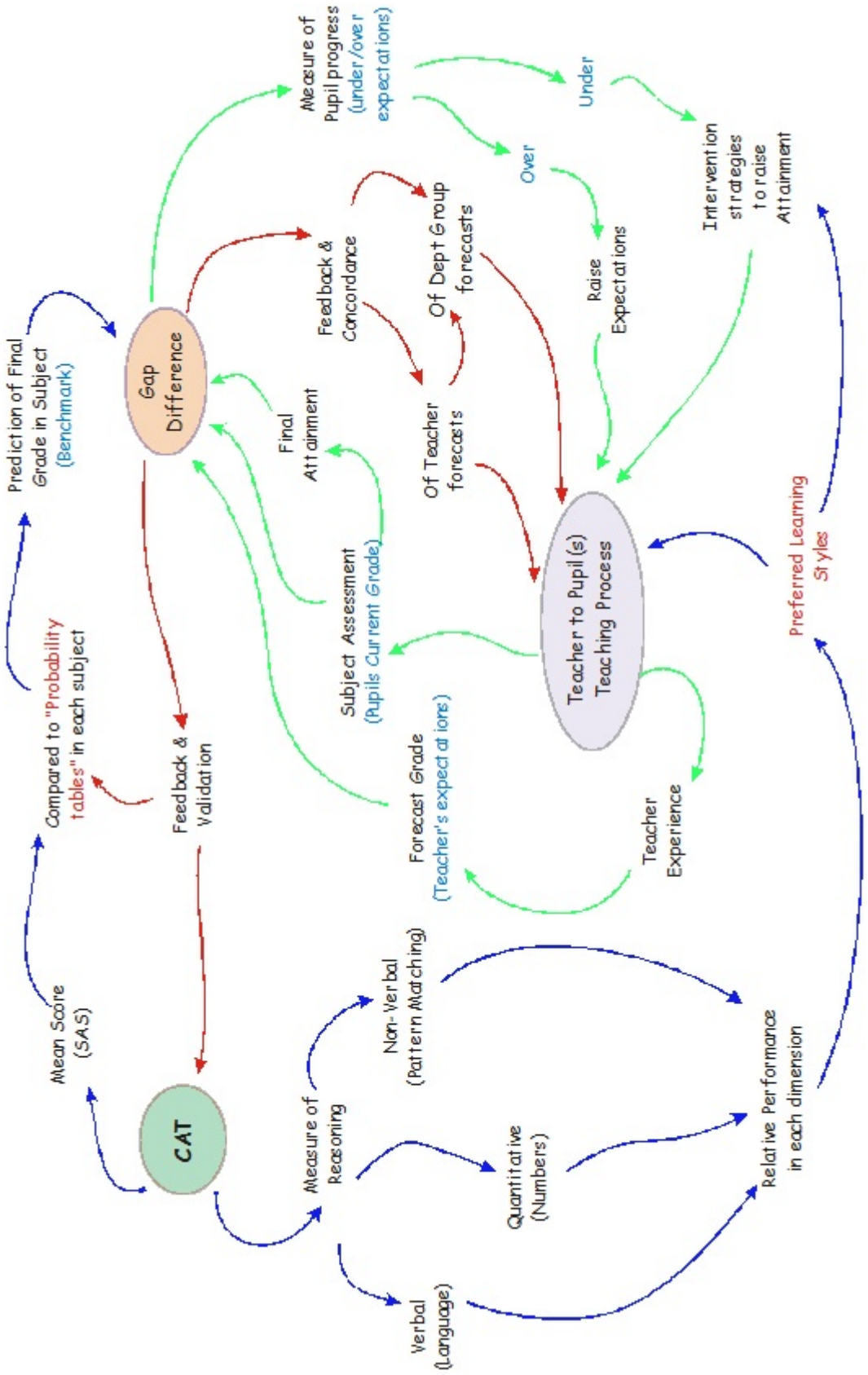
However, on the grounds that the tests were based on probable outcomes and would not be used to exclude pupils from subjects, the HT decided to proceed in order for staff to see if they produced useful information. An allowance to test outcomes is included in figure 46 through measurement of the relative difference between the collective final grades of pupils and those forecast, i.e. in the *'performance'* dimension of the MSC. A disproportionally large gap would indicate that forecast grades derived from CAT tests had little relationship to final Standard Grade outcomes and could cast doubt on the reliability of Nfer-Nelson's claims. Similarly, a close match between two could re-enforce Nfer-Nelson's claims with

Figure 45: The Logic underlying Cognitive Ability Testing (CAT)



regards to accuracy of the tests. It has been interesting to note that since its inclusion within the application, the difference between the two sets of data, has been within the range of 4% - 9%, with the final Standard Grade outcomes consistently exceeding those forecast by CAT tests.

Figure 46: Integrating CAT into Pupil Assessment



Substituting S2 Indicator Grades with independently generated CAT forecast benchmark grades, breaks the dependency on the assessment regime in S1 and S2 and introduces an element of *'objectivity'* into *'value added'* claims, where final outcome grades exceed those forecast by cognitive ability testing. In the application, the *'cut off'* tables against which each pupils mean SAS are compared to generate each pupil's CAT grade for the subject are contained within each subject profile. These form part of Departmental expectations -see figure 42, page 242 - and represent levels of performance attained in CAT tests equivalent to final Standard Grade outcomes. In terms of normative planning, the *'cut off'* tables are the point where departments can alter the setting of *'potentiality*', i.e. by lowering the cut off points in the mean SAS, departments can increase the proportion of pupils expected to achieve high Standard Grade outcomes. This increases the challenge for departments where the strategic aim is to exceed benchmark grades and over time shows how departments can gradually improve. However, because of the way the HMIE assess schools and their refusal to consider ways of measuring attainment other than those described by league tables, there wasn't an opportunity to see this reflected in actual practice.

The first series of CAT tests were completed with the *'new'* S1 in September 1999 and the SMT agreed with Nfer-Nelson to conduct a second series of CAT tests with S2 in March 2000 with the results expected in time for their Standard Grade option choices. Overall, staff were considerably surprised to see how well the results conformed to their own understanding of each pupils abilities and it's a programme of testing that the school has since maintained. However it wasn't until the academic session 2000 - 2001 before the first set of pupils with CAT results (S2 pupils tested March 2000) entered S3/S4, that teachers could begin to see CAT derived grades begin to be reflected in actual Standard Grade assessments.

5.7 Intervention Two: S1-S2

Based on the successful implementation for S3 and S4, the SMT wanted to extend the application to cover S1 and S2, incorporating the refinements discussed in the last section. In April 2000 another questionnaire was passed for completion to PT's requesting full details of courses and assessments run in S1 and S2. As well as helping to define the scope of the additional related tables within the database application, this data was used to provide

an initial starter set of data within each subject profile. And as with S3 and S4, PT's were asked to provide outlines for preferred layouts for group summaries and reports. Significantly, they were also asked to provide *'cut off'* scores for each assessment.

The process of overcoming *'fragmented learning'* had begun in the earlier intervention with the requirement to generate S2 Indicated Grades for entry into S3. For many departments this required the collection and collation of data into one place for the first time. The questionnaire now gave this process added impetus, requiring departments to consider standardised assessment regimes common to all teachers in the course, whereas previously, teachers in some departments used different methods for assessing pupils for the same topics in the course. The requirement to supply *'cut off'* scores for each assessment was designed to address the issue of *'superstitious learning'* and creating standard expectations.

Results from the questionnaire revealed the diversity of approaches used by departments in S1 and S2 to assess pupils. Most departments assessed pupils on a number scale, either recording pupil results as raw numbers or as percentages. English and Maths though, graded pupils according to letter grades on the 5 - 14 scale. Each approach had different consequences for organisational learning and methods of generating equivalent Standard Grades for use in monitoring and tacking pupil performance using the relative difference methodology described in figure 41 (page 228).

5.7.1 Departments using a number scales

These departments lacked carefully constructed National Tests against which they could compare the performance of pupils. Instead they had to develop their own and even in the few cases where they were seen to be applied uniformly within a department led to issues related to consistency and standards. Some of these issues could be seen in the way results of assessments were reported to parents.

Within the manual system at the time, reports to parents listed the topics studied during the session. Teachers would provide a band performance score (1 - 4) for each assessed element in each topic, with 1 representing the best outcome and 4 the worst. But without a common assessment regime, the band allocated to each pupil was open to chance and could be

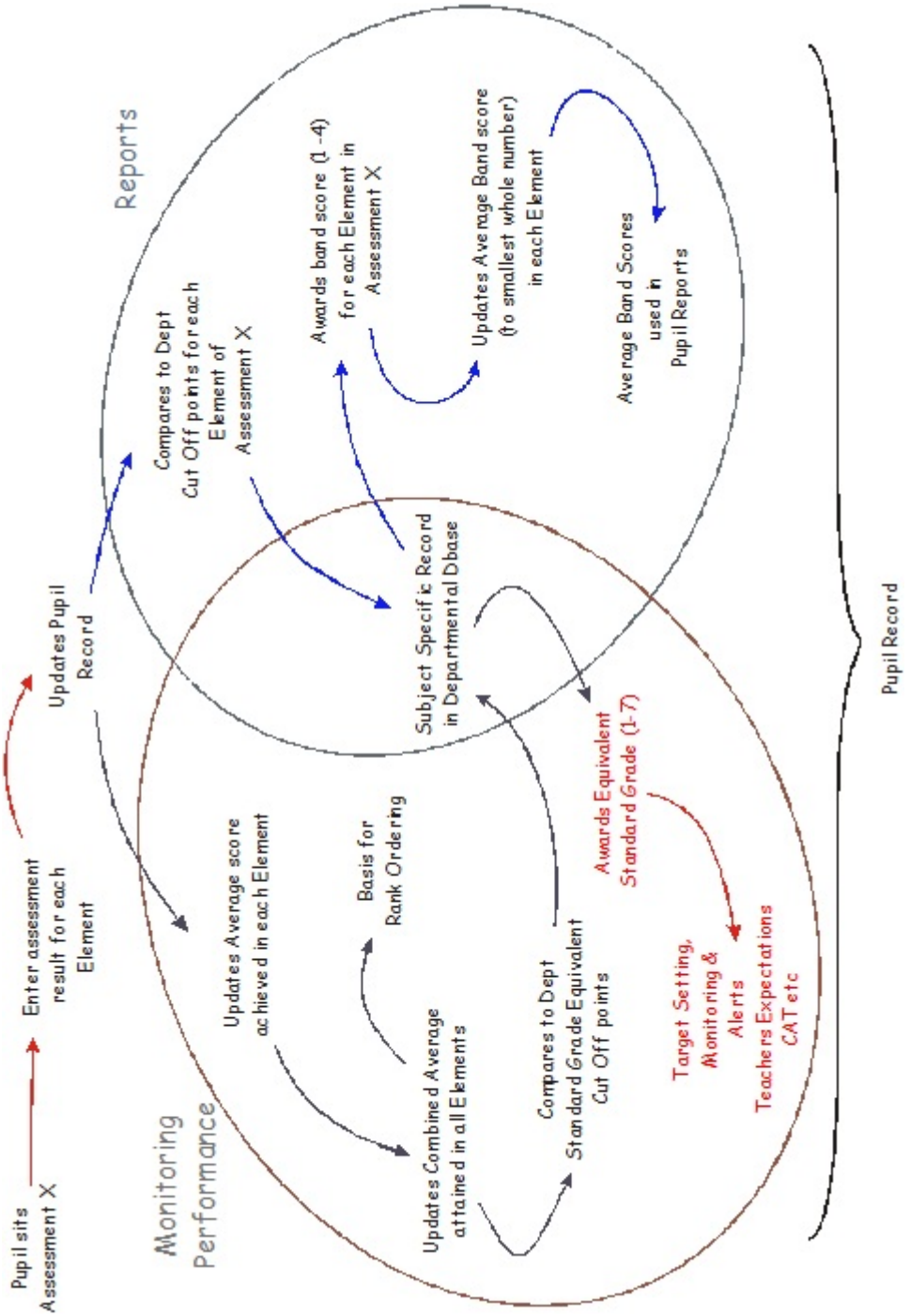
coloured by other factors like behaviour and attitude which were reported separately. Even where teachers systematically reflected on results, judgements about pupil progress depended on how difficult the teacher considered the assessment. For example, a test where lots of pupils passed with high scores might be considered easy. In such instances, individual teachers might raise the threshold in order to reduce the number of 1's being awarded. However, it could also be the case, that the topic was well-taught resulting in all pupils doing well. Conversely, a test that resulted in lots of low scores might be considered difficult and induce the teacher to lower the threshold for each band. But it could be possible that the test instrument was constructed badly, using language with which pupils were unfamiliar or that the topic was taught badly. Thus, the request for common *'cut off'* scores was a call for the collective consideration in departments of the difficulty of each test and the level of performance expected to merit a corresponding band score. In this way, the *'cut offs'* contained with the subject profile represent one way to align staff expectations and embody departmental expectations as a whole.

Another way of aligning a common understanding and meaning of pupil performance between staff in order to overcome *'superstitious learning'*, is to express pupil performance with reference to a common scale. Outlined in figure 43 (page 244) this is essentially the same process used by Nfer-Nelson to generate Standard Grades from CAT results and by the Science department to produce S2 Indicator Grade. Here, each pupil's performance is compared to others who attained the same result and later went on to achieve known outcomes on an independent scale. Relating the two sets of results together, the performance of S1 and S2 pupils can be *'calibrated'* to the Standard Grade scale, but in the application rather just use the process for producing the S2 Indicator Grade, the intention is to use it to express each pupil's ongoing performance (i.e. *'actuality'*) in Standard Grade terms. The translation from one form to another is handled by another set of *'cut offs'* produced through rank ordering and comparison to historical data. Or where this is lacking, using a greater degree professional judgement to define the limits where in the collective view of the department, a particular level of performance in S1 and S2 merits a corresponding grade in Standard Grade terms.

Figure 47 illustrates the process of how in the application, ongoing pupils performance in S1/S2 assessments are expressed in Standard Grade format, i.e. in relation to a known

standard. It also shows the relationship between the different ways in which the same result is used to report pupils progress to parents in one format in a consistent and fair manner and for monitoring their progress in another. The standardised output (i.e. *'actuality'*) is then used for comparison to the CAT forecast grade (i.e. *'potentiality'*) and the teacher's

Figure 47: Process of producing standardised results from number data



expected grade (i.e. *'capability')* in the ways described in previous sections.

Expressing S1/S2 attainment in Standard Grade terms was a new innovation and mediated through the *'cut off'* tables, teachers and departments could for the first time begin to understand how performance in one course articulated with performance in Standard Grade. Expressing teacher's expectations or the pupils target grade within the S1/S2 course in Standard Grade terms was another new innovation and it might be thought that this would have presented a barrier to implementation. However, early interviews with staff revealed that they implicitly made judgements about S1/S2 pupils with reference to Standard Grade and was not an issue in implementation. Again, as with S3/S4, teachers could also for the first time see how pupil's performance varied across subjects both in relation to other teachers expectations and their CAT predicted grade.

5.7.2 Departments using letter grades

The alignment of expectations within Maths and English was to some extent easier to achieve. Parental reports only included 5 - 14 letter grades achieved by the pupil in National Tests. Teachers therefore had a good and shared understanding of competencies pupils had to demonstrate in order to merit a particular letter grade. However, there remained systemic difficulties with this method of assessment. The first related to the issue of distinguishing between pupils at the same attainment level. A few pupils would reach level F by the end of S2, but most (70% - 80%) would be at level E. Of these, some would only just pass the level test, while others pass it easily, but with all recorded at the same level it was difficult for independent observers to know who was who. One result is that in class, without information from other sources, teachers would be unable to address teaching responses appropriate to difficulties experienced by the pupil in the test. It also made planning for the future difficult, especially for class setting in S3, with more pupils at a particular level that could accommodated within a class. Also related to planning was the issue of how 5 - 14 connected to Standard Grade.

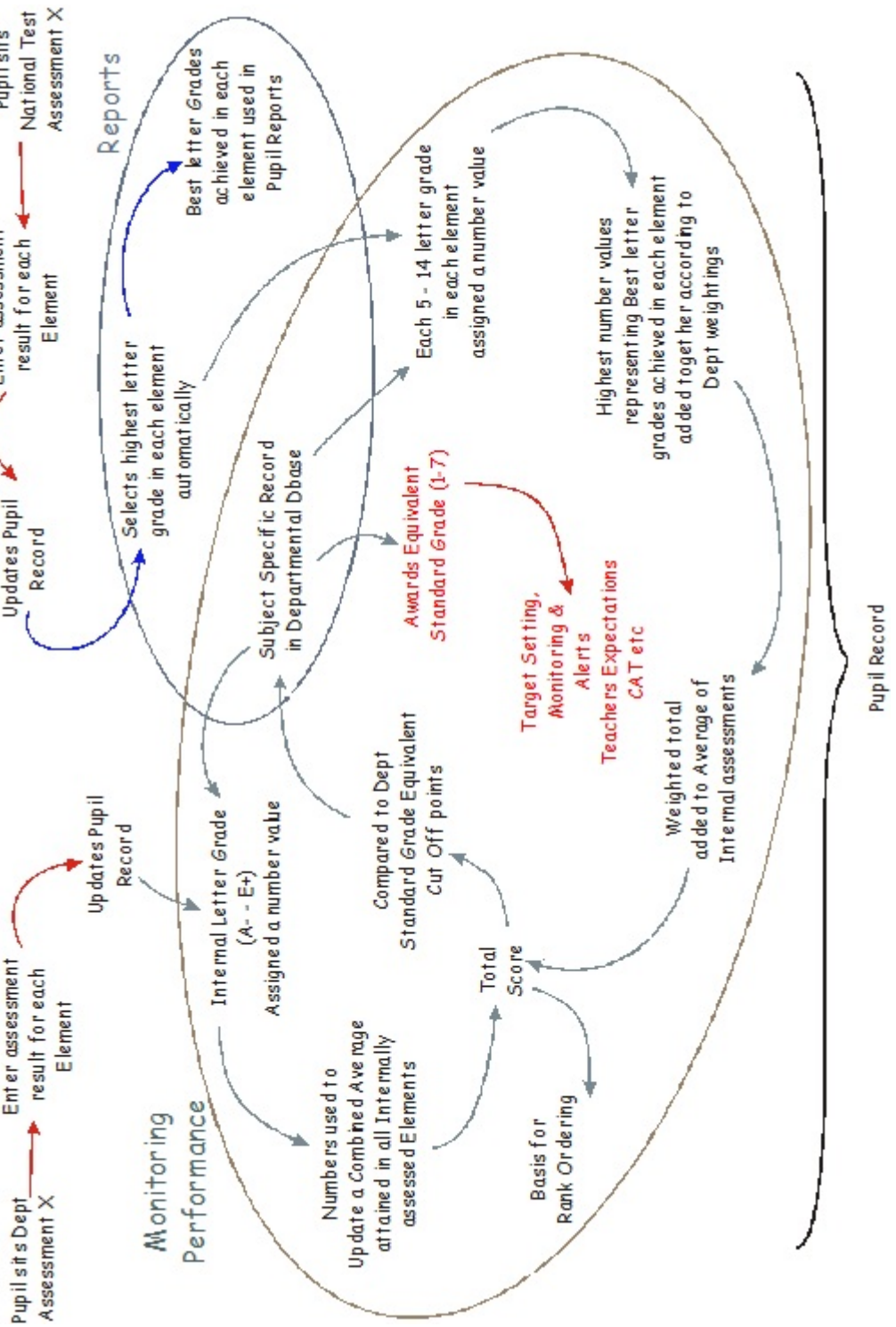
Although 5 - 14 courses and associated National Tests wasn't constructed with a view to making predictions of performance at Standard Grade, it appears logical to assume that demonstration of high degrees of competence in 5 - 14 assessments would translate into

good passes at Standard Grade and visa versa. However research by Ron Mitchell, the Education Officer of the Inverclyde Education Authority, had shown that there was no correlation between 5 - 14 attainment levels and final Standard Grade outcomes. This research was supported by experience at Burnview and consequently 5 - 14 attainment grades was a flawed basis for making planning decisions for pupils as they progressed into S3.

The inability to adequately distinguish between pupils in 5 - 14 levels and the discontinuity between 5 - 14 courses and Standard Grade, show that in the Maths and English departments, teachers were attempting to make decisions based on unreliable measurements. For Espejo et al (1996) this demonstrates a form of *'ambiguous learning'*. Additionally, National Tests were only conducted once or at the most twice a year resulting in further discontinuities between identifying a difficulty and taking action. At one level the Maths and English PT's had recognised the issues associated with these forms of *'ambiguous learning'* and attempted two strategies. One involved an attempt to synchronise the identification of difficulties with teacher action and this resulted in the development of their own internal assessment regime. In subsequent interviews both PT's claimed to prefer the results of internal assessments to National Test results as the basis for planning decisions. However, this was a claim that wasn't supported by actual practice. Because of the obligation of the school to report on National Test results, these were the only grades that were centrally collected and collated. The internal test results remained *'private'* with each class teacher and so the more detailed knowledge remained *'fragmented'*. Second, in an effort to distinguish between pupils, + or - symbols were appended to each letter grade to produce three levels of performance, for example a pupil at level D, could be at grades D-, D or D+. Although, an approach adopted in many schools, it remains one open to a degree of ambiguity. For example D-, could be interpreted as *'performing just below level D'* or as *'just attained level D'*. Similarly D+ can be interpreted as *'performing well above level D'* or *'performing just below level E'*. It is also an approach that fails to connect assessment in 5 - 14 letter grades with Standard Grade outcomes, where with numbers it is easy to amalgamate the attainment in each element into an overall single grade. In contrast producing an overall grade from letter grades spanning a number of levels across four elements and where some elements according to PT's are more important than others is

problematic.

Figure 48: Process of producing standardised grades using letter grades



The resolution to these issues are shown in figure 48. Letter grades, whether derived from National Tests or internal assessments entered into are the application are assigned a number value. These number values are entered by the department into the subject specific profile and reflect the significance attributed by the department to each letter grade. The numbers from internal assessments are combined with a weighted average produced from the best grades achieved in the National Tests to produce a total score. The weighting given to the National Tests results represent in the collective view of the department, the relevance of each element of the National Test results to Standard Grade outcomes. The total score, which is also used as the basis for rank ordering, is compared to the *'cut offs'* in the subject record to produce an equivalent Standard Grade that reflects the pupil's performance both as a result of internal assessments and National Tests. The significance of this process in that for the first time, departments assessing pupils in letter grades could begin to distinguish between pupils attaining similar letter grades and examine the relevance of their courses to Standard Grade outcomes on a fair and equitable basis. And as described in the previous section, the Standard Grade result is used to make comparisons to the CAT grade and teacher's expectations following the relative difference method referred to earlier.

5.7.3 Implementing the S1/S2 Extension

In September of the academic session 2000 - 2001, the extension incorporating CAT predicted grades and translating S1 and S2 assessment results into Standard Grade format, was introduced to PT's. An agreement was reached to *'roll out'* the extension in the following month, during which time staff would begin to populate the S1 and S2 records with assessment data. Each department would be given separate demonstrations and support to help with the generation of preliminary *'cut off'* tables which could be subsequently refined as new assessment data arrived from the ongoing assessments in S2. It was also agreed that all parental reports and intermediate reports would be produced through the system.

Undoubtedly, teachers prior and ongoing experience with S3/S4 together with familiarity with the relative difference method helped ease its introduction. Another factor helping its implementation was the application's conformation to existing practices and recording of data together with its facility for handling mixed data types. *'Click & Go'* by contrast could

only handle letter grades and the date on which each pupils sat their National Test. Consequently, it couldn't discriminate between pupils of the same grade and left the date or the speed of progression as the only point which could be tracked. However, in making judgements about speed of progression requires comparison to an idealised progression which assumes an increase in grade each year from P1. Unfortunately, this isn't reflected in teachers experience who see pupils progress in fits and starts.

By the end of December, all teacher's had gained some experience with the extension and the use of CAT data. Teachers who had used the cross subject graphical summary of pupil performance with pupils were extremely positive about the application. Pupils, they reported, could easily understand the global representation of their results and described how the display could be used to: -

- Identify and acknowledge attainment, even amongst pupils of low ability. Earlier research had shown that teachers had tended to associate hard work and high attainment with pupils achieving high grades. However, the performance index of pupils or the difference between their CAT forecast grade and their current grade proved a more reliable and consistent indicator of attainment. For example, Pupil A with a CAT forecast of grade 3, but achieving a current grade in *'actuality'* of a grade 2 and be expected by their teacher to have the *'capability'* of a grade 1 might be judged as showing high attainment. Pupil B on the other hand could have a CAT forecast grade of 6 and be meeting their teachers expectations by achieving grade 4 in assessments. A comparison in the performance index of +1 with Pupil A and +2 with Pupil B reveals that Pupil B has shown a higher degree of achievement than Pupil A, even though B has moved from Foundation Grade to a General Grade while A is now working at Credit level.
- Challenge under achievement within and across subjects where pupils perform below their CAT forecast grade and teacher expectations. One approach adopted by pupils who have a particular dislike for a subject is to claim an inability to understand and complete class work. Providing they persist in refusing to acknowledge the teachers belief in their abilities, they can often succeed in doing less work while attaining grades below their true potential. Although it's a work avoidance strategy that can be adopted in any subject, it's commonly used in Modern Languages, where both pupils and parents may

have little regard for foreign languages. Presenting pupils with the results of an independent test that shows they are capable of achieving more was proving an effective way of defeating this strategy and made even more powerful if the global view showed them performing at higher levels of attainment in other subjects and supported by other teachers expectations.

- Identify early weaknesses and strengths in learning style preferences through systemic access to the details of each pupil's CAT results. On occasion, the underlying mean SAS score used to generate the CAT forecast grade can be derived from results occupying the polar extremes in each of the three measured dimensions of the CAT test. In such cases, some pupils have proved very adept at developing strategies that mask areas of weaknesses, like dyslexia or dyscalculia, and which because of their strengths have previously gone undetected at Primary level. These problems have often been first identified at subject level where alerts have been generated through the difference between the CAT forecast grade and the pupils attained grade. Confirmed by subsequent independent tests conducted by learning support, teachers have been able to follow alternative teaching strategies to assist them in their learning, for example paired reading.

As with S3/S4 there was a noticeable drop in *'round robins'* from Guidance, and by March 2001 all staff were using the application to advise S2 pupils with respect to their Standard Grade choices and prospects. In terms of the applications impact on planning, results were mixed. At Recursion 0, the level of the teacher it was very successful. The exception reports signalled by alerts enabled teachers to monitor and track through System Three★ and coordinate their actions with teachers in other subjects and learning support via System Two links. Depending on the results, teachers were modifying their teaching strategies with regards to particular individuals. At departmental level, Recursion 1, there was considerable success in aligning expectations. Departments had all developed a common assessment regime and staff had a shared understanding of standards of performance required to merit a particular grade. The collection of all data in one place had overcome the difficulties associated with *'fragmented learning'* and with expectations, mediated via *'cut off'* tables applied uniformly and consistently to all pupils, departments had largely overcome issues of *'superstitious learning'*. Joint reflection on the results grounded in what was happening in the classroom enabled staff to surface hidden assumptions and resolve difficulties related to *'ambiguous learning'*. For example on one occasion, all staff within the Science

Department had become convinced that a new cohort of S1 pupils were of lower ability than the previous S1, now S2 cohort. A comparison between the two sets of results however, revealed there was no difference in terms of ability and what was happening was that staff were allowing changes in behaviour to affect their expectations of academic attainment. The application therefore, allowed departments to answer the questions of *"How we are doing?"* and *"How do we know?"* but there was difficulty in applying the learning to *"What are going to do now?"*. In terms of operational planning, the application was used extensively for supporting decisions concerning areas related to class setting, sizes, composition and resource planning etc. There was also an observable impact on strategic planning, as departments considered articulation with Standard Grade courses and developed new materials and topics to ensure that expectations and pupil performance remained above CAT forecast levels of performance. However, there was little impact on normative planning. In part, this was because departments and the school were compelled to make plans in response to National and Local Authority priorities which were not necessarily reflected in the department's or school's actual needs. Also, departments and the school had to plan using formats and evidence recognised by the HMIE and to date, while recognising the power of the application, the HMIE have continued to refuse to acknowledge the relative difference method and *'value added'* measures as a appropriate ways of measuring departmental and school achievement. Consequently, the SMT at Recursion 2 have used a *'light touch'* in making PT's accountable for departmental expectations and performance, even where System Three★ audits have revealed a few departments which expect pupils to perform worse in the future than levels of performance being attained by pupils in current *'actuality'*. Thus the approach used by teachers to make pupils accountable for their performance at Recursion 0, and to some extent teachers made accountable for classes within departments at Recursion 1, are not being reflected with respect to departments by the SMT at Recursion 2.

5.8 Intervention Three: S5 - S6

Before the introduction of Intermediate courses, admission onto Higher courses was broadly controlled by the heuristic rule of requiring a Standard Grade Point Average (SGPA) of 3. Pupils below with an SGPA below 3 tended to be directed towards SQA SCOTVEC National Certificate Courses or Modules. But the introduction of Intermediate courses saw this rule more or less broken by the blurring of boundaries between courses, where within

the Scottish Credit and Qualification Framework (SCQF) pupils could gain the same number of credit points at the top of one course, for example Intermediate 2, as another who attained a bottom grade in the Higher course. At Burnview, without general guides to determine admission onto courses, too many pupils were being enrolled into courses at inappropriate levels. This could be seen in the high failure rate of some courses, particularly at Higher level with pupils failing at the final exam stage or course assessments requiring them to be re-registered in a lower course. Generally teachers believed that pupils could achieve much better outcomes if they received better advice and made the correct decisions at the initial choice stage.

The successful implementation of the database application, now covering years S1 to S4, combined with recognition of the problem led the SMT to request a new extension to cover the years S5 - S6. Work began on the new addition in May 2001 for implementation in the 2002 - 2003 academic session. The initial task was to find a replacement for the CAT based grade as an indicator of future *'potentiality'*.

STACs data prepared by ScotXed, a branch of the Scottish Executive Education Department, provided an analysis of historical exam results that drew a relationship between SGPA and final outcomes at the various levels of exam presentation i.e Higher, Intermediate 2 etc. From the regression curves of each subject, based on the attainment of all pupils in the subject across Scotland, a series of subject specific *'cut off'* tables were prepared, relating SGPA to each pass band across four levels of presentation - Advanced Higher, Higher, Intermediate 2 and 1. Like the process used by Nfer-Nelson to produce CAT grades, these tables formed the basis of generating *'potential'* grades of future attainment in each subject.

For each pupil, the application would calculate their SGPA from their current Standard Grade results and compare it to each subject's *'cut off'* table, to produce a forecast band pass on a 15 point scale spanning all four levels of presentation across all the subjects with courses in the school. Although, reports could be generated at any time from S3 onwards, the intention was to generate the reports in S4 at their S5 option choice interviews using their prelim results as the basis for their *'potential'* grades - see Appendix D for an example. Together, the interviewing teacher (Guidance Staff or Year Head) and the pupil could

consider the results and make more informed decisions as to where their best prospects lay, both in terms of subjects and levels of study. Emphasis was given to the fact that the results were based upon the band pass attained nationally by pupils with the same SGPA. It was possible as the STACs charts demonstrated, to achieve passes higher - or lower - than the national average for the given SGPA, but it becomes increasingly difficult to attain passes more than three bands higher than the forecast grade. This allows pupils to consider the element of risk involved in choosing particular presentation levels and the teacher to emphasise the degree of effort required to reach desired outcomes. For example, someone forecast to attain a band 3 pass (Upper B) at Intermediate 2, would be extremely unlikely to achieve anything higher than a band 5 or Upper C pass at Higher Level. Choosing to study the subject at Higher level with the knowledge that a great deal of effort would be required to beat the national average would therefore, be high risk strategy and the pupil would be better off to sit at Intermediate 2 with the reasonable chance of achieving band 1 or an Upper A grade together with a good margin of safety if they failed to perform as forecast.

Following enrollment into their chosen courses in S5 or S6, their SGPA is compared to the *'cut off'* tables containing values derived from the regression curves in the STACs data to generate the *'potential'* forecast bands appropriate to the level of study i.e Higher, Intermediate 2 etc. As with S1 - S4, Staff enter their expectations of *'capability'* and the pupils current level of attainment or *'actuality'* is generated from their National Assessment and prelim performance. Consistent with earlier implementations, the three measures are combined in same way to enable different views and triangulation on pupil, departmental and whole school performance.

Again, in contrast to *'Click & Go'*, the extension to the database application enables pupils to consider the consequences of their choices with possible outcomes based or grounded in their own performance data. Whereas *'Click & Go'* only registers passes of units in post 16 courses, the new extension with its ability to maintain a running band pass based on assessments, allows teachers to see the effect of their own teaching and monitor pupil performance both in relation to their expectations and forecast *'potential'*.

The new extension was *'rolled out'* with no formal introduction to staff in March 2003. Initially, the application was used instead of a paper based method, to capture and collate the

unit passes of each S5/S6 pupil for registration with the SQA via *'Click & Go'*. Their final exam results published at start of the 2003 - 2004 academic session were compared to the predictions generated from their SGPA and overall, the results confirmed that pupils were being presented at too high a level. The results also indicated that had they followed guidelines indicated retrospectively by their SGPA, pupils would have achieved passes or better outcomes than those they actually achieved. Although introduced and validated too late for S5/S6 option choices for 2003 - 2004 session, tabulated reports detailing all pupils possible prospects in the various levels have been released to departments from 2003 - 2004 session onwards. Additionally and starting for the first time at the end of 2003 - 2004 session, interviewing staff have used the individual reports to help guide option choices for the following session. However, the ongoing results have shown that pupil attainment still remains an issue with pupils continuing to underachieve both in respect to their teachers expectations and their *'potential'* forecast grade.

5.9 Summary

The chapter began by describing some of the difficulties associated with individual and organisational learning at various levels within the school. Most of these difficulties arose from the way information was handled within the school. In the main, assumptions made about pupils remained unspoken and assessment information kept *'private'* within the marks books of class teachers. The fragmented and uneven nature of this knowledge represented information that was generally inaccessible to others or *'lost'* to the organisation, leading to *'fragmented learning'*. Being unable to access this information often meant that action proceeded at all levels either on the basis of what people thought was happening - *'superstitious learning'* or from using different measures - *'ambiguous learning'*. At some level, teachers and the SMT recognised the problems and a great deal of time was spent attempting to re-gather and make sense of this information: teachers seeking out information in conversation with other teachers and the SMT and Guidance repeatedly sending out requests for information and adding to the bureaucracy of the organisation.

It was suggested that the development of a shared information resource, whereby information entered remotely would update pupil records in realtime and be accessible to all was a possible solution. As a starting point a theory was developed of how teachers made

judgements in relation to pupil attainment. Rather than make them about pupils in isolation, teachers internally make a comparison between their own estimated grade of each pupils ability to the grade or mark attained by them in assessments. From the teachers perspective, the estimated grade is a complex amalgam condensed from existing knowledge of the pupil gained in the teaching learning cycle, experience of teaching similar pupils in the past and knowledge of work to be completed in the future. Depending on the difference between the two, teachers either raise their expectations or make changes to their teaching in order to raise pupils attainment. Although the model shows how suitably high expectations can lead to improved attainment, it also reveals how low expectations can lead to poorer performance or how poor performance rather than lead to interventions to raise attainment leads to lower teacher expectations. Implicitly the vulnerability of the teachers process of making judgments about pupil attainment and progress, to the development of self reenforcing *'vicious'* cycles suggests a third measure against which pupil performance and teachers expectations can be compared.

The roots to the issues associated with *'fragmented', 'superstitious'* and *'ambiguous learning'* were traced to systemic deficiencies in organisational relationships. Essentially, the problems were located in the inability of the System 3's at each level of recursion to *'measure'* what was happening within their areas of concern i.e their System 1's. The problem was further compounded by inadequate and time consuming monitoring systems (System 3 star) and particularly the inability of teachers to coordinate their actions with one another (System 2). The aim therefore, was to restore requisite variety to each of these systems. This capability was to be grounded in what was happening in the classroom, so that planning and action based on the measures, was seen to be reflected in changes in attainment outcomes.

The theory about how teachers ascribe meaning to the relative difference between their expectations and actual performance was discussed in relation to Beer's (1981), ideas about measurement. It was shown how the third measure of *'potentiality'* with the strategic aim of exceeding this value could help guard against the development of self reenforcing *'vicious'* circles. Combined with *'capability'* or teacher's expectations and *'actuality'* or the pupils current grade, the three measures provide a method of *'triangulating'* on each pupils abilities; bringing together an historical view of something achieved in the past with

estimations of future possibilities and what pupils are attaining in the present. Each measure was shown in correspondence to the three logical levels of management in the Model of Systemic Control (MSC) (Schwaninger, 2000), and it was proposed that managing the indices or difference between them was the objective of each level of management. For example, operational management is focussed on raising *'actuality'* to *'capability'* levels, strategic management focussed on raising *'capability'* to levels of *'potentiality'* and normative management focussed on performance or raising *'actuality'* to levels of *'potentiality'*. According to the VSM framework, the MSC exists at each level of recursion and it was shown how the results from the relative difference method could be aggregated and interpreted at different levels. First at the level of the teacher with individuals and classes, then at departmental level and finally at whole school level where the measures and indices represent the collective view of pupils *'potentialities'*, *'capabilities'* and *'actualities'*. The common systemic framework, it was suggested, helps integrate planning throughout the organisation, with each level of recursion managing its planning objectives at its own level of resolution. In accordance with VSM theory, these planning objectives it should be emphasised, are not imposed from above but emerge from data generated from below or within their own areas of concern i.e their corresponding System 1's. It should also be emphasised that while the framework outlines what has to be managed, it doesn't prescribe how it should be done. Different departments for example, may see different underlying causes to pupils actual attainment and therefore may develop different operational plans to raise their current attainment levels to levels expected by teachers.

As well as providing the framework and structure to the proposed application, it was also shown how the principles of variety engineering underlying the VSM were used to develop a series of design objectives. Essentially, these were focussed on encouraging early adoption by:

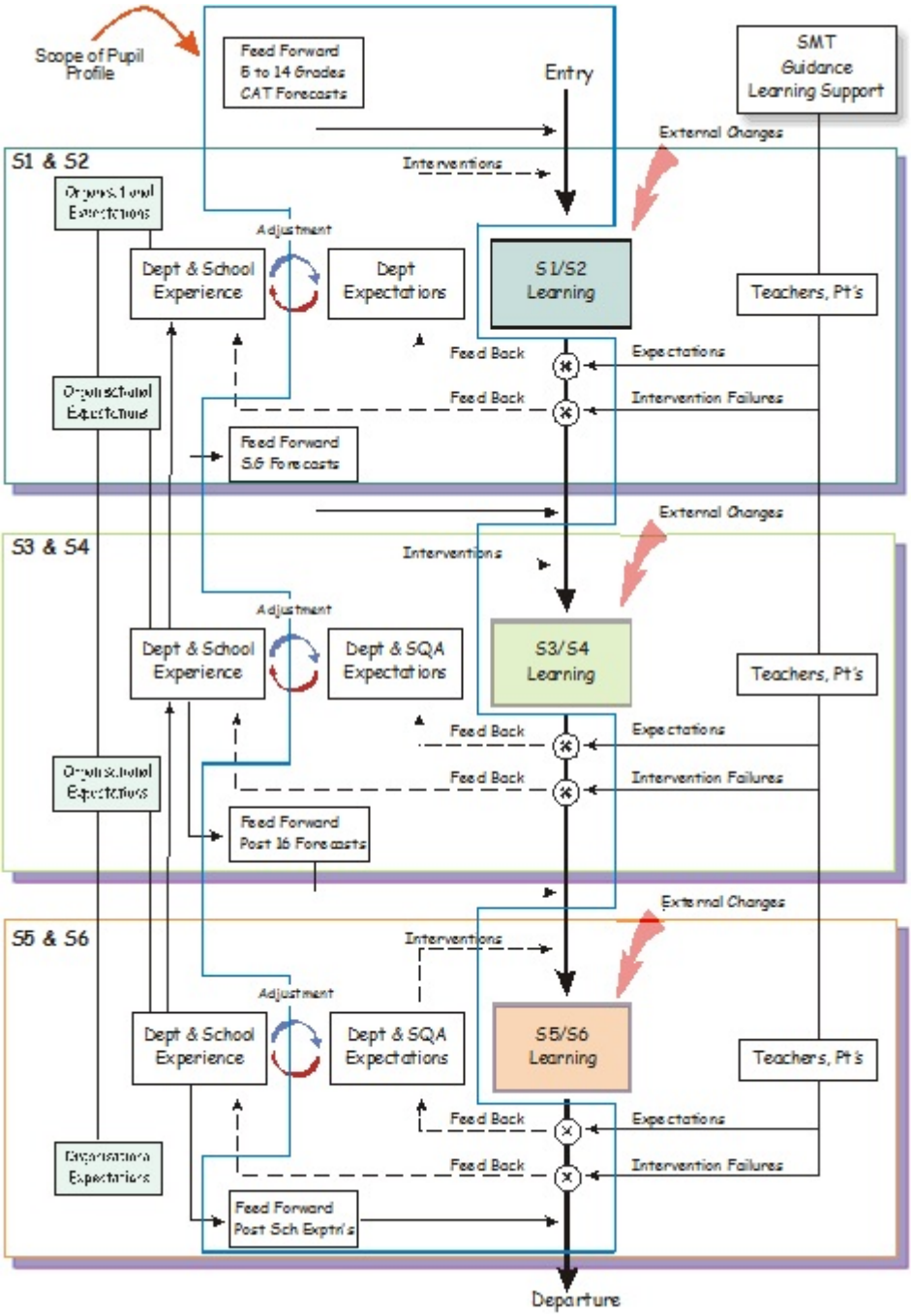
- minimising the discontinuity between existing working practices and the way teachers entered and recorded data on the grounds that moving from a private manual system to a shared computer based system was a sufficient challenge in itself.
- fitting the application to *'real'* world needs as it was recognised that teachers and PT's of each department were in the best positions to judge their informational needs.
- using existing language familiar to each recursion level and the school to express

functions and options.

- accounting for differences in methods of understanding by presenting the same information in range of different formats i.e number, text and graphical formats.
- avoiding mathematical complexity to minimise the distance between raw data and final result.
- absorbing as much environmental complexity as possible, for example relieving from the teacher, the burden of calculation of overall grades.
- using exception reporting generated through the indices, to provide early identification of changes in patterns of attainment or expectations.
- allowing departments a degree of customisation and access and the ability to change their own parameters.
- encouraging openness and trusting in the professional conduct of staff by allowing them as much access to other areas and subjects as possible in line with the maintenance of data integrity and accuracy.
- reducing staff workload by replacing and automating manual systems, for example report production.

The application was developed and implemented in three stages. Figure 49 shows the full scope of the application after the implementation of the final stage. The departmental expectations represent how staff believe that teaching is related to outcomes. In the database application, these expectations are reflected within *'cut off'* tables which contain cut off points above which staff as a whole believe represent particular levels of attainment. There was considerable discussion of how these *'cut off'* points can be generated, especially in the section dealing with the implementation of the S1/S2 stage. Primarily because although they are introductory courses to Standard Grade courses started in S3, they have no specified independent standards at the end of the course against which pupil progress can be measured, other than 5 - 14 grades and teacher expectations: 5 - 14 levels as the discussion made clear, have little relationship to Standard Grade outcomes and relying solely on teacher expectations leads to *'ambiguous'* and *'superstitious'* learning. It was argued that it is in the actual process of generating these *'cut off'* points that staff develop a common understanding, both in what the assessments tell them and standards of performance required to attain defined levels of performance. It was also suggested, that it through the consideration of how levels of performance in the S1/S2 courses are reflected in outcomes at

Figure 49: Boundaries of the database application after three interventions



the Standard Grade courses, that teachers come to appreciate and understand the articulation between and progression through the courses. In other words, the rank orders generated by the application become an hermeneutic enabler to further understanding. The matter of standards is less important at Standard Grade, firstly because the course arrangements detail

precisely what has to be demonstrated by pupils to merit particular grades and the SQA are active in moderating teachers marking to make sure they are neither too lenient nor unduly harsh in assessing pupils work. Nevertheless, a series of *'cut off'* points are included to relate pupils performance in terms of their SGPA to likely outcomes in a range of post 16 courses.

For staff, the introduction of the application was a significant change. As well as moving from a manual system, to a computerised one, they had to be much more open about the expectations of pupils. They also had to learn how to enter, access and generate reports but overall this was accomplished easily and met one of the initial objectives of minimising the training overhead. In the academic sessions since its first introduction no formal training has been required and despite a significant staff turnover, new staff quickly learnt to use the system with the little assistance from others in departments and a quick reference guide. According to one new PT who had experience of using *'Click & Go'* and other systems in other schools, the application was *"the best and easiest to use";* a view shared by the School's SMT and office staff who had extensive experience in the use of *'Click & Go'*. It should be emphasised that staff were not unwilling to do these things. To some extent, staff and particularly the SMT were practically aware of the limitations to individual and organisational learning and these were being imposed on the school through the way information was stored and used. Unfortunately, they lacked a theoretical base on which to develop practical solutions and this had led over time to the accretion of time consuming ad hoc manual systems, which had greatly added to the bureaucracy of the school. Now though, the developed application based on Beer's theory, had provided them with a tool to easily manipulate the data in to arrive at conclusions.

From the outset, one of the intentions was for teachers to use the application to deliver information to pupils. In effect, the application becomes an amplifier of variety helping teachers to close the loop between them and the pupils. Consequently, it was important that pupils could understand the information being given to them. As discussed earlier, teachers who used the application in this way reported how surprised they were to see a global view of their attainment across all subjects, together with their teachers expectations made so explicit. Teachers were also surprised at how they became quite observant in detecting when teachers had failed to enter their most recent assessment results, even in other subjects.

Compared to being verbally given the same information, where the content of the message was confused with the messenger or channel carrying the information, pupils appeared to regard the display as less emotive, more impartial and objective .

In terms of its impact on planning, the results were mixed. There was plenty of evidence that the application was used for operational and strategic planning. Departments across the school had standardised their assessment regimes and were developing an understanding of how performance in courses articulated with one another. Advice to pupils, class setting in S3, resource planning etc was all achieved through information provided by the application. For the first time, the SMT and departments could see and anticipate progress towards meeting targets and make early interventions with pupils who could demonstrably be seen to be underachieving. It was also suggested that the difference between their starting Grade, represented by their CAT forecast grade at Standard Grade and at post 16 by their indicated band pass generated from their SGPA, and final grade could be attributed to the *'value added'* in the course. However, as noted earlier, there was less success at the normative level of planning. One reason for this was attributed to how the HMIE evaluated schools. They were interested in the absolute number of passes attained at various grades, not the number of passes attained relative to their forecast predictions. Another, was that the school was compelled to plan in response to local Authority and National priorities in formats approved by the HMIE. Consequently, the SMT were reluctant to make departments accountable for the measures through the command channel between the System 3 links and their systemic System 1's or areas of concern.

Despite the last concern, the success of the application demonstrates that Beer's VSM theory is not only one with considerable descriptive power, capable of capturing organisational complexity and processes across multiple levels, but is also one that has practical consequences. These are not confined just to the rearrangement of the physical relationships between parts of the organisation, but can be extended to measurement and the design and development of IT solutions with the aim of providing capacity for individual and organisational learning.

Chapter 6: Conclusions

Learning about complexity, managing complexity and adapting to change within the context secondary education have been the principal themes of the preceding chapters. Chapter 1, apart from introducing the research questions, discussed some of the background changes developing in the educational domain and the broader social environment that are having to be accommodated within schools. The nature of complexity was discussed and it was argued that the changes are creating such a complex situation that the issues could only be appreciated from a holistic systems perspective. A contrast was made between this approach and the traditional reductionist viewpoint in education where issues are tackled in isolation from one another and compete with one another for management attention.

In the first half of Chapter 2 it was proposed that aim of managing complexity is a prime objective of management and it was shown how this objective was satisfied from within three contrasting schools of thought. Discussions of the principal approaches used within each school to tackle complexity emphasised the issues of learning about a situation and coupling individual learning to the rest of the organisation in order to produce more effective individual and organisational action. The discussions also highlighted some of the deficiencies associated with the different approaches adopted by each school of thought, and it was argued that the kind of social cybernetics advocated by Beer, shared the strengths of each school while minimising their disadvantages. So in contrast to the view of Beer's cybernetics as standing alone as some other disconnected body of work, it was shown to be grounded within the traditions of diverse schools of management.

The second half of Chapter 2 developed the idea of complexity further and discussed problems of measuring complexity with Beer's ideas on measurement in relation to other measures of complexity. Variety as a measure of complexity together with principles of managing complexity elaborated in earlier discussions were used to explain Beer's *'Viable Systems Model'*. The VSM according to Beer, models viability with respect to complexity identified by the system's purpose. With a recursive structure built on the principle of devolving autonomy consistent with the maintenance of identity or purpose, it was offered as an analytical tool for examining how schools were configured for dealing with complexity. As well as being a *'scale thick'* integrative model capable of describing how

organisations deal with complexity across multiple levels of resolution, it was also argued that the principles used to construct the VSM have practical implications for design or for action.

Chapter 3 described the methodologies used in the research and how Espejo's cybernetic problem solving methodology was used in a *'research orientated'* mode to guide and manage the analytical process. It was also explained how Espejo's methodology was used in an *'action orientated'* mode to complete work described in Chapter 6. This work was used to illustrate some of the practical consequences of using the VSM as a lens to examine how organisations are configured to deal with complexity and how the concept of *'variety engineering'* can inform the design process. There was also some discussion of how this work qualified as *'action research'* in relation to Eden and Huxham's (1993) distinguishing characteristics.

Chapter 4 provided an extensive description of how an anonymous school, Burnview Academy managed its complexity. It began with unfolding the school's structure to reveal the structural strategy used to filter environmental complexity. This identified three recursion levels and it was subsequently shown how the educational, professional and social changes first described in Chapter 1 impacted on each level within the context of Burnview. As well as the need to develop additional response capacity to match increasing complexity, it was also shown how the school's autonomy or freedom for action was constrained by the National, Local Authority and HMIE requirements. Additionally, a number of obstacles to *'learning'* were identified. These were discussed in greater detail in the following chapter and a solution developed using the VSM as a framework. The answers to the initial research questions were implied in the discussions throughout these chapters and the remainder of this section is concerned with making explicit the connection between the research questions and the findings, together with some recommendations before concluding with some final remarks.

6.1 The research questions revisited

The research questions all relate to how management copes with complexity in the environmental, action and management domains at the various levels of recursion within the

school. To avoid repetition, they are split into the two groups given in table 36 according to the main processes identified by Espejo (1996) as *'Inventing in the Organisation'* and *'Inventing the Organisation'*. As discussed in Chapter 2, *'Inventing in the Organisation'* equates to the cyclic operation through time of Beer's VSM Systems 3-2-1 and *'Inventing the Organisation'* is equivalent to VSM Systems 3-4-5 operation.

Table 37: Orientation of the research questions

Process	Questions	Focus
Inventing in the Organisation	Question 1, Question 4 and Question 6	On the *'Inside and now'* with the emphasis on *'doing things right'*.
Inventing the Organisation	Question 2, Question 3 and Question 5	On the *'Outside and then'* with the emphasis on *'doing the right things'*.

Following the qualitative longitudinal single case study approach to research described in Chapter 3, discussions of the main findings in the next sections are made in reference to Beer's Viable Systems theory and other theories. However, it should be remembered that the changes underlying the complexity faced by school are the same as those operating on other schools. Similarly, other local authority run schools in Scotland have similar management structures and are exposed to the same constraints imposed by National, Local Authority and HMIE priorities. On these grounds of similarity therefore, it's possible to extend the recommendations arising from the research to a broader theory concerning systemic relationships between systems in relation to the management of complexity and change.

6.1.1 Inventing in the organisation

Question 1, Question 4, Question 6

The educational and professional changes initiated by government and described in Chapter 1 can be seen as directions to schools to develop their capacity for accommodating an increased variety in the range of pupils attending schools. Or in Espejo's (1999) terms

schools are being directed to increase the number of distinctions they make in pupils to match those seen by government and be able teach these pupils according to their own distinctive needs *(Question 1)*.

To an extent government and local authorities have attempted to inject increased variety into schools or endow them with greater response capacity through the funding of Learning Support and Behavioural Support departments, the provision of classroom assistants and additional administration staff and extending the role of Guidance staff. However as Chapter 4 revealed, the systemic consequences of making further distinctions in pupils has considerably increased the internal organisational complexity that individual teachers and the school have to deal with; especially under the principal of greater accountability, schools are having to demonstrate to others how the particular needs of pupils were satisfied. As described in Chapter 4, the strategy adopted by the school of handling this increased complexity has been one of standardisation of routines and processes that conform to the expectations and standards of others, notably the HMIE and the Local Authority. One consequence and contrary to VSM theory which suggests that freedom for action or autonomy should be devolved to lowest recursion levels consistent with organisational purpose, this has diminished teachers professional autonomy constraining them to respond to pupil differences in only approved ways. Paradoxically at a time when the government is trying to encourage change and innovation, their policies of greater personalisation and increased accountability are leading to situations where this is becoming more difficult as schools attempt to deal with the increased complexity.

Government seeks to improve the quality of education received by pupils through the setting of targets, the use of quality indicators and accountability to the HMIE and the Local Authority. *Question 4* essentially addresses the issue of *'how do individuals and the organisation know what they know'* which is necessary both to determine the impact of any action they undertake and to demonstrate improvement. As the discussions in Chapters 4 and 6 made clear this is fairly inadequate in Burnview, with action proceeding on the basis of *'ambiguous', 'superstitious'* and *'superficial'* learning. HGIOS, the quality assurance framework which has become the de facto basis for self evaluation because the HMIE use it for inspection purposes, indicates some sources of evidence and illustrations of quality indicators that merit particular grades on a scale of 1 - 4: though this has recently been

extended under HGIOS 3 introduced in 2007 - 2008 to a six-point scale. But as evidenced in Chapter 4, the complexity and amount of work involved in monitoring and tracking 97 themes across 33 quality indicators covering seven areas results in individual, departmental and organisational strategies which subvert the process and undermines the *'learning'* and consequently the *'action'* aspects to the self assessment exercise. In contrast to the concept of *'total information awareness'* implied by HGIOS, VSM theory suggests that areas for which systemic management at each recursion level are held accountable should be restricted to only the minimum consistent with the *'purpose'* of the recursion level and that targets should be agreed through negotiation. These agreements should be amplified through System 2 coordinating functions and monitored through System 3 Star. Imposing additional areas of responsibility according to VSM theory, adds further constraints to freedom for action and this can be seen reflected in HGIOS which specifies what has to be done and what has to be seen to show its being done. The difficulty of knowing and demonstrating everything across the areas covered by HGIOS is implicitly recognised by the HMIE who now only inspect on a restricted set of quality indicators. The issue for schools is that until an inspection is announced, they never know which indicators are going to be inspected. Schools therefore have to ready to account for what they do in all aspects of HGIOS, equipped as they are with an inadequate set of tools or monitoring methods that allow systemic evaluation of the evidence.

Question 6 is orientated towards uncovering the implied management model used in schools. Government strongly promotes teaching as a profession, encouraging the development of professional knowledge and competencies, collegiality and equality between colleagues and it's true, that teachers identify themselves as being part of the *'professional class'*. However as discussed in Chapter 4 and alluded to in the answer to *Question 1*, government attempts to increase accountability has led to a move towards a more Scientific approach to management, with its emphasis on standardised routines and procedures both in terms of outcomes and process. Driven by the need to meet HMIE, Authority and National objectives measured by Quality controls is leading Schools to Weber's (1947) description of *'full bureaucracy'* characterised by its emphasis on hierarchical relationships and increasing centralisation of authority and where objectives are imposed from above, first by government and then by the local authority. Earlier than Beer, Burns (1963) had associated these characteristics with *'mechanistic'* organisations where the approach was best suited to

stable unchanging conditions and consequently, despite government's proclaimed objective of encouraging change and innovation, the effect of current initiatives to raise attainment in schools is leading to entrenchment of existing procedures and methods of operation, reducing the school's capacity for change and ability to adapt. Beer, like Burns, suggests that changing conditions require a more flexible, organismic approach to management with a network structure consisting of distributed control and authority, where communications proceed laterally, focussing on the transfer of information and advice, rather than vertically consisting of instructions and decisions. And greater commitment is attained through continual redefinition of tasks in interaction with others as opposed to being determined externally. For Beer, this can only occur if each recursion level is granted the freedom to solve its own problems and allowed the risk of attempting solutions that may step beyond someone else's preconceived ideas embodied in policies or quality control frameworks.

6.1.2 Inventing the organisation

Question 2, Question 3, Question 5

Question 2 is directed towards uncovering the extent to which staff can realise the benefits of new learning through the formation of new relationships. Chapter 4 revealed the nature of the specialised differentiation in the structure of the school, showing the division between curriculum staff and guidance or pastoral care staff. Reflecting the traditional academic approach to reducing the totality of knowledge to manageable proportions, curriculum staff are further sub-divided into subject areas. Staff in each subject area are responsible to a Principal Teacher (PT) or departmental head. These are in turn nominally directly responsible to the Headteacher, but in reality do so through *'link managers'* or Deputy Head teachers (DHT's). This widely accepted hierarchical structure with its horizontal differentiation into specialised subject areas is strongly re-enforced by the professional requirements of qualification - teachers have to be graduates of their subject - by the examination system and by broader public expectations reluctant to see education radically different from their own experience. Together these factors combine to make it very difficult for schools to consider alternative structures, despite strong government encouragement through initiatives like *'A Curriculum for Excellence'* (Curriculum Review Group, 2004) that place considerable emphasis on cross curricular links. Promoted through

continuous professional development (CPD) programmes, individual staff learning does nevertheless occur. However many of the CPD courses are orientated towards re-enforcing subject specialisation or on functional aspects associated with particular tasks, for example *'How to construct school timetables'* or compliance with the law, for example The Education Act (2004). The organisational impact of additional learning acquired on courses with broader pedagogical concerns such as *'How to motivate disaffected pupils'* or *'Promoting cross curricular links'* has been limited and retained within the individual. Partly, this is because CPD learning is focussed on the enhancement of personal knowledge and competencies and partly, as Beer argues in his VSM theory, the realisation of action proceeding on the basis of new learning, can only occur with establishment of new relationships supported by new structures. The most successful innovations that have occurred in the school, like the implementation of the pupil profiling application described in Chapter 6, tend to be those focussed on the internal operation of the organisation and created in support of existing structures. They also tend to have their beginnings in what Stacey (2000) describes as the *'shadow 'system'*; a loose informal network of affiliations that lies behind the publically recognised legitimate organisation, which people use to exchange information, shortcut and circumvent official channels. Eventually when such developments have proven themselves in this shadow organisation they become part of the official organisational landscape: an example of what Espejo et al (1996) describe at *'opportunistic learning'*. For Beer, Stacey's (2000) shadow system develops because the official system lacks the requisite variety to deal with emergent issues and consequently develops as staff intuitively develop *'workaround's'* to match the variety being generated within the respective System 1's of their concern. Implicitly, this suggests that schools should be allowed to develop alternative structures to combat the complexity generated from their own immediate environments and to meet the challenges envisioned in *'A Curriculum for Excellence'* and *'Schools of Ambition'* programmes. But, as previous comments have made clear radical change can only occur with the support of government and changes in other areas of the educational domain.

Question 3 examines the extent to which schools are able to interact with their *'given'* and *'problematic'* environments, both in terms of influencing environmental states and in terms of adapting to environmental states as new distinctions emerge. Chapter 2 described these under VSM theory, as System 4 Intelligence activities with decisions emerging from a

dialogue between Systems 3 and 4. According to Beer, or what Stacey (2000) describes as being on the edge of chaos, the creative tension between an interest in stability expressed by System 3 and instability induced by System 4 should exist all recursion levels. However, Chapter 4 revealed that while the school was good at interacting with their given environment through links to local employers, links to primary schools, newsletters and reports to parents etc., little attention and consideration was paid to detecting possible future environmental states and how the school might adapt in response. Instead of creative tension, an atmosphere of compliance prevailed with decisions over future changes being presented as *fait accompli's*. Whether by design or simply through functional drift, responsibility for System 4 activities have been expropriated by the authority. Under the guise of *exchanging information*, school and subject advisors from the local authority *'tell'* school managers and PT's what to do. Much of this information is orientated towards how the school and departments can satisfy the standards of the HMIE or implement the policy objectives of the authority and government. In the absence of System 4 activities and consideration of possible alternative futures within the school, management has collapsed into System 3 with its focus on internal control and stability. Consistent, with earlier conclusions, the induced bias towards stability reduces the opportunities for radical change. Implicitly, VSM theory suggests that one of the prerequisites for successful change is for management to initially create instability and diversity in viewpoints rather than work at developing a common consensus around given viewpoints. Described as *'problem jostle'* (Beer, 1994), the intention is to increase the internal variety of the organisation to allow alternative views on possible futures to emerge. Management should then provide opportunities to allow these alternative viewpoints to condense on an agreed few before the generation of accepted statements. In the *'Team Syntegrity'* model, Beer (1994) describes these latter two steps as *'Topic Auction'* and *'Outcome Resolve'*. However, this can only occur if participants at each recursion level, have the autonomy to consider possible futures and implement solutions that are perhaps at variance with the goals under current model of directed planning, together with a process in with which staff can engage and participate constructively.

While *Question 3* examined the capacity of the school to adapt to the challenges emerging from their own environmental complexity, *Question 5* was directed towards looking at the process by which staff engaged in planning and problem solving. Chapter 4 revealed how

under the current system of directed planning, staff have the difficulty of resolving the complexity involved in a tripartite system of objectives. First there are the central governments' national priorities and policy objectives. Second, there are the local authority's priorities and targets based on their interpretation of national priorities and modified for authority's context (Strathclyde West Education and Leisure Services, 2002). And finally there is the set of HMIE targets and inspection criteria. Although there is some commonality and overlaps between the three sets, for example in the area of Statutory Performance Indicators - information concerning attainment rates, staying on rates etc. which has to be supplied to parents and to the local authority and used in turn by the Audit Commission to assess the performance of local authorities. - complete reconciliation between the three sets into a coherent whole has so far been beyond the school and the authority. Nevertheless, despite the difficulties involved, the Headteacher has attempted to engage staff in the school improvement planning process. Operating as a System 2 coordination function, the HGIOS performance indicators are distributed in the format shown in Appendix B. Departments apply their grading's and from the average scores in the collated returns, the Headteacher selects the areas for improvement. Again in standard forms, departments then have to produce plans to show how they are contributing to improvement in the areas of identified weakness. These are matched to the relevant local authority and national priorities and the collated departmental returns are used by the Headteacher to prepare the school improvement plan for the following session. While the process creates an *'audit trail'* linking government and local priorities through school to departmental improvement plans and action, Chapter 4 described various strategies staff and the SMT use to undermine and subvert the process, beginning with the self assessment and continuing through to the action planning stages. Perhaps the most significant of these are the *'clear steers'* used by the Headteacher to direct departments to particular grades with respect to particular Quality Indicators. Another, is a reversal of the process whereby instead of requiring evidence to support a particular grade, staff collectively in their departments are required to produce evidence to show why they are not awarding themselves high grades across the range of Quality Indicators. Two explanations for the SMT behaviour were provided. One, was the openly explicit aim of the Headteacher to minimise the bureaucratic burden of the self assessment exercise. The other, was the implicit but widely understood need to supply the authority with 'good' scores, who used the average scores across all schools to demonstrate *'progress'* to the electorate through

published Quality and Standards reports (Strathclyde West Education and Leisure Services, 2001). Low scores, it was assumed, would reflect badly on the school and its management and thereby attract unwanted attention by authority *'advisors'*. Even if the effect was unintentional, the feedback loops operating between the authority and the school was offered as an example of how external reporting needs distorted the internal self assessment exercise and consequently any action that resulted from the process. At departmental level, the perception of the self assessment process as simply a *'tick box'* exercise designed to supply others with what they wanted to *'hear',* was further reenforced by the breadth and depth of the HGIOS indicators. Lacking adequate tools to assess performance in each indicator, departments engaged in strategies to shortcut the amount of work and time to required to complete the process. This undermined the opportunity of any organisational learning which is claimed as the main aim of the HGIOS assessment exercise (HMIE, 1996). Apart from responding to *'clear steers'*, departments took the minimisation of work as their other goal, typically avoiding awarding high grades that might invite responsibility for spreading a *'model of good practice'* or low grades that could call for major action. Often, as Chapter 4 showed, departments employed the heuristic of using the previous years grade, keeping it the same or adding a bit to suggest progress. Viewed from the perspective of VSM theory, both the SMT and departments successively lack the requisite variety in the vertical management dimension to match the complexity be required of them from above, each being required to make more distinctions in their respective action domains than they were capable. Under such conditions their only solution was either to provide or seek guidance that effectively leads to predetermined outcomes or treat the exercise in the most superficial way. A significant consequence of this, if the same behaviours are shared by other schools, is that it undermines claims to rigour and careful analysis in the authority Quality and Standards reports (Strathclyde West Education and Leisure Services, 2001) together with claims of effective staff participation in self assessment. Additionally under the current planning process, the dislocation between *'real world'* needs and the requirement to demonstrate accountability in the management domain, is further exacerbated at the planning stage. The identification of areas of weakness by the Headteacher as common themes to be tackled by the whole school, places the focus of planning effort on the past with an emphasis on incremental improvement to existing processes and methods. Leading to further embedment of existing systems, this increases the trend towards stability, effectively restricting the opportunities for change through limiting the consideration of

possibly different futures. Furthermore, there is an underlying assumption that the common themes of weakness identified at whole school level are also relevant to each department. However, as discussed in Chapter 4, the process can lead to departments having to develop plans to improve in areas in which they consider themselves strong or of a low priority. Areas of weakness are also identified with reference to the HMIE model which adds to the imperative to develop and implement plans to suit the model rather than their own *'real world'* needs. In combination, these factors explain why the self assessment exercise and the planning process is given little attention and considered a major distraction from the real work of teaching rather than a positive opportunity for real development. Seen through the lens of the VSM, the situation is a consequence of a lack of System 4 functionality identified in the answer to Question 3, and the opportunity to have a dialogue over alternatives. Without System 4, the planning process is a one-sided conversation and the idea of normative and strategic planning at school or departmental levels is illusory. Essentially under the external control of the directed planning system, schools and departments have little impact on the why's and what's of planning. Instead, planning is restricted to tactical or operational levels with consideration of how to implement plans to achieve the objectives of others.

6.1.3 Recommendations

Answers to the research questions have revealed some significant issues, particularly with regards to the government's aim of improving the quality of teaching and encouraging change in schools in order to deal with increasing complexity. The aim of this section is to make explicit some recommendations orientated towards improving the learning and adaptive capacity of schools.

- Extend to schools the right to interpret that National Priorities from within their own context. Consistent with the Government's *'Schools of Ambition'* (Scottish Executive, 2004a) programme, this implies acceptance of diversity between schools rather than conformity to a single model. It also lays the foundation of how schools can begin to establish their own distinctive identity within the National Priority framework.
- Simplify the chain of accountability by systemically incorporating the HMIE within local government, replacing the current system where schools have to demonstrate

accountability to two bodies: the HMIE and the Local Authority. Instead of the current arrangement of HMIE bypassing local government, the new systemic arrangement would consist of HMIE operating as an System 3 star function at the highest level of recursion, auditing and monitoring the activities of the next lower recursion, i.e. local government. HMIE embedded within this level would operate in turn as a System 3 star function, auditing and monitoring the performance of the authority schools. Adoption of this arrangement would reduce the schizophrenic tendency at school level of simultaneously facing two ways and avoid the duplication of effort involved, as authority advisors try to *'second guess'* the HMIE and carry out their own *'inspections'* in order to *'help'* or prepare schools in advance of any real HMIE inspection. In line with the emerging trend of *'localism'* (Cooper & Raynsford, 2004; Conway, 2006; Hannan and Carswell, 2007) or the decentralisation of authority and responsibility for local decision making, it would restore some of the capacity of local accountability and assist system 3 functions at authority level in negotiations with schools.

- Devolve to schools the direct responsibility for adapting to changes in their environmental domains, extending the principle already recognised in the Devolved Management of Resources (DMR) (SOED, 1993) that those closest to the changes are in the best position to decide how to respond. This involves restoring System 4 functions to schools and departments, moving advisors from their assumed *'command'* function in the management domain back to their intended System 2 function, helping to coordinate the activities of schools where they overlap in the action domain.
- Extend the range of measures used to assess the performance of schools beyond for example, levels of educational attainment, attendance or destination of school leavers which can be combined in a manner described by Felix and Riggs (1983) to give a single overall measure or '*multiple objectivity index'*. And, importantly allow schools the flexibility to decide which dimension(s) to on which to concentrate their efforts. This will help make schools more comparable where for example research indicates (Webber & Butler, 2007; Gerstenberg, 2004; Paterson, 2002) that schools in predominantly middle class professional areas owe their success more to parental involvement and parental prior educational attainment than the quality of teaching.
- Minimise ambiguous, superstitious and fragmented learning by basing the development of measurement systems used to evaluate performance in each dimension on the principles identified in Chapter 6; for example each measure to be arranged systemically

in relation to potentiality and capability, based in *'real time',* use simple calculations to keep close to the raw data and portray the information in a variety of ways to cope with different ways of understanding information.

- Develop commitment and accountability through *'meaningful'* negotiation with respect to targets to be achieved in each dimension at all recursion levels, i.e. between SMT and local authority and departments to the SMT. These negotiations are to be based on school level data as opposed to deriving targets from statistical analysis of gross performance data, though this information can be drawn on in the negotiation process. Part of the agreement reached in the *'command'* channel between recursion levels should also cover agreement on audit routines and processes used by the System 3 star functions operating on behalf of each System 3 of the next high level of recursion. Implicitly, this suggests that the HMIE embedded at the local authority level has to become more flexible in what and how they inspect at school level. However, the agreement will avoid the current situation where schools adopt the conservative position of undertaking actions to please the inspectorate rather than actions they believe they should undertake in *'reality'* and resent the HMIE for their lack of flexibility.
- Restore a sense of purpose and build a distinctive identity through Facilitated Work Groups (Phillips & Phillips, 1993) or Syntegration exercises (Beer, 1994, Schwaninger, 1997). In particular, Syntegrity which fits neatly within the Model of Systemic Control (Schwaninger, 2000) is a process designed to encourage participation and foster collaboration in tackling *'large'* questions over identity and the production of plans. Essentially, a future orientated approach, it sits on the interface between System 3 and System 4 exploiting the tension created between what schools are currently doing and what they could be doing. Producing improved articulation between purposes, plans and *'real world'* needs, it implies the surrender of some control over the process by school managers who, from the perspective of ordinary staff use the planning system to arrive at predetermined outcomes.
- Encourage self regulation in schools and for schools to develop their own quality assurance programmes. Linked to the negotiations between recursion levels and using HGIOS as a starting point, this involves reducing the number of quality indicators to those identified by the school as being critical to the achievement of purposes. Reducing the number of quality indicators to those considered relevant by the school creates space for change and consideration of alternative approaches. This is in contrast to the current

range of quality indicators which in their detailed coverage constrains schools to working within a very specific framework that is disconnected from the context of the school, i.e. applies to all schools. In the spirit of self regulation and to encourage openness, honesty and *'reality'* in the self assessment process, the results of any quality assurance programme should be retained within the school. Additionally, a process that operates without having to provide results to satisfy the agenda of an external body considerably reduces the systemic complexity and workload involved in the self assessment process; where under the current system, the local authority and the HMIE first of all require schools to complete the self assessment process and then have a second separate process to demonstrate to external observers that they completed the first process. Changing the current process requires recognition of the difficulties involved in *'knowing'* everything about the school and the restoration of trust and faith in the professional judgment of staff (Espejo, 2001).

- Address the limited problem solving skills within schools that results in continual deferment to external bodies for solutions, by including within existing CPD programmes courses on understanding systems and problem solving methodologies. Providing an extra dimension to staff development in terms of systems understanding will allow staff to see the broader interrelationships between systems, moving the focus from almost exclusively pedagogical concerns of *'how to's'* to *'what's'* and *'why's'*. It will also foster an interdisciplinary approach to problem solving, helping staff to escape from the straight jacket of viewing issues from the perspective of their own subject specialisation or subject needs. To a limited extent a start has been made with the recent introduction of the Chartered Teacher programme (Scottish Executive, 2002b) which places increased emphasis on learning through action research. However, the benefits of individual single and double loop learning often remains with the individual and fails to extend to others in the organisation, providing an example of what Espejo et al (1996) define as *'fragmented learning'*. Developing improved problem solving skills becomes more significant if schools are allowed under previous recommendations to become more self reliant and encouraged to develop their own specific identities. The interdisciplinary approach will also provide mechanism by which the benefits of individual learning are shared with others in the organisation.

6.2 Reflections on the VSM & Methodology

There is little doubt that Beer's Viable Systems Model is extremely powerful. One of its major strengths is the ability to relate different levels of the organisation into a coherent whole. It allows examination of emergent properties that cannot be found in a system's disparate parts. With only five systems necessary to ensure viability, it is very easy to use as a *diagnostic* tool to identify *'pathogenic system failures'* (Beer, 1985) where necessary functions, procedures or systems are missing or being misapplied in an organisation. Armed with an understanding of variety that underpins the structural relationship between each of the VSM's five subsystems, it is easy to use as a *design* tool, as illustrated by the action research project.

Espejo's methodology (1989a, 1996, 2011) for using the VSM has also proved useful. Perhaps its greatest strength is the difference in emphasis on system naming and root definitions from Checkland's (1981) Soft Systems Methodology. Espejo's methodology makes the distinction between what a system is observed to do and what participants say it does, freeing up the observer to start the modelling process on what the system does. Its iterative nature was useful as a strategy to guide both the case study research process and in the applied action research project.

Achieving a wider organisational understanding of the VSM and the problem solving methodology was less successful. The translation process required for participants to relate their context in terms of one or more of the VSM subsystem was too difficult. The pragmatic and functional orientation of staff with emphasis on wanting *'solutions that worked'* counted against the VSM. The action research project showed that they could readily understand and appreciate problems diagnosed arising from the application of the VSM and understand solutions designed using the concepts of variety engineering, but they had little interest in discovering *'how'* the diagnosis was arrived or *'why'* the solution should work. In this respect, the usefulness and future of the VSM and Espejo's methodology probably best belongs in the critically reflective realm of the *'expert'* consultant or action researcher for use as tools used to solve clients problems.

6.3 Concluding remarks

Chapter 1 emphasised the significance and importance that has become attached for various reasons to the concept of schooling and education. Set against a background of Scottish devolution with a desire to establish a distinctive 'Scottish' agenda, the failure to realise the benefits of previous educational reforms and the increasing rate of social change, Government initiatives to raise the standard of education have increased the degree of centralised directed planning and emphasised accountability and inspection. It has been argued that far from encouraging adaptation and change, these approaches operate to inhibit change, relying as they do for their effectiveness on stable unchanging conditions. Essentially, from the perspective of complexity, Government has been attempting to control how teachers deal with the horizontal complexity generated in their environmental and action domains through targets, emphasising accountability and prescribing standard routines and procedures in the vertical management domain. So whenever a state occurs in the horizontal action and environmental domains that can't be accounted for by routines and procedures in the vertical management domain, a discontinuity occurs, with teachers compelled to ignore the new state and continue as before. Chapter 4 for example, described how staff perceived the lack of relevance of government initiatives to their needs. Currently, it is only when the divergence between the *'reality'* of the states in the environmental and action domains and what can be accounted for the management domain becomes apparent at a global level is action taken. Unfortunately, the general trend for this *'action'* has been for increasing specification of routines and procedures, seen for example in the recently expanded set of quality indicators in HGIOS 3 (HMIE, 2007), to take account of emergent *'new'* states. This delay between required response and action has been attributed in prosaic terms as the *"dead hand of local authorities"* (Martin, 2008; McTernan, 2008) working to reduce flexibility in education. Espejo (1997) on the other hand, sees it as a consequence of the inevitable *"lack of requisite variety"*" that one part of a system has to match the variety being generated in the environmental and action domains. Contrary to the current approach of directed change and control, it has been argued that the capacity for change can be more effectively achieved by granting more autonomy to schools. Implicitly this requires Government and local authorities to surrender the idea of an homogenous school model, with schools fulfilling the their educational purpose in the same ways regardless of context. Instead, it requires recognition that educational purpose can be

fulfilled in different ways via diverse models. To a degree this recommendation is matched by the arguments underlying the establishment of independently sponsored academies (Blunkett, 2000) in England and *'Schools of Ambition'* (Scottish Executive, 2004a) in Scotland. But, rather than advocate complete independence from local authority control, the recommendations recognise that local authorities still have a metasystemic role to play, particularly in the areas of coordination, support and the maintenance of accountability through correctly aligned audit or monitoring functions. In this way accountability to the local electorate is maintained. However further research is required to identify a set of suitable dimensions in which schools can set their own targets and have meaningful negotiations with the local authority.

In contrast to Ralph Stacey's (2000) theories of complexity, which Rosenhead (2001) recognises as powerfully descriptive but offers little in the way of practical action, Beer's VSM theory is both good at capturing or describing the complexity of a situation and through comparison to the ideal form, capable of offering practical guidance for design or the resolution of problems. For example the difficulties of change in schools, and this is implied in the directed planning process, have been attributed to teacher's lack of flexibility and unwillingness to change. Yet as described in Chapter 1, teachers have participated in and successfully implemented a series of major reforms, demonstrating that this particular criticism has little validity. Instead, as examination of the *'reality'* of the situation in Chapter 4 through the lens of the VSM revealed, schools and departments lack System 4 functionality and have had to rely on policy advice from Government and the Local Authority before adopting new configurations to deal with emergent complexities. It is the delay incurred in this process brought about by structural relationships that have generated misplaced accusations of inflexibility, rather than the generally assumed reluctance of staff to change. Compared to the ideal form, the continued viability of schools is being artificially sustained at the cost of lost adaptability and the logic of the model indicates the development of System 4 functions at each level of recursion. Further work is required here to identify suitable System 4 functions. However, the exact nature of these would be dependent upon the identified purpose or identity of the school as this in turn establishes the boundaries of the *'given'* and *'problematic'* environments. The concept of *'variety'* may appear unremarkable to Checkland (1986) but it can be useful in producing insights into the processes and methods of communication intended to achieve balance between two systems.

The *'variety engineering'* diagram in Chapter 2 shows how teachers have unconsciously been striving towards achieving a balance in complexity, both in the ways they amplify or convey information to groups of pupils and in the ways they attenuate or understand the impact of their teaching on classes. A prior knowledge of variety it's been argued, can be used to assess the likelihood of meeting intended objectives of mechanisms developed to enhance communications on a one-to-many or a many-to-one basis. This is becoming increasingly necessary with the Government's policy objective of increasing the personalisation of education with the development of personal learning plans (PLP's). Here, the policy objective appears perfectly rational on a one-to-one basis, but becomes increasingly problematic for teachers in terms of handling the requisite information when scaled up to classes and across classes. As illustrated in Chapter 6, an understanding of variety can also inform software design and if applications are created to be congruent with the way organisations are structured to deal with complexity as modelled by the VSM, then this can ease its implementation and support the processes of organisational learning. As a tool for analysing complexity, the VSM is powerful and quick to use, depending as it does on the observable outcomes and structural relationships between the parts of an organisation, rather than claimed purposes. However, its strengths in terms of language which provide it with its universality of application and recursive structure which gives it the capacity to model organisations in an holistic *'resolution thick'* integrated manner, are perhaps the biggest barriers to increased popularity.

6.4 Postscript

The last few years have continued to see dramatic changes injecting further complexity into the educational system. The trend for new family structures with dislocated parents has continued. Pressure for schools to cope and manage an increasing diversity of intake is increasing and there are still high expectations that schools can deliver greater personalisation in pupils' learning experiences: all overlaying the introduction of new qualification system to replace the Standard Grade and Higher Still courses.

The new *'National'* qualifications have removed many of the distinctions made by the older qualifications, by reducing the range of possible outcomes to a binary pass/fail system, apparently removing much of the complexity involved in monitoring and tracking pupil performance.

Unfortunately this has increased uncertainty and overall complexity in the system. Monitoring and tracking pupil performance is no longer possible in situations where able hard-working pupils achieve the same recognition if they pass with high percentage scores as those pupils who struggle and just pass. Now monitoring pupil progress is achieved by proxy following changes in behaviour, effort and homework. Like measuring the efficiency of a boiler by the sound it makes, these characteristics bear little relationship to final outcomes. In terms of systemic control there is little possibility to detect deviations in expected performance and taking effective action through feedback loops to achieve desirable outcomes. Neither is there the possibility for effective teacher or organisational learning where pupils perform significantly better or worse than expected, either individually or as a group. Instead the best that can be achieved is superstitious learning where progress is attributed to factors that may or may not be related.

The new qualification system has reduced the importance of exams. There are no longer formal exams for National 4's and with all qualifications there is greater emphasis on internal assessment. To retain public confidence in qualifications without exams, the SQA has developed a complex system of moderation involving internal cross marking and external marking, doubling the work load of staff and introducing a huge bureaucratic overhead to keep track of it all.

Further complexity has been injected through the removal of age and stage restrictions. Only in core subjects like English and Maths are classes reasonably homogeneous in terms of age and ability. In non-core subjects, classes can be a mix of pupils from multiple age groups studying the subject across National 4, 5 and 6 levels. Maintaining control in such situations can be extremely problematic for teachers.

Against this background of change, one of the few consistent features has been the hierarchical reductionist subject specialist management model used to control the situation.

Unfortunately this is leading to a mismatch with using yesterday's management model to manage the current situation with its focus on cross disciplinary skills-based learning. And if one thing can be predicted there is going to be further change in the next few years.

Appendices

7. Appendix A: Exam Performance[10]

Table 38: 2001 Attainment in Standard Grades

School	School roll in Sept '00	S4 roll in Sept			% S4 roll gaining 5+ awards at level 5 or better			% S4 roll gaining 5+ awards at level 4 or better			% S4 roll gaining 5+ awards at level 3 or better		
	00	98	99	00	99	00	01	99	00	01	99	00	01
Whinfield Secondary School	904	163	161	168	56	58	63	93	87	93	97	95	99
Alderbank High School	1245	228	219	251	24	31	31	70	75	72	87	94	91
Burnview Academy	503	88	90	109	28	24	31	88	84	79	105	99	91
Bradfield High School	358	70	65	66	33	22	38	80	78	85	97	92	94
Barndean Secondary High School	431	98	84	85	28	23	19	65	81	76	90	92	93
Strathclyde West					34	33	36	77	81	78	92	94	91

[10] Source: Scottish Office: Percentage attainments calculated from S4 roll at the beginning of the academic year in the previous year, i.e. the roll in 2000 for 2001

Table 39: 2001 Attainment by the end of S5

School	% Staying on rates to S5 (post Christmas			% S4 roll gaining 1+ awards at level 6 or better			% S4 roll gaining 3+ awards at level 6 or better			% S4 roll gaining 5+ awards at level 6 or better		
	99	00	01	99	00	01	99	00	01	99	00	01
Whinfield Secondary School	75	82	76	54	66	61	37	47	40	24	29	28
Alderbank High School	56	55	53	34	36	32	15	19	21	5	9	13
Burnview Academy	52	55	46	33	38	27	12	16	6	**	**	**
Bradfield High School	61	74	42	31	47	28	15	21	18	**	**	**
Barndean Secondary School	53	51	52	31	33	31	12	19	12	**	**	7
Strathclyde West	64	64	63	40	42	39	21	25	22	8	10	10
National	65	65	64	39	41	39	21	23	22	7	8	9

Table 40: 2001 Attainment by end of S6

School	% Staying on rates to S5 (post Christmas			% S4 roll gaining 1+ awards at level 6 or better			% S4 roll gaining 3+ awards at level 6 or better			% S4 roll gaining 5+ awards at level 7 or better		
	99	00	01	99	00	01	99	00	01	99	00	01
Whinfield Secondary School	75	82	76	48	46	55	35	34	42	20	21	27
Alderbank High School	56	55	53	21	26	25	11	14	15	6	8	7
Burnview Academy	52	55	46	29	22	24	10	9	9	19	6	**
Bradfield High School	61	74	42	27	21	29	15	7	13	11	**	7
Barndean Secondary School	53	51	52	15	20	23	8	11	14	**	5	6
Strathclyde West	64	64	63	29	31	31	16	18	20	11	10	10
National	65	65	64	29	30	31	17	19	19	10	10	11

8. Appendix B: Quality Indicators from HGI0S

No	Quality Indicator	Themes	4	3	2	1
Curriculum						
1.1	Structure of the curriculum	• breadth and balance across elements of the curriculum • integration, permeation • time tabling and arrangements for pupil choice				
1.2	Courses and programmes	• breadth, balance and choice • integration, continuity and progression • support and guidance for teachers				
Attainment						
2.1	Overall quality of attainment	• the school's progress in raising attainment • pupils' progress in learning • pupils' attainment in relation to national 5-14 levels and/or in national examinations • evaluations across other related quality indicators				
Learning and teaching						
3.1	Teachers' planning	• planning of programmes and day-to-day activities				
3.2	The teaching process	• range and appropriateness of teaching approaches • teacher-pupil interaction • clarity and purposefulness of questioning				
3.3	Pupils' learning experiences	• extent to which the learning environment stimulates and motivates pupils • pace of learning • personal responsibility for learning, independent thinking and active involvement in learning • interaction with others				
3.4	Meeting pupils' needs	• choice of tasks, activities and resources • provision for pupils with differing abilities and aptitudes • identification of learning needs				
3.5	Assessment as part of teaching	• assessment methods and arrangements for recording • judgements made in the course of teaching • use of assessment information				

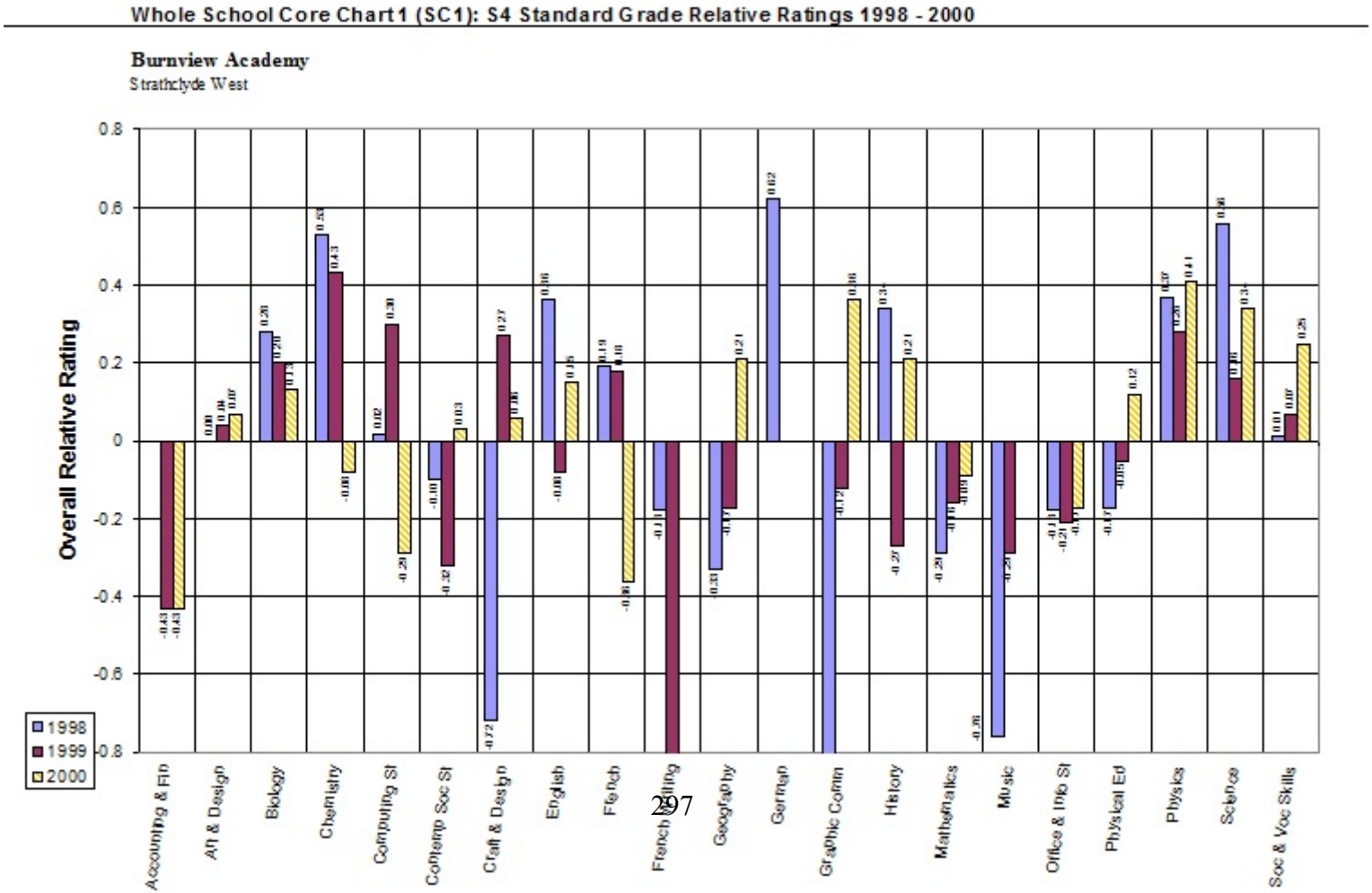
3.6	Reporting pupils' progress	• reporting procedures • information given to parents about each pupil's progress • responsiveness of the school to parents' views and enquiries about their child's progress				
Support for pupils						
4.1	Pastoral care	• arrangements for ensuring the care, welfare and protection of pupils • provision for meeting the emotional, physical and social needs of individual pupils				
4.2	Personal and social development	• planned approaches to promoting personal and social development • pupils' progress in developing positive attitudes and personal and social skills • contribution of extra curricular and other activities				
4.3	Curricular and vocational guidance	• preparation for choice in education, training or employment • accuracy and relevance of information and advice • extent to which guidance is founded on appropriate consultation				
4.4	Monitoring progress and achievement	• the monitoring process • profiles of pupils' progress and development • arrangements for using acquired information				
4.5	Learning support	• programmes to support pupils' learning • pupils' progress and attainment • implementation of the roles of learning support				
4.6	Implementation of legislation relating to special educational needs and disabilities	• knowledge and understanding of legislation and related procedures • meeting the requirement of legislation • procedures for implementing legislation				
4.7	Placement of pupils with special educational needs and disabilities	• processes for placements of pupils with special educational needs and disabilities into provision • processes for placements of pupils with special educational needs and disabilities into classes				
4.8	Links with local authority or other managing body, other schools, agencies and employers	• links with local authority or other managing body • links with other educational establishments • links with voluntary organisations, the wider community and employers • links with statutory organisations				
Ethos						

5.1	Climate and relationships	• sense of identity and pride in the school • reception and atmosphere • pupil and staff morale • pupil/staff relationships • pupils' behaviour and discipline				
5.2	Expectations and promoting achievement	• pupil and staff expectations and use of praise • promoting an ethos of achievement				
5.3	Equality and fairness	• sense of equality and fairness • ensuring equality and fairness				
5.4	Partnership with parents, the School Board and the community	• encouragement to parents to be involved in their child's learning and the life of the school • procedures for communicating with parents • information given to parents about the work of the school • links between the school and School Board • the school's role in the local community				
Resources						
6.1	Accommodation and facilities	• sufficiency, range and appropriateness • arrangements to ensure health and safety				
6.2	Provision of resources	• sufficiency of available finance • sufficiency, range and suitability of resources				
6.3	Organisation and use of resources and space	• organisation and accessibility • use of resources • display and presentation of items of interest				
6.4	Staffing	• provision of staff • experience, qualifications and expertise of staff				
6.5	Effectiveness and deployment of staff	• effectiveness of teachers and teamwork • formation of classes and deployment of teachers • provision for liaison to support pupils • effectiveness and deployment of auxiliary staff				
6.6	Staff review and development	• links between staff review and development and school self-evaluation and planning • staff review procedures • staff development				
6.7	School management of finances	• understanding of school funding mechanisms • arrangements for managing the school's budget • use of finance in support of school planning and learning and teaching				
Management, leadership and quality assurance						
7.1	Aims and policy making	• clarity and appropriateness of aims • effectiveness of procedures for formulating policy				

7.2	Self-evaluation	• processes of self-evaluation • monitoring and evaluation by promoted staff • reporting on standards and quality				
7.3	Planning for improvement	• the development plan • action planning • the impact of planning				
7.4	Leadership	• leadership qualities • professional competence and commitment • relationships with people and development of teamwork				
7.5	Effectiveness and deployment of staff with additional responsibilities	• remits and deployment • individual effectiveness • corporate effectiveness				

9. Appendix C: Relative Performance Between Departments

Figure 50: Relative Ratings (RR) Measures



10. Appendix D: The Pupil Profile Application

In this section, it is not the intention to discuss every function or aspect of the application. Rather, the aim is just to give some indication of how teachers use the application and how it helps overcome some of the obstacles to individual and organisational learning discussed in Chapter 6.

10.1 Using in teaching and learning: recursion 0

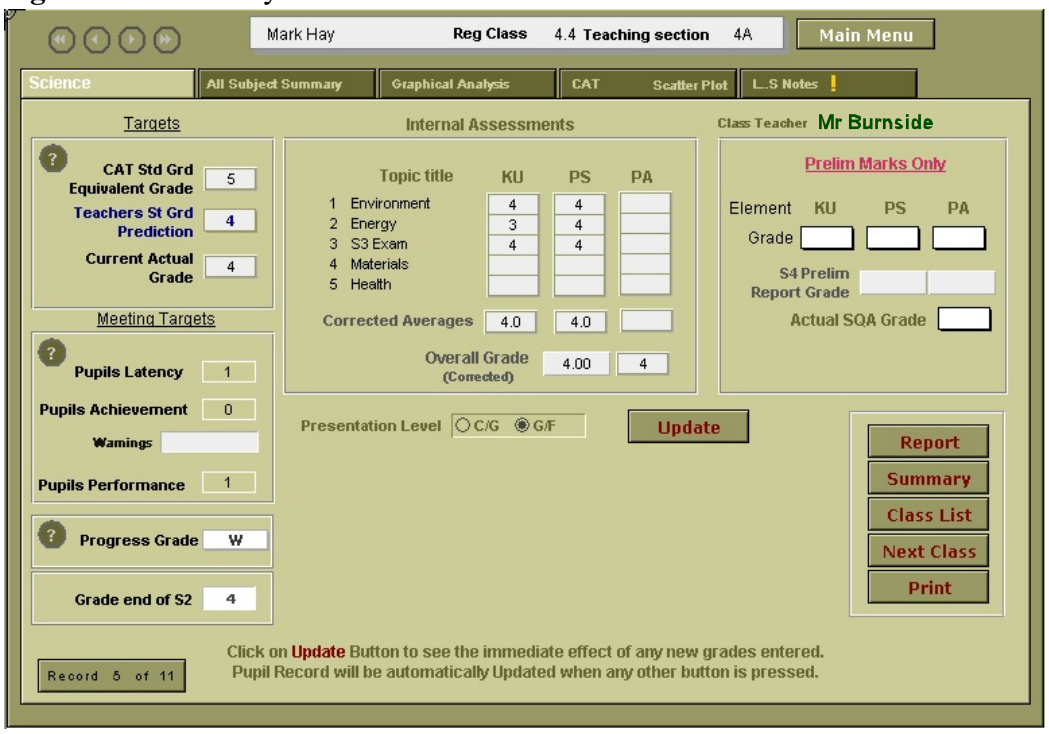
Figure 51 shows a screen shot of the data entry form for Standard Science. Each subject has their own specific form tailored to their own requirements.

The **Targets** section shows the Standard Grade forecast grade automatically predicted from their best CAT results from the tests taken in S1 and S2. It also shows the grade expected by the teacher. The last, shows the current grade at which they are attaining in assessments. This is fully dynamic and is automatically updated following the entry of any grade attained in any assessment. The way this is calculated is appropriate to the subject. At present the form is incomplete, because the individual hasn't finished the course. A separate section is included for **Prelim Grades** so that they stand alone for appeal purposes.

The **Meeting Targets** section automatically calculates the differences between each of these three measurements, in the manner described in figure 41 (page 228). A warning box is provided for alerts if the differences become too large. Some additional sections are included primarily for reporting purposes. There are also buttons to specific subject layouts that display summary data and detailed data for the entire class to enable teachers to see the individual attainment in relationship to others. At the top left are navigation buttons which allow the teacher to scroll through class members.

In use, the teacher following any assessment, enters the result data in each pupil's form. In this respect, the pupil profile represents an enormous mark book holding assessment data for all S3/S4 pupils in all subjects. In this way, a longitudinal profile of each pupil's performance is recorded. The corrected data (i.e. Rounded grades) from each assessed subject element is automatically carried forward into their subject reports.

Figure 51: Data entry form

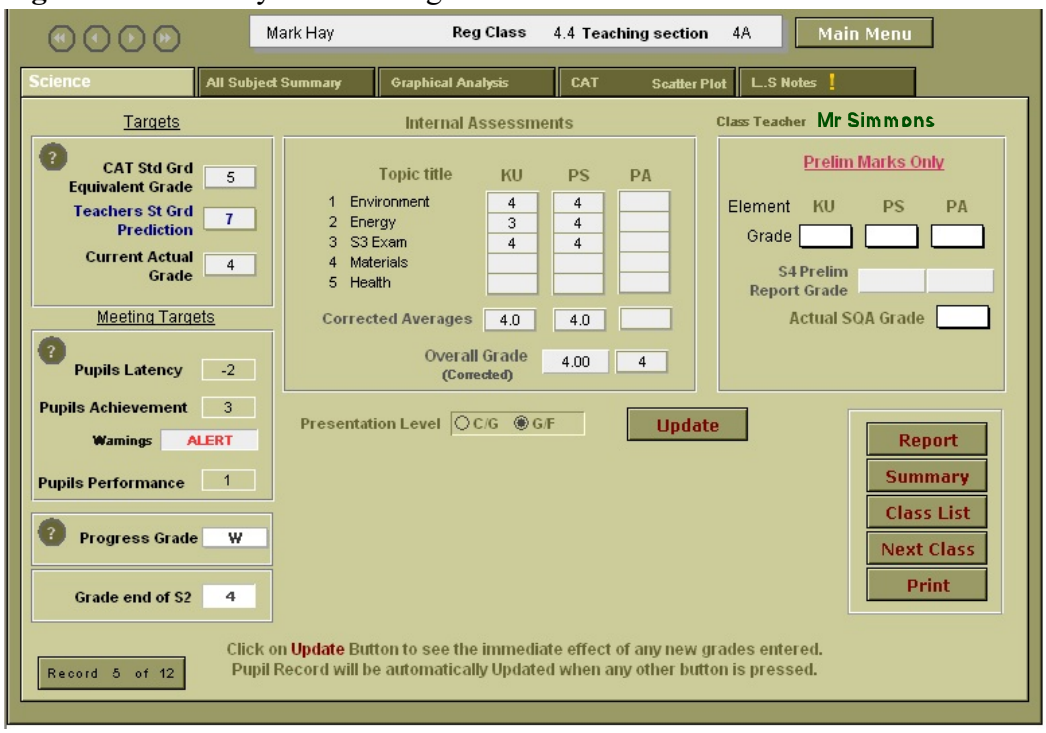


If the gap between Teachers Expectations and the current grade are close, then no action is required and the teacher can continue to enter the result data from other pupils. However, if it becomes too large, an alert is generated. In figure 52, showing the same record as above, The teacher's expectations of future attainment has been temporally amended to a Grade 7. This alert shown would still have been generated if the pupil's performance had fallen below expectations. On the basis of exception reporting, the alert is a trigger to further investigation, for which there are several options, although these can be conducted at any time, whether an alert is generated or not.

10.1.1 Coordinating with others (System 2) - Graphical representation

From research after implementation and in line with the original design intention, the first step used by most teacher to investigate the possible systemic cause of alerts, is to click on

Figure 52: Data entry form showing an alert



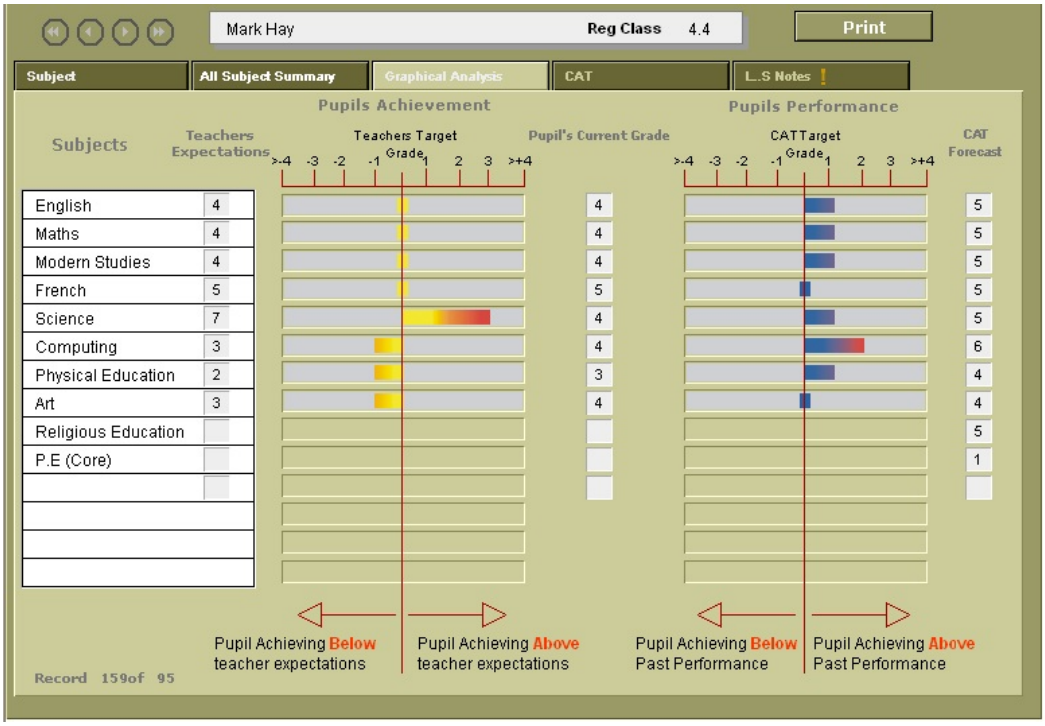
the **Graphical Analysis tab button** lying along the top of the form. This transfers the user to a Graphical Analysis of data from all subjects shown in figure 53.

Figure 53 provides a holistic view of the pupil's performance across all their subjects. It is dynamic, so it only shows information from the subjects taken by the pupil. On the left, yellow bars show the extent to which the pupil is attaining the level expected by the teacher. They become progressively redder, as an increased visual warning, as the disparity between teachers expectations and actual performance increases'. For example, in Science where expectations were lowered to 7, the yellow bar shows that the pupil is performing in actual assessments 3 grades better than expected.

From comparison between expectations in Science and those of other teachers, it is clear that in this case, teacher expectations are unfairly low and are an indication that the teacher should be expecting much more from this pupil. Notice also, the range of expectations. In the top four subjects, the pupil is matching expectations with current attainment, but generally most teachers expect general level outcomes for this pupil, with the exception of Physical Education, where his teacher expects a credit performance, which is not excessively out of line with the actual attained grade. This shows that pupils can be perform

differently across a range of subjects. Like Physical Education, teachers in Art and Computing expect the pupil to perform one grade better than current attainment. As these differences are not too large, they represent in the professional opinion of the teachers involved, stretching but achievable targets.

Figure 53: Graphical Analysis of Performance



On the right-hand side blue bars indicate the difference between the pupils current grade and the CAT forecast grade based on past performance in CAT assessments. As with the yellow bars, they become progressively redder as the difference between the two grades increases. These can be used to identify good performance even in low ability pupils. In Computing, for example, the pupil is performing two grades better than forecast and represents a significant improvement, even though the pupil is performing one grade below that expected by his teacher. In most of his other subjects, the pupil is matching the forecast grade or exceeding his CAT forecast by one grade.

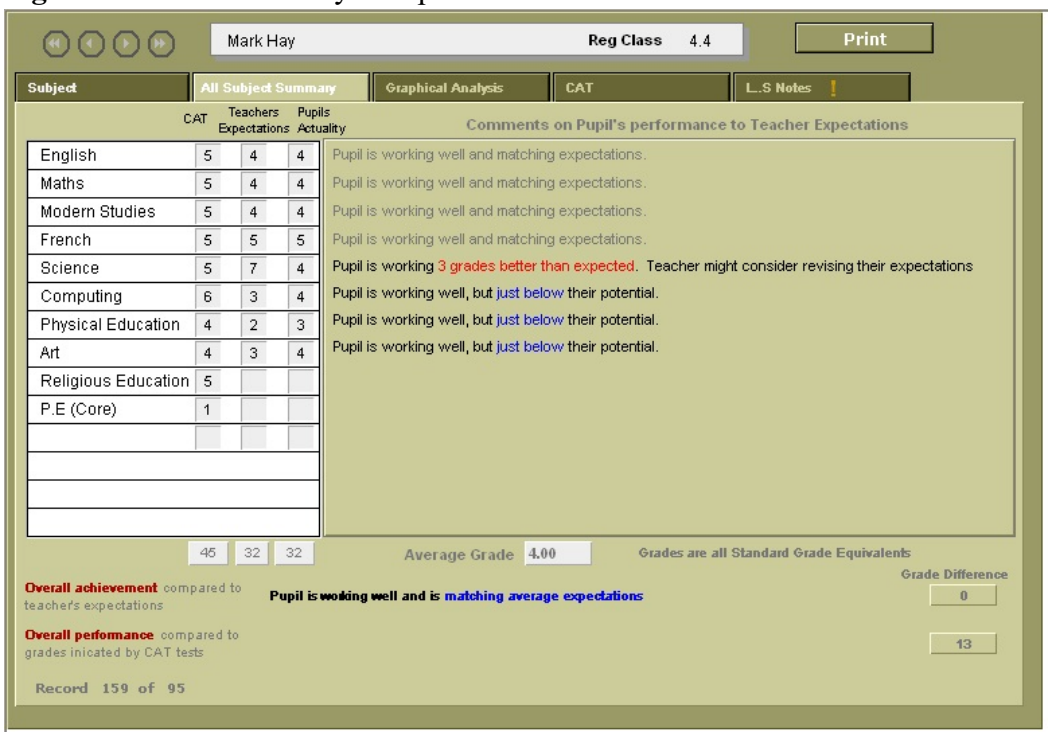
There are no grades for Religious Education or PE (Core) as these are not assessed in Standard Grade terms.

As discussed in Chapter 6, when shown to pupils, teachers have reported that this particular layout has been particularly useful. For the first time pupils can see an overall view across all their subjects. They can identify the level of performance expected by their teachers, they can see that these expectations are realistic when compared to those of other teachers and even low ability pupils can see they can do well relative to their CAT forecast grades.

10.1.2 Coordinating with others (System 2) - text representation

An alternative view of the same data can be seen by the teacher by clicking on the **All Subject Summary tab button**. This view, seen in figure 54 shows similar information as Graphical Analysis form, except that instead of bars, it displays text-based explanations contingent on the difference between teacher expectations and the pupil's current attainment. Looking at Science, the large difference between the expectations and current attainment is highlighted and the dynamic message includes a recommended action for the teacher. At the foot of the form, a comparison is made between the aggregated teachers expectations and the aggregated grades being attained by the pupil. Contingent on the difference, a global statement is generated describing the extent to which the pupil is meeting the targets set by the teacher expectations.

Figure 54: Text based analysis of performance

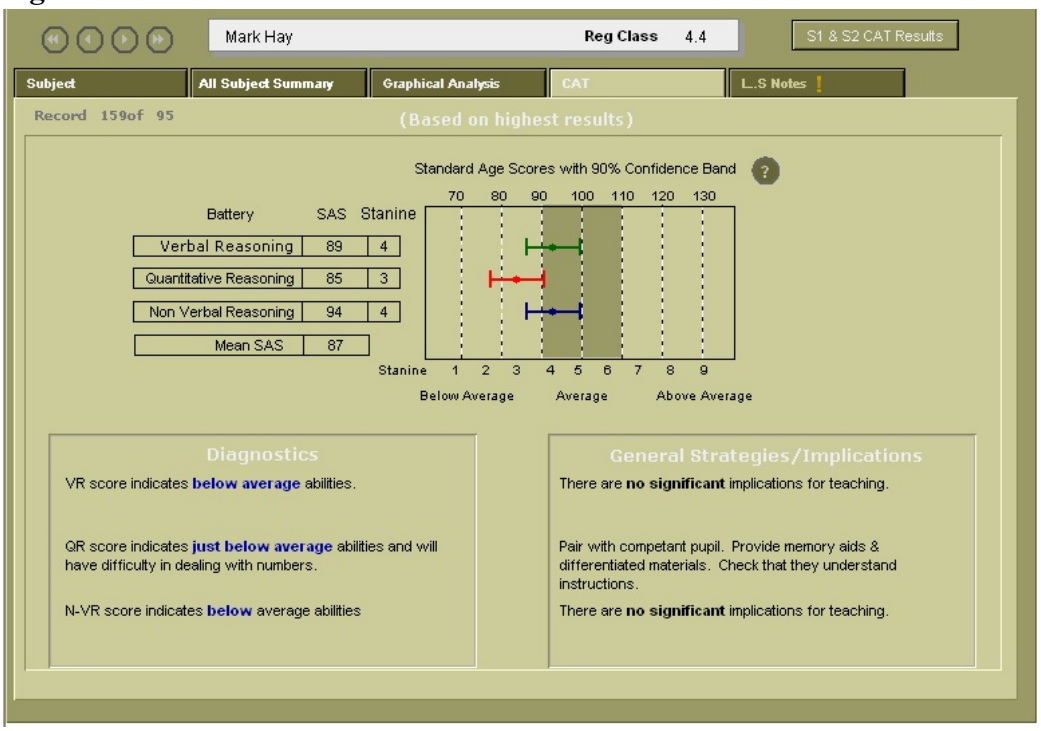


The reason for including this alternative view, is that it was apparent at the research stage, that different teachers responded in different ways to the same information. Some had a distinct preference for number type information and could easily discern patterns in a range of numbers. Others had preference for information presented in graphical format, while others preferred text-based information. It was recognised at that early stage, that successful implementation depended on providing multiple access points to the same information

10.1.3 Cognitive Ability Test (CAT) data

To understand further differences between teachers expectations and pupil actual attainment, teachers can also access each pupils' CAT results by clicking on the **CAT tab button**. Shown in figure 55 are the pupils' best scores in each of the three dimensions assessed in the tests. For short hand purposes Nfer-Nelson divide the range of test values into 9 categories (Standard nines or Stanines). The mean SAS is used to generate the

Figure 55: CAT results

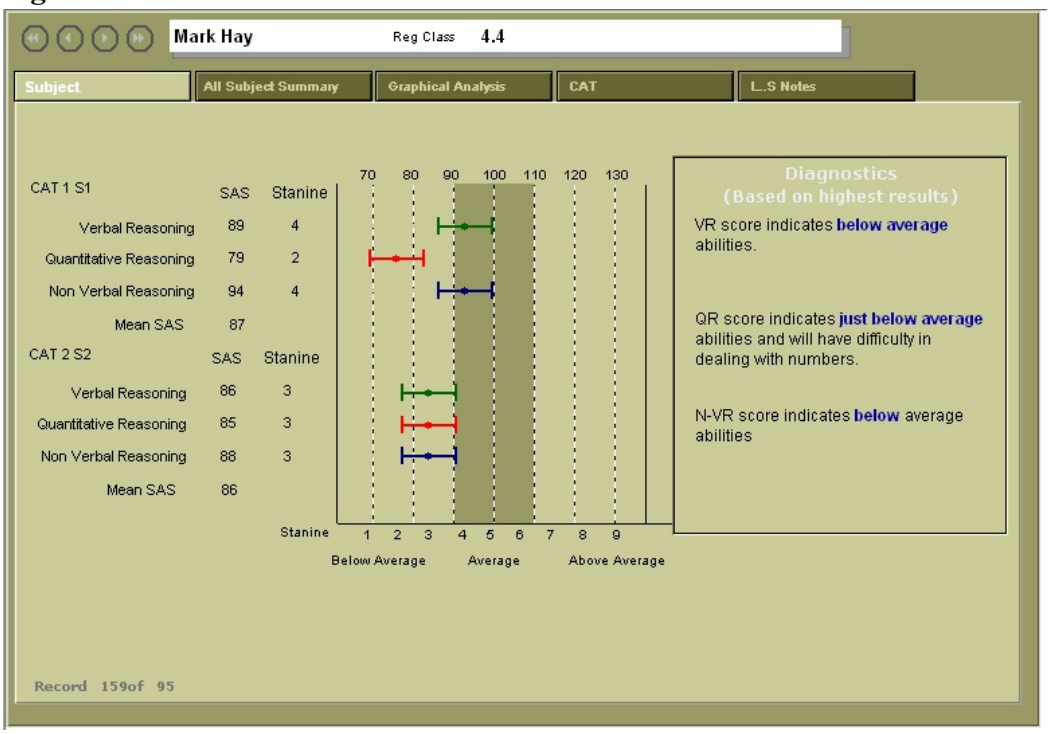


forecast grade for each subject. This data is returned by Nfer-Nelson in large tabular form accompanied by graphs similar to that shown. However to help the teacher, some contingent text-based messages have been built into the profile that explain what the scores mean. To

help the teacher further, each diagnostic message has been paired with additional dynamic massages explaining the implications for teachers and recommending actions they can follow to raise attainment.

For completeness teachers can also access both sets of CAT results by clicking on the **S1 &S2 CAT Results button**. These are shown in figure 56. Only verbal explanations or diagnostics of test results are shown in this display.

Figure 56: S1 and S2 CAT results

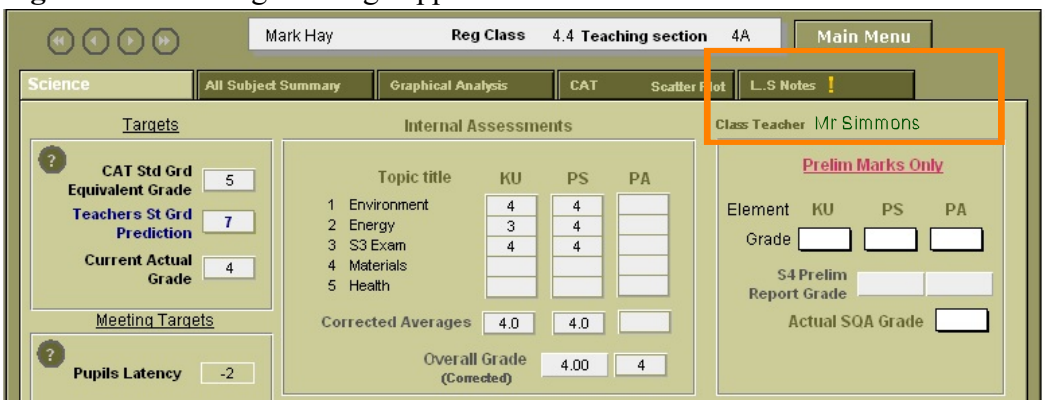


10.1.4 Learning Support

Learning Support notes are a fourth source of information that staff can consult in helping them arrive at a more informed view of a pupil's potential. Consisting of *'soft'* data this is the confidential information about pupils distributed to staff in folders at the beginning of academic sessions. For S1 pupils it mostly consists of information passed from the Primary Schools. As discussed in previous chapters, research had revealed two issues associated with this form of distribution. Firstly and following instructions these folders are often filed away in secure places after first reading, that they often forgotten about. Second and more

importantly there was the issue of how quickly they became out of date and this was undermining the work of the Learning Support department with staff attaching very little significance to the information they provided. Therefore, it became one of the aims at the design stage to include separate files used by Learning Support to manage their records on pupils and link these with the assessment records in the pupil profile. This would allow Learning Support to amend their records in real time without have to reprint and redistribute personal information about pupils.

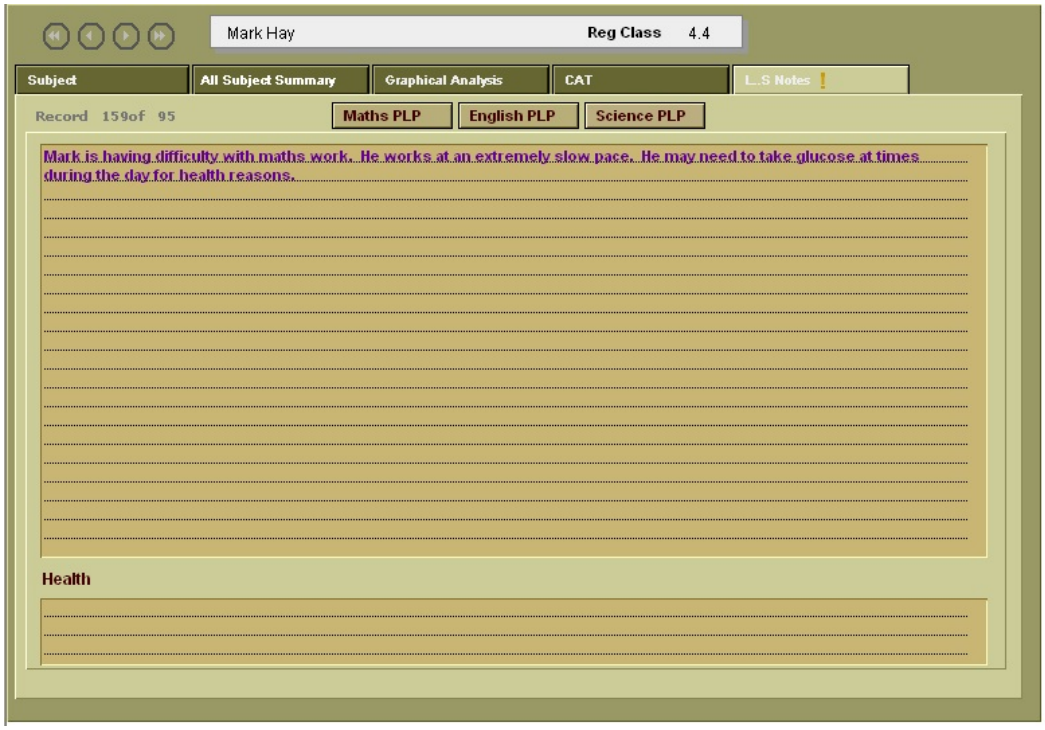
Figure 57: Accessing Learning Support Information



The presence of such information is indicated to the class teacher by an exclamation mark appearing within the **LS Notes tab button** - see figure 57. This is automatically generated, when Learning Support enter information in their own part of the profile. Clicking on this tab, transfers the teacher to a form shown in figure 58.

While figure 58 contains a separate section for Health issues, Learning Support have decided for this particular pupil, his condition impacts directly on how he learns and performs in class. While the example show brief notes, for other pupils information can be extensive, particularly on pupils with recorded needs. It can include notes about their difficulties and techniques and strategies which Learning Support considers will be useful to the class teacher. The screen shot also show links to Maths, English and Science Personal Learning Plans (PLP) which are currently being prepared.

Figure 58: Learning Support information



10.2 Evaluating groups: recursion 0 and 1

So far, the examples have focussed on how the Pupil Profile can be used to by teachers with respect to individual pupils. They have shown how longitudinal information about a pupil's performance can be developed over time, enabling deviations from teacher expectations and in levels of performance actually attained in assessments to be quickly identified to allow for more timely interventions. They have also shown how the teacher can access *'cross case'* information on an individual pupil, ranging from their performance in other subjects together with their other teachers expectations, to information provided by Learning Support, thereby enabling the teacher to reflect on the causes for deviations in performance in their own subject.

The remainder of this section focusses on how the Pupil Profile enables teachers to step back and view a pupil within the context of a group and see the effect of their own actions on a group, either in relation to other groups or to a whole cohort.

10.2.1 Viewing group attainment - graphical representation

Like other databases, the Pupil Profile enables teachers to view and obtain tabular printouts of group information selected according to search parameters entered by the teacher (subject, teaching section, registration class, year group). This information is arranged systemically with the teacher first of all accessing summative information, but then with a single click being able to access a detailed record of assessments that lie underneath the summative current grades. The layouts of these reports are specific to each subject, arranged according to the needs of the department. However, discerning patterns in tabular data can be difficult and so following the principle of making the information more accessible, a graphical representation of group performance was developed.

Figure 59: Graphical display of group attainment

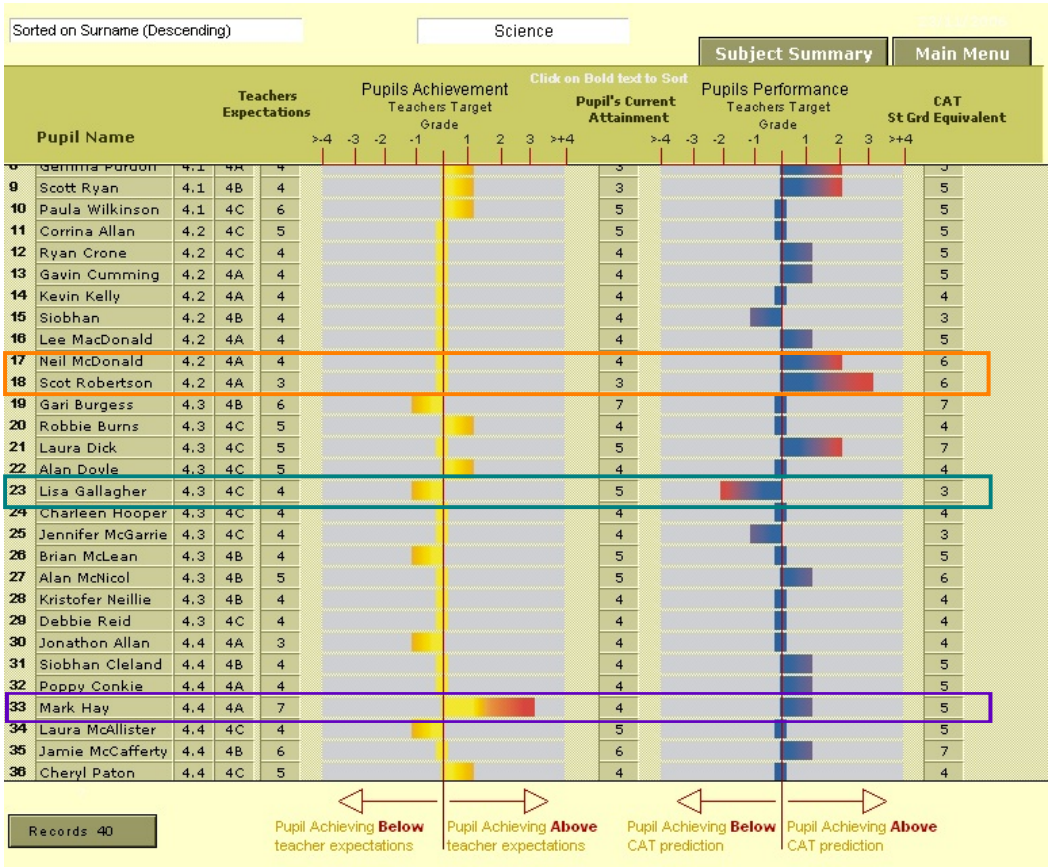


Figure 59 is a screen shot of some the records of pupils taking Standard Science from the graphical display of group performance: in the example, all the fourth years taking Standard

Science. As described earlier, the yellow bars indicate the relative difference between teachers expectations and the current grade, the blue bars, the difference between their CAT forecast grade and current attainment. Following the pupil used in previous illustrations - marked out in the purple/blue box - the artificially low expectations can easily be seen to be unusual in relation to the expectations, both in relation to other pupils within the same group and in relation to the expectations that other teachers have of other pupils. In the example, the pupil is performing 3 grades better than expected. Its worth emphasising that this information is continually available to all in the department, so even if the teacher had missed the discrepancy, a PT or Faculty Head evaluating the level of expectations and performance within the subject, could alert the teacher to the possibility of unduly low expectations.

Figure 59 also shows how effective learning and teaching and hard work of pupils can be identified regardless of levels being attained. Two pupils, marked out by the orange box, are meeting their teacher's expectations exactly. In the usual course of events, perhaps the effort shown by these pupils would be overlooked, especially given that they both exhibit challenging behaviour and they are after all, working to a level expected by their teacher. However, the blue bars indicate that in this class, in this subject they are doing very well. One of them is performing 3 grades better than was indicated by his CAT results. Notice, that the converse is also true. Figure 59 shows one pupil whose performance has markedly deteriorated. Marked out by the green box, is a pupil whose decline in performance, could be easily overlooked. She is after all working at a level 1 grade below the expectations of her teacher, but the blue bar highlights that she is indeed, working two grades below her indicated grade. Reasons for this decline may be complex, related to other events happening in her life, or it may simply be that she doesn't like Science or even the teacher. A clear starting point to identifying possible causes, would be to look at her individual record and see if this decline in the level of performance is reflected across her other subjects. If it is, then an early Guidance parental intervention might be appropriate. If it isn't and isolated within Science or a few subjects, then the issue and possible causes/remedies can be tackled directly with the pupil.

Implied within figure 59 are the systemic ideas that first; the difference between the aggregated teachers expectations and the aggregated current levels of attainment provide a

measure of teacher expectations. And second, the difference between the aggregate of actual attained grades and the aggregate of CAT forecast grades provide a measure of the educational value added by the teaching. These ideas are illustrated later in more detail in the section on Planning Support.

10.2.2 Viewing group attainment - text-based representation

In the same way as teachers can access text-based descriptions of individual pupil performance, teachers can switch to text-based descriptions of group performance by clicking on the **Subject Summary tab button**.

Figure 60: Text summary of group attainment

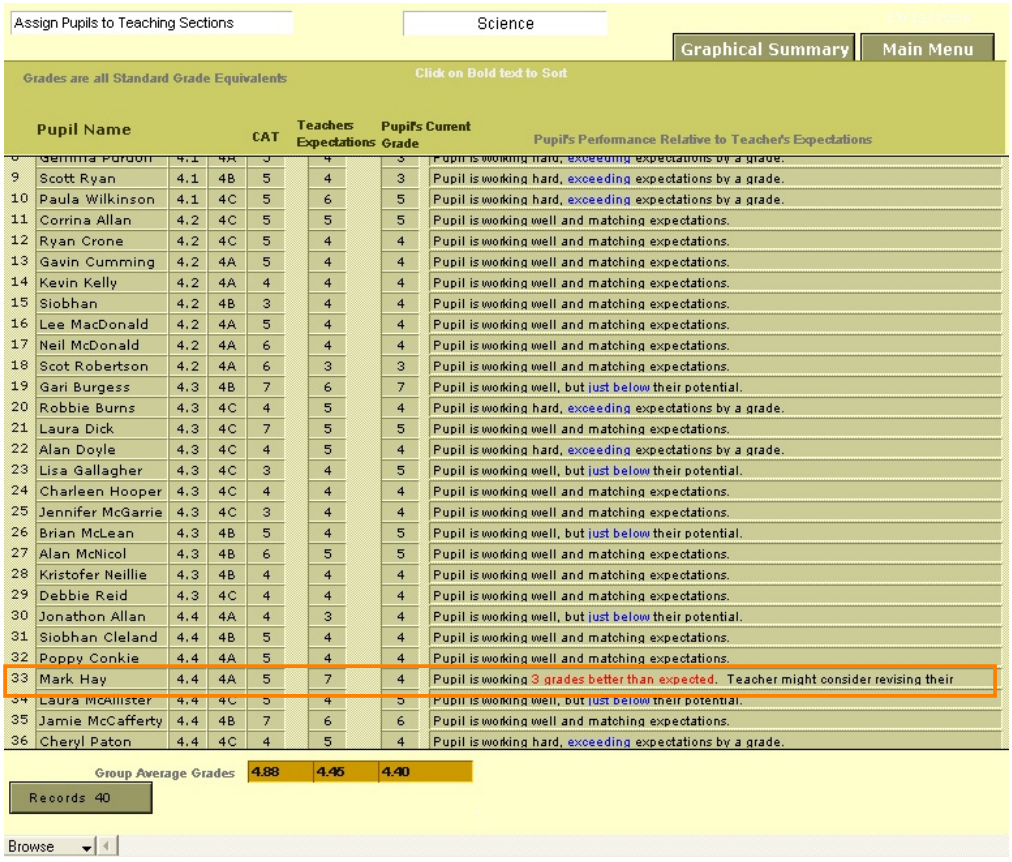


Figure 60 shows a sample screen shot of the text summary of the Standard Science group with text explanations of the difference between teachers expectations and current attainment. Coloured text is used to highlight pupils with significant differences to enable

quick identification of pupils.

Shown in the foot of the report are group averages of each of the three measurements maintained on each pupil. Currently these pupils as a group are performing 0.48th of grade better than indicated by their group CAT average grade: Rounded to the nearest whole grade, this represents a 1 grade difference. Taking into account my artificially depressed expectations, pupils are performing as a group 0.05 of a grade better than their teachers expect, but teachers still expect them to perform better in the future as a group than that indicated by their CAT results, derived from past performance.

10.2.3 Planning Support

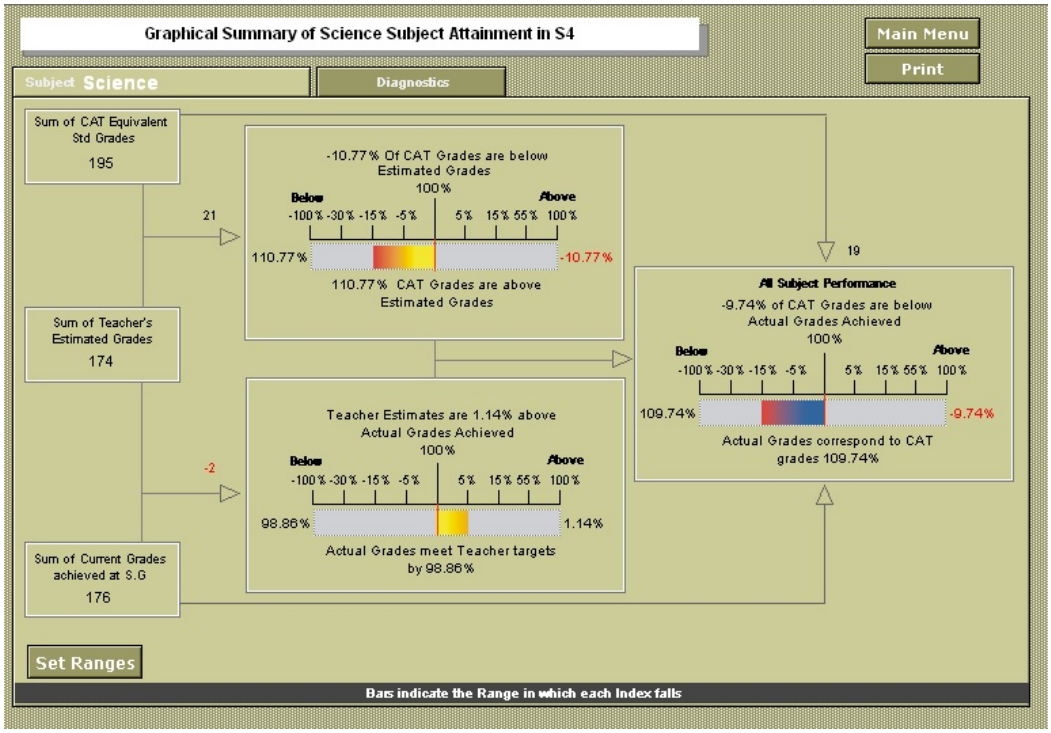
One of the aims in the development of the Pupil Profile was to make a connection between what teachers actually do in the class room with outcomes, in order to compensate for some of the weaknesses inherent to STACs data: briefly, STACs is based on historical data; assumes a connection between cohorts, where year groups can vary considerably from one year to the next; lacks the ability to take into account baseline information; expresses monitoring information in difficult to understand statistics and arrive after the event. All issues which make it difficult for teachers to see objectively how what they do, contributes to final pupil outcomes and consequently plan for improvement.

To do this, the Pupil Profile uses ideas implicit in the previous sections which have illustrated how teachers can use the Pupil Profile to view individual performance within the context of selected groups, and see how the effect of their teaching and the hard work of pupils has raised their attainment levels beyond those indicated by their CAT forecast grade.

Figure 61 shows a screen shot of how the Pupil Profile relates each of the three measured grades to one another for a selected group at subject level. Essentially, the system sums the grades and calculates the percentage difference between them, which is then used to generate a graphic representation of the difference in three dimensions. As with other displays, the bars become increasingly red as the disparity between each of the two measurements increases. For a general rule, the lower the sum of the grades, the higher or better the level of group performance in each dimension.

Following the same Standard Science group used in previous sections, the top bar shows the difference between teachers expectations represented by the central red line and CAT forecast grades. The example shows that for the selected group, teachers[11] expect them to perform 11% (10.77%) better in the future than a level indicated by a base line test. If the converse was true, teachers as a department might start to question why they are expecting them to do worse now than at a level indicated by something done in the past. It could be for example, that what was done in the past bears no relationship to teacher expectations and perhaps overestimates pupil abilities.

Figure 61: Planning Support, measuring the difference



The bottom bar compares teachers expectations to actual attainment represented by the vertical red line to the current actual grades attained in assessments. In this case, teachers expect them as a group to perform 1% (1.14%) better in the future than their indicated current level of attainment. If the gap were excessively large, teachers as a department

[11] For the sake of completeness, the artificially depressed teacher expectations used to highlight conditions in relation to a particular pupil have been corrected to an expected grade 3.

might start to reflect on the achievability of their expectations. Again if teachers expected them as a group to do worse in the future, they might begin to question the underlying cause. It could be for example, that the assessments used, over estimate pupils ability.

The third bar on the right, compares the sum of the forecast CAT grades to the sum of the actual grades attained in assessments as indicated by the red line. Figure 61 shows that as a group, the level of CAT Grades are 10% (9.74%) below the level attained by the group. Or, in another way, the group are performing 10% better than a level indicated by an historical test. In other words, teaching and learning has added 10% of value to overall group attainment. Once again, a large disparity would cast doubt on the relationship between CAT forecast grades and Standard Grade Assessments and should trigger reflection on the underlying causes. Similarly if the pupils performed better in the historical dimension as indicated by the CAT forecast grades, teachers should begin to question why pupils performed better in the past than they are achieving now.

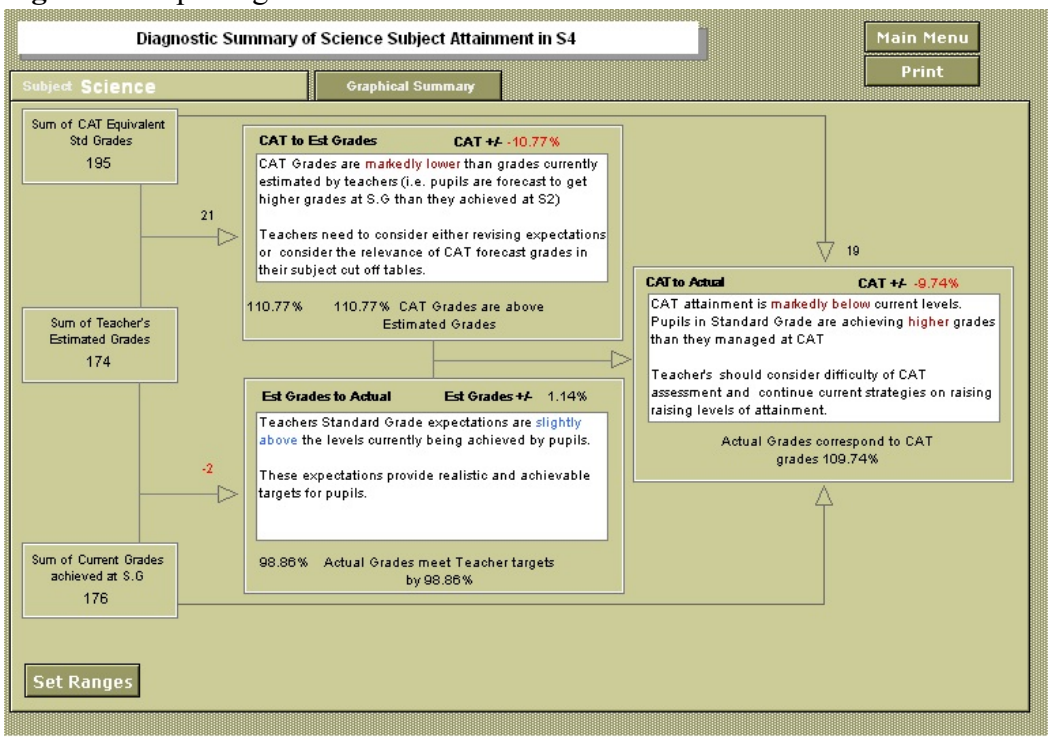
To help teachers understand some of the implications implicit in the three indices represented by each of the bars, teachers can switch to a diagnostic summary which provides a text-based interpretation of the results. Each of the diagnostic messages shown in figure 62 are completely dynamic and change according to the difference between each part of the ratio, the boundaries of which are determined by a sensitivity range set by the department.

Arriving at overall interpretation of the results requires taking account all three messages. From the diagnostic messages shown, teachers expectations show a close correlation to actual attained grades demonstrating that they are realistic. This close relationship between expected grades and actual grades attained also supports the view that the assessments are valid in identifying appropriate levels of performance. The fact that there is only 10% difference between actual grades attained and forecast grades supports the relationship between the two. Chiefly, that CAT grades are valid and that teaching has *'added value'* to pupils learning.

Note that the relationship between the three measures are such, that it makes it very difficult to use *'pokelers constant'* to achieve more favourable results. For example artificially

raising teachers expectations to high levels to demonstrate high staff expectations calls into question the achievability of targets. Similarly, depressing pass marks in assessments to achieve higher assessment grades is shown up when compared to CAT forecast grades. Independent evaluations of the Nfer-Nelson CAT programme and the validity and reliability of the Pupil Profile for presentation to the HMIE have demonstrated the reliability of this method.

Figure 62: Explaining the difference in each ratio



Note too, that all this information is generated from pupil level data and can be generated in real time, i.e. following any new assessment. And although, the implications of each ratio can be difficult to take in, the underlying maths is such, that they can be easily understood and traced back to the original data.

10.3 Evaluating Departments: recursion 2

As well as enabling teachers to step back from individuals to see individuals within the context of groups, the Pupil Profile enables teachers to step further back and see their

subject within the context of overall school performance. Using the same principles described in earlier sections, grades in each of the three dimensions are summed and the differences evaluated across a year group and within subjects. An example of this method of analysis is briefly discussed in the next section. However, perhaps more usefully, certainly to the SQA coordinator, is the ability to generate progress summaries of actual grades being attained by all pupils within in selected cohorts or groups, together with an analysis of how the school is progressing as whole towards meeting key targets. Producing similar summaries by hand used to take the SQA coordinator a few hours to collate and analyse departmental returns and they would frequently contain errors. Now, generating these summaries can be completed in minutes. They can be generated in real time as required and can be generated retrospectively, i.e. following the entry of final SQA grades, progress summaries can be generated to show the level of attainment at S3 and at the Prelim stage to examine changes in the level of attainment. Although these summaries were regularly distributed by the DHT, access to them within the Pupil Profile was initially restricted to members of the SMT. However, following presentations made to the Learning and Attainment Committee, essentially a user group consisting of Faculty Heads and PT's, output from the Pupil Profile have been incorporated into the schools' quality assurance program and the Pupil Profile is being adapted so that all teachers will have immediate access to this facility.

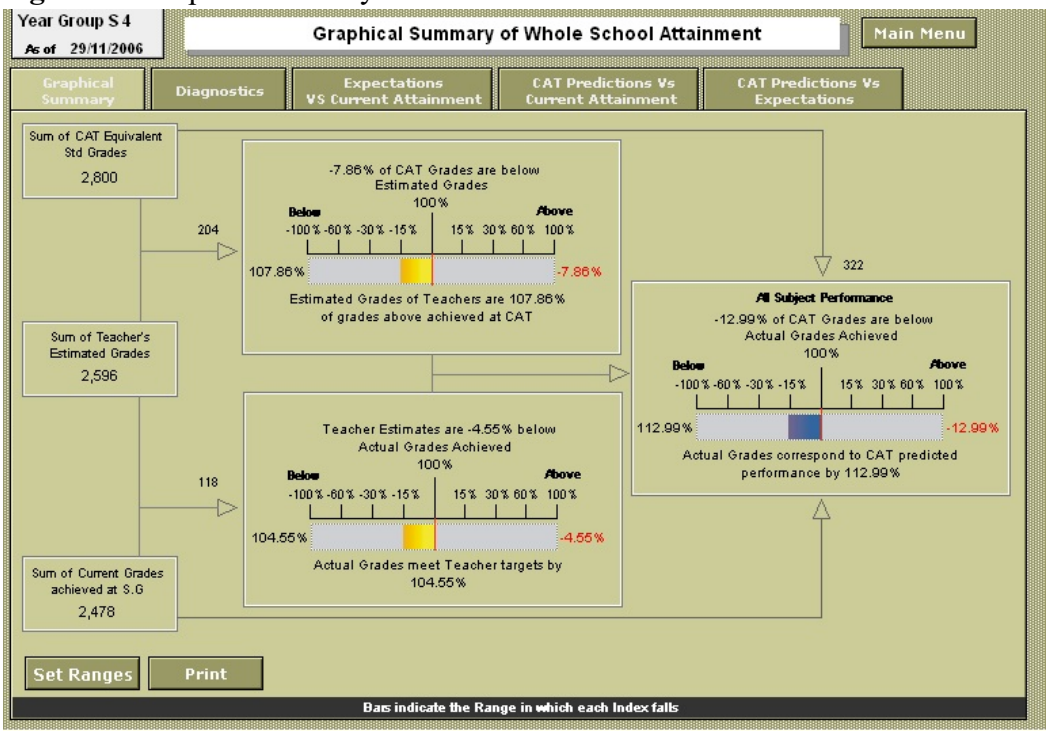
Containing the assessment records of all the pupils over several years, the Pupil Profile has become a rich source of data and the application, with the ability to separate out particular pupils for comparison purposes, can itself act as research tool. For example there was considerable debate over a *'mentoring'* programme introduced to raise pupil attainment. This is where volunteer pupils are assigned to members of staff, who in their own time advise pupils, on a one to one basis on the *'best'* ways to study and encourage them with their work. As this involved a considerable time commitment by staff, there was considerable debate over the effectiveness of the programme and the time the programme should start. Prior to the introduction of the Pupil Profiling application, debate was primarily grounded within individual staff experiences with their assigned volunteer pupils and polarised around three viewpoints, displaying aspects of *'superstitious'* and *'ambiguous'* learning: those that thought it had no effect, those who thought it had an effect and those in between who considered that the critical factor was the way that the mentoring

was given. Following the introduction of the application, the Pupil Profile has been used over several sessions has been used to compare the attainment of *'mentored'* pupils with control groups and has been able to show that in Burnview for the greatest effect, mentoring needs to start in S3 and that the later it begins the less the effect. While this appears a common sense conclusion, it hasn't always appeared clear cut to staff and the Pupil Profile has been able to provide empirical evidence.

10.3.1 Planning Support at whole school level

Using the same principles used in earlier examples, figure 63 shows an evaluation of S4 at the level of the whole school in the three dimensions of CAT forecast grades (past), teachers' expectations (future) and currently attained grades (present).

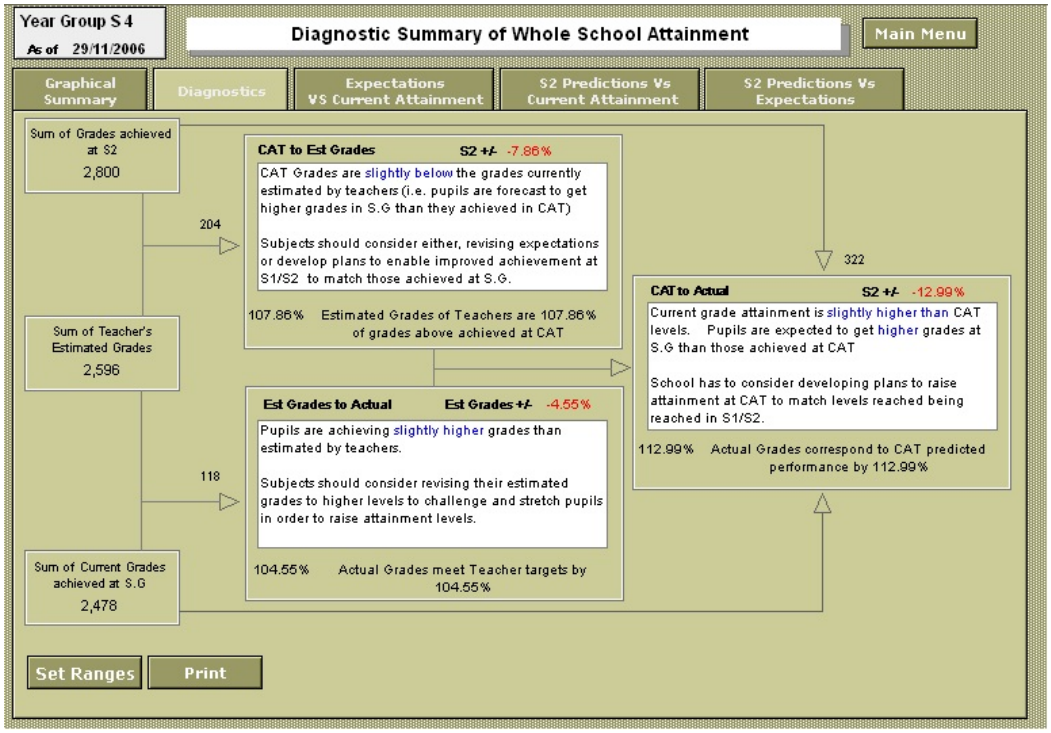
Figure 63: Graphical summary of whole school measures



From the information shown, teachers' in all subjects expect all pupils to do 8% (7.86%) better in the future than the level indicated by the total of the CAT grades. Even so, pupils as a year group are performing above teachers expectations to the extent of 5% (4.55%). In other words, the analysis shows teachers as a group do not have high enough expectations of

what the pupils can actually do. For some reason, teachers' expect them as a group to do less well in the future, despite the fact, that the *'value added'* evaluation shows the pupils as a group are exceeding their CAT forecast grades by 13% (12.99%). A text based diagnostic interpretation of these results are shown in figure 64.

Figure 64: Diagnostics of whole school measures.

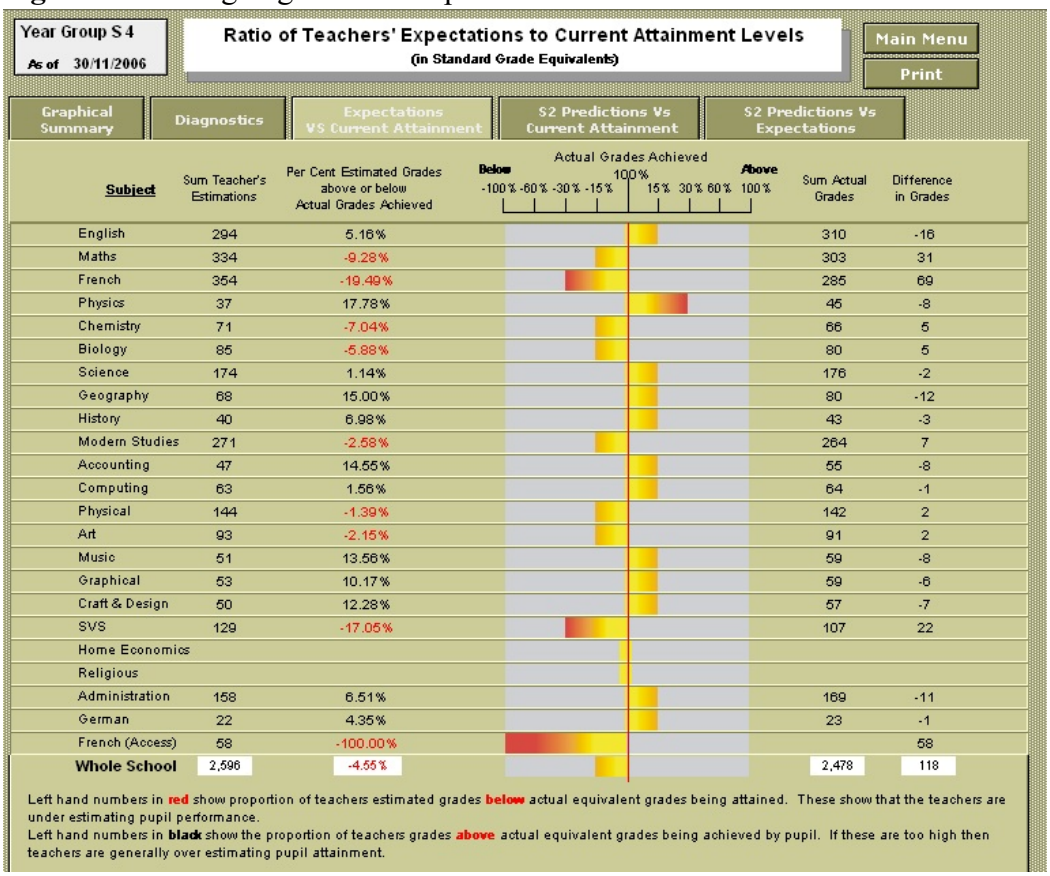


With regards to low teachers' expectations, it could be inferred that low expectations represent an issue to be tackled at the whole school level. Alternatively these low expectations could be confined to a few departments and reflect an issue just for them. Deciding on these two options is a matter of looking at other displays.

Figure 65 compares teachers' expectations to the level of actual grades attained - represented by the vertical red line - for each department. From this, it can be seen that the low level of expectations at whole school level is derived mostly from the French(Access) course, which doesn't require the teachers to enter a level of future performance in Standard

Grade terms[12]. Nevertheless, the lower teacher expectations in French (-19.5%) and Social and Vocations Studies (-17%) relative to actual attained grades would appear to be significant and consequently, worthy of further investigation.

Figure 65: Investigating teachers' expectations to current attainment.



Year Group S 4
As of 30/11/2006

Ratio of Teachers' Expectations to Current Attainment Levels
(in Standard Grade Equivalents)

Main Menu | Print

Graphical Summary | Diagnostics | Expectations VS Current Attainment | S2 Predictions Vs Current Attainment | S2 Predictions Vs Expectations

Subject	Sum Teacher's Estimations	Per Cent Estimated Grades above or below Actual Grades Achieved	Actual Grades Achieved (Below -100% -60% -30% -15% 100% 15% 30% 60% 100% Above)	Sum Actual Grades	Difference in Grades
English	294	5.16%		310	-16
Maths	334	-9.28%		303	31
French	354	-19.49%		285	69
Physics	37	17.78%		45	-8
Chemistry	71	-7.04%		66	5
Biology	85	-5.88%		80	5
Science	174	1.14%		176	-2
Geography	68	15.00%		80	-12
History	40	6.98%		43	-3
Modern Studies	271	-2.58%		264	7
Accounting	47	14.55%		55	-8
Computing	63	1.56%		64	-1
Physical	144	-1.39%		142	2
Art	93	-2.15%		91	2
Music	51	13.56%		59	-8
Graphical	53	10.17%		59	-6
Craft & Design	50	12.28%		57	-7
SVS	129	-17.05%		107	22
Home Economics					
Religious					
Administration	158	6.51%		169	-11
German	22	4.35%		23	-1
French (Access)	58	-100.00%			58
Whole School	2,596	-4.55%		2,478	118

Left hand numbers in **red** show proportion of teachers estimated grades **below** actual equivalent grades being attained. These show that the teachers are under estimating pupil performance.
Left hand numbers in **black** show the proportion of teachers grades **above** actual equivalent grades being achieved by pupil. If these are too high then teachers are generally over estimating pupil attainment.

Again, the Pupil Profile is not intended to provide answers. Instead, the aim is to provide a focus for further investigation with evidence.

10.4 Advising and improving information to pupils:

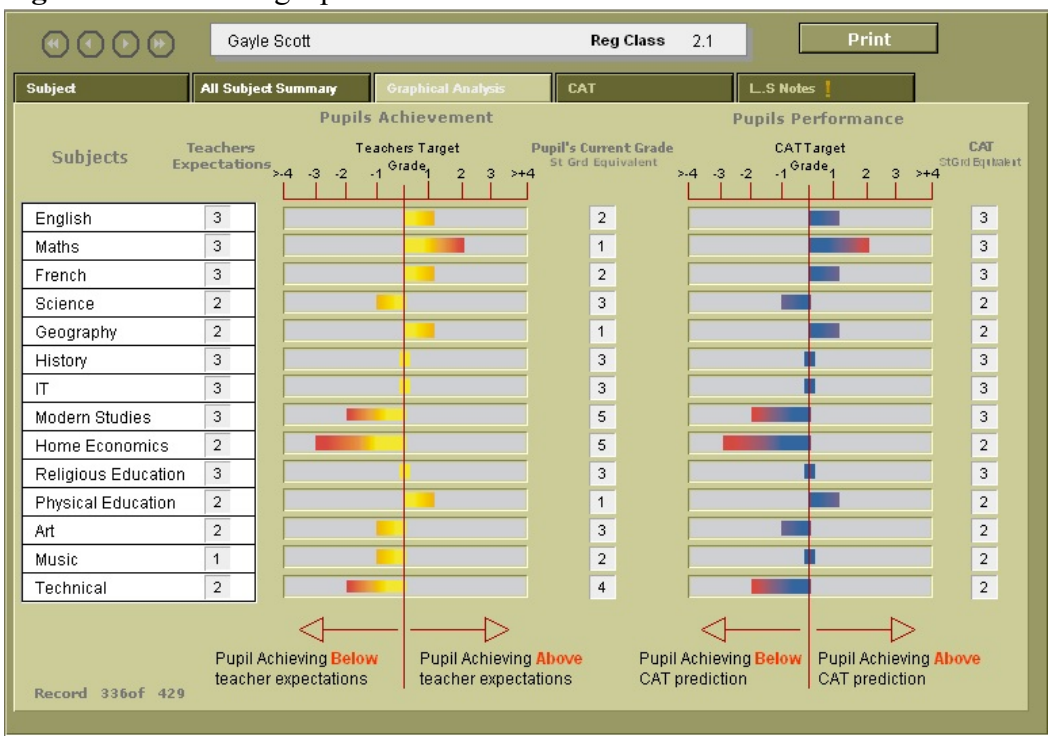
One intended result of the Pupil Profile has been to introduce greater consistency and consequently greater fairness in assessment. It was found at the research stage, prior to its

12 This represents a flaw in programming which has to be addressed. It is only included because it was new course option for entry in S3. Notice that for Home Economics and Religious Studies which both offer established Intermediate courses, the effect is neutral.

introduction, different members of departments were assessing pupils within the same cohort differently, using different instruments and different criteria. This was especially true in S1 and S2 courses which lacked external SQA guidance and moderating processes. Now, with the imperative of having subject specific cut off tables embedded within the Pupil Profile, departments have had to take a collective view of the assessment methods used, and the criteria which pupils have to meet in order to attain a certain grade. Because these are coupled with reports, this has led to much more accurate reporting to pupils and parents, with less risk of the *'halo'* effect in which pupils who behave or present well, receiving unintentionally, over inflated grades and vice versa for pupils who behave less well or who aren't perceived as articulate or well presented.

The improved quality of information with the three measures triangulating on the pupils potential for subject, together with equality in the information provided, enable improved guidance at option choice times. At S2 and S4 option choice time, Guidance teachers can use the graphical display of showing attainment in all subjects. An example of an S2 record is shown in figure 66.

Figure 66: Considering Option choices.



These help, and experience has shown using this display with pupils, that they provide a focus to discussions. Less career focussed or less articulate pupils appear to find it difficult to offer a rationale for their choices. For example Home Economics in figure 66, where both the CAT forecast grade and the teacher's expectations suggest an aptitude for subject, actual pupil attainment is three grades below. This might suggest the pupil has failed to engage with the subject content. Modern Studies and Technical are other subjects that show similar patterns and it may be the case, that the pupil would be unwise to select them as Standard Grade options. The pupil, is of course, free to make their own choices, but at least with this kind of information they are making it from a more informed viewpoint. While subject teachers have access to their own departmental summaries, they can gain a broad overview of each individual attainment across all subjects through progress summaries, both in terms of actual current attainment and CAT forecast grades.

A similar approach is followed with S4 pupils at the times of their S5 option choices. However, the opportunity for making inferences from their graphical summary record are very much reduced. First, pupils may be interested in courses not studied at Standard Grade and therefore have no *'history'* to consider when making choices. Second, courses exist at multiple levels and finally, outcomes are expressed in terms different to those at Standard Grade. But following the methodology described in Chapter 6, it is possible using each pupils the SGPA to produce similar reports containing probable outcomes across multiple levels in the same subject. A few examples are provided overleaf.

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Annexe

1. *"… Craig 'should have sent down the road' for that. I mean for God's sake, he was caught red handed with half the pencils from the English Dept in his bag* ***and*** *he'd virtually cleaned out the Math's Dept. But he's still here. What does it take to get excluded around here!" (PT PE, BA)* (Page 138)

2. *"In Craig's case, we had him bang to rights. We caught him at the end of the school day. We had his bag full of stolen pencils. He had his pockets full of rubbers and other things he had nicked from Maths. We also had witnesses who saw him doing it. We kept him in the boss's office* [Head teacher] *until a parent could be brought in for the exclusion. But when his dad finally arrived at 4.30, he just claimed that we had detained his son without permission and would take us to Scotland Street* [LEA Headquarters]. *Since this was true, although we had been trying to get someone to school as soon as we'd caught him, we had to let that one go." (AHT, BA)*. (Page 139)

3. *"Sometimes exclusion can make matters worse and provoke the child into even more extreme behaviour. With David M, his dad is supposed to suffer from Gulf War Syndrome with a history of violence. If I send him home, I know his dad will knock him around badly." (AHT, BA)*. (Page 139)

4. *"… an opportunity to talk to intelligent life forms"*. (Page 140)

5. *"I know Peter is a bright boy and would have no trouble with the work. But I don't want him in my class because he would do nothing but disrupt the work of others" (Computing Teacher, BA)*. (Page 142)

6. *"I don't think Guidance read our course requirements. I told Guidance, that anyone below E in maths, would really struggle, especially with programming. But when I spoke*

to 3E, half of them said their Guidance teacher told them to choose computing and they're all at level D. I think that Guidance just choose us as a dumping ground for all the misfits." (Computing teacher, BA) (Page 143)

7. *"We share a column with Physics and all the brighter kids are going to choose that as their second science with Biology or Chemistry being picked from the other column. As a result, we are going to be left with all the numpty's" (PT Business Studies, BA)* (Page 143)

8. *"Some of these people should not be doing academic subjects at all, they would be better off and probably enjoy it more, if they were doing something more vocational instead. They should expand the technical department and learn brick building or plumbing just like we used to." (PT Art, BA)* (Page 143)

9. *For example you get first years calling older pupils names. Eventually, under provocation they snap and give the pupil a belting. Next thing you have, is a first year snivelling at your door, complaining about being bullied. This kind of thing, has been a real problem this year and we have even warned S1 not to do it in assemblies, but they still persist in doing it and we still have to investigate it. You also get kids who almost enjoy playing the role of victim. Its almost as if they go around with 'please kick me' on their backs. For some of them, undoubtedly it's a way of gaining attention, from both other kids and teachers. They know if they say they are being bullied, they are going to get me and John* [AHT] *running around with themselves at centre of all this attention. I can't tell you how much time I've spent on Stewart, but whatever happens, its never his fault: but we always have to look into it." (Guidance, BA)* (Page ?)

10. *"Social Inclusion is going to cause us immense problems, and whether you or I think it's a good idea or not - and I tend not to - doesn't matter. At the moment, with this government, it's the only game in town and we are just going to have to learn to live*

with it". (HT, BA) (Page ?)

11. *"If you didn't have to teach them, most of these kids are OK. They really can be quite pleasant, even Andrew X. It's only when you try to get them to work; to challenge their comfort zone, that they turn into kids from hell" (Art Teacher, BA).* (Page 157)

12. *"God, 3A are thick. I swear that they get thicker with every passing year. One or two might get general, if they're lucky; the rest are all foundies at best* [Foundation Pupils]*." (PT Social Subjects, BA), "I thought the fourth years were dense, but this current crop of second years make them all look like Einstein's."* are fairly typical comments. (PT Physics, BA) (Page 158)

13. *"Inclusion, Pah! I'd like to see how they react when told to Fuck off, or deal with the likes of Craig M when he goes on the rampage." (PT History, BA)* (Page 173)

14. Departments approach the exercise extremely reluctantly, often in the last few minutes of a meeting, enter information that is deliberately ambiguous and anticipate what they believe the head teacher and the authority want to hear. (Page 173)

15. *"Our problem as members of the SMT is trying to convince staff that these changes are necessary and that we have no choice but to push them through. For example, I had an English teacher tell me the other day, that he couldn't teach a child with a record of needs, because it took up too much of his time at the expense of others in the class. As far as he was concerned, if this child couldn't read nor write, then he needed specialised attention, but if he was going to be in his class, then as long as he was quiet, he was content to leave him alone. I had to explain to him, and I know its really difficult, that its no longer acceptable to do that anymore; that he has to learn how to deal with these children and that we are obliged by law to accept these children and that we have to do the best for them that possibly we can." (AHT, BA). .* (Page 173)

16. According to the head teacher *"... we replaced Modern Studies with CSS* [Contemporary Social Studies] *because we felt it was more suitable for the type of our intake. In particular, the nature of the practical portfolio work made it very difficult for them achieve good grades." (HT, BA)* . (Page 191)

17. *"Lets get off this shit and onto something more useful." (PT Social Subjects, BA)* was a typical view shared by many staff. (Page 194)

18. *"Joan* [PT Mod Lang] *was called to his office last year to explain some of her low ratings. From all accounts, she and the boss had a blazing row because she refused to change her mind. And it's not often that the boss gets angry, but when he does, you certainly know it." (PT Physics, BA)*. (Page 195)

19. *"These chalk board failures come into your class room with their pre-conceived notions and expect to see things like group working and interaction. I'd like to see them do it with my standard science knuckle trailers. Seriously, they can't be civil to one another for longer than five minutes and even then I'm being generous. Get them in, get them working; don't give them an opportunity to snipe and pick at one another and you just might achieve something." (Science Teacher, BA)*. (Page 202)