The relationship between the cognitive style(s) and preferred teacher style(s) of PGCE students

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The Relationship Between the Cognitive Style(s) and Preferred Teacher Style(s) of PGCE Students

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Abstract

To a greater extent the nature of the relationship between the cognitive style of a student teacher and their predominant teaching style in the classroom has been ignored by educational research. To pursue this line of research, an opportunist sample of 84 student teachers (n: m = 23, f = 61), studying for a one year full time Post Graduate Certificate in Education in a range of subject specialist areas (Geography, Classics, Science, Physical Education, Modern Foreign Languages, Mathematics and Religious Education), based at a single English university, was used. The age of the students ranged from 20 to 48 years.

In order to determine their preferred cognitive and learning styles, all student teachers completed the 'Cognitive Styles Index' (Allinson & Hayes, 1988), the 'Approaches to Studying Inventory' (Entwistle & Ramsden, 1992), a 'Learning Preferences Questionnaire' adapted from Riding and Read, (1996), as well as questions on attitudes towards teaching and learning. In addition, 55 of the student teachers completed a computerised version of Riding's 'Cognitive Styles Analysis' (1991). Consequently, on the basis of their more extreme cognitive styles, 25 of the students were selected to participate in semi-structured interviews. Of the subject specialist mentors assigned to each student, 77% (n = 59) completed a questionnaire on their perceptions of the teaching style of their PGCE student.

Statistically significant differences in approaches to learning and teaching were identified using two-way between-groups ANOVAs; the following results were found: a) an interaction effect between cognitive style and gender was identified with analytic-verbaliser males demonstrating a greater preference for tutorials as a preferred mode of learning; b) an interaction effect between cognitive style, age and teaching style was found, with 25-29 year-old wholist-imagers teaching in the most intuitive style; c) main effects for gender and cognitive style were found: male wholist-imagers demonstrated the most wholist approach in the classroom and analytic-verbaliser females displayed the most analytic teaching style; d) a gender effect, with males showing a greater preference for presenting to others and females demonstrating a greater preference for working alone. Using Pearson Product-Moment correlation and t tests, verbalisers were identified as adopting a more analytic approach in the classroom compared to imagers.

The qualitative analysis identified differences in approaches to teaching between the students with 'more extreme' cognitive styles; further research is recommended to verify such findings. In this respect, a longitudinal study focusing on changes in cognitive style and approach in the classroom could be fruitful. Within the extreme group, the students' attitudes to teaching reflected their cognitive style; however, their teaching generally mirrored the way in which they were taught in school and at university. Consequently, it is recommended that universities need to adopt teaching and assessment tools that are increasingly varied in order to accommodate all cognitive styles.

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Declaration

The material contained in this thesis has not previously been submitted for a degree in this or any other university and is solely the work of the author.

Statement of Copyright

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Abbreviations

ALIS	Advanced Level Information Systems
ASSIST	Approaches and Study Skills Inventory
ASI	Approaches to Studying Inventory
ATL	Association of Teachers and Lecturers
CEM	Curriculum, Evaluation and Management Centre
CSA	Cognitive Styles Analysis:

AB	Analytic-bimodal
AI	Analytic-imager
AV	Analytic-verbaliser
IB	Intermediate-bimodal
II	Intermediate-imager
IV	Intermediate-verbaliser
WB	Wholist-bimodal
WI	Wholist-imager
WV	Wholist-verbaliser

CSI	Cognitive Styles Index
DfEE	Department for Education and Employment
DfES	Department for Education ad Skills
LPQ	Learning Preferences Questionnaire
NACCCE	National Advisory Committee on Creative and Cultural Education
QTS	Qualified Teacher Status
RASI	Revised Approaches to Studying Inventory
TSQ	Teaching Styles Questionnaire
TES	Times Educational Supplement
TTA	Teacher Training Agency

Related Publications

Evans, C. A. (2001) The impact of teaching in a particular cognitive style on student performance. In: S. Armstrong, A. Francis, M. Graff, J. Hill, S. Rayner, E. Sadler-Smith & D. Spicer. (Eds.) *Proceedings of the 6th Annual Conference of the European Learning Styles Information Network,* 26 and 27th June 2001, Treforest: University of Glamorgan, Wales, 206-221.

Evans, C. A. (2002) Should we expect a relationship between Cognitive Style and Motivational Style? Are these concepts useful to Secondary School Teachers? In: S. Armstrong, A. Francis, M. Graff, J. Hill, S. Rayner, E. Sadler-Smith & D. Spicer. (Eds.) *Proceedings of the 7th Annual Conference of the European Learning Styles Information Network,* 26 and 28th June 2002, Ghent: Ghent University, Belgium, 161-172.

Evans, C. A. (2002) *Who Minds the Mentors?* Unpublished paper, University of Durham.

Waring, M. & Evans, C. (under review) Awareness of Cognitive Style and Learning Preferences to enhance learning in an Undergraduate Population, *Educational Psychology.*

Chapter 1: Introduction and Rationale

1.1: Introduction

The aim of this research is to investigate how teachers' cognitive styles impact on their teaching styles and the subsequent teaching and learning in their own classrooms. The phase of learning to teach which trainees go through during a PGCE year was deemed to be one which would highlight issues around this topic. It has been argued that cognitive style is pervasive in nature and may only be evident when individuals are placed in challenging situations (Riding and Rayner, 1998); to address this concern, by observing training teachers in unfamiliar and thus challenging environments, it was hoped that their cognitive style(s) would be more apparent (Furnham, 2000).

In order to discuss key issues and the rationale for this study, certain terms, often used synonymously, but inappropriately such as cognitive style, learning style and strategy and teaching style require an initial definition to contextualise the debate and ground more detailed discussion and definitions to follow.

Cognitive styles are typically seen as distinct from learning styles in as far as they are perceived to be more fixed/constant and less receptive to external influences than learning styles and far less obvious to the individual. Cognitive style is commonly viewed as a 'higher level heuristic' that organises and represents information (Messick, 1976; Riding and Rayner, 1997) and is responsible for organising lower order functions such as strategies. Riding (2002:23) views cognitive style "... as the automatic way [individuals] respond to information and situations. It is constant for them and does not appear to change. They cannot switch it on and off since it represents the way they are." Riding and Rayner (1998:7) define cognitive style as "an in-built and automatic way of responding to information and situations...present at birth or at any rate...fixed early on

in life and...deeply pervasive." This concept of cognitive style as being immutable, unchangeable and omnipresent will be examined.

In contrast, learning style(s) are viewed as being more amenable to change, to include cognitive (thinking and knowing), motivational and affective (mood, feelings) and physiological behaviours (Keefe, 1979) and associated with preferred working environments, approaches to studying, learning processes, format preferences (Dunn, 1989; Entwistle, 1979; Kolb, 1976). Completing the learning profile are strategies, viewed as lower level functions representing the way an individual copes with a task which is amenable to change through instruction. As Riding (2002:23) comments: "...when [individuals] are aware of their style they can develop strategies to utilise their strengths more effectively and to limit the effect of their weaknesses."

Confusion often lies in the fact that some authors use the terms cognitive and learning style interchangeably whilst others use the term 'learning style' as an umbrella construct to include cognitive style, learning style and strategy. The notion of cognitive style in particular relation to learning styles and strategies is explored further in Chapters 2 and 3.

With a responsibility for the training / education of initial and newly qualified teachers comes a need to understand the factors that affect how and why we learn in certain ways. This is a point Lawrence (1997) and Adey (2000) make note of when they refer to the comparative lack of studies focusing on the effect of learning styles on classroom practice in schools in Britain. Lawrence (1997:160) has also argued that application of knowledge about how people learn, the dynamics involved and how this might affect classroom learning has taken a back seat, a deficit model which this thesis seeks to examine through interviews with teacher trainees. In support of this notion, the Association of Teachers and Lecturers (ATL) (2002) question whether amendments to the 'Standards for the Award of Qualified Teacher Status and Requirements for the Provision of Initial Teacher Training' from the Teacher Training Agency (2002), place

enough emphasis on the latest research on teaching and learning and strategies to enable students to become reflective practitioners.

This also raises the issue as to what currency cognitive styles research has with classroom teachers. To this end, the need for more classroom based experiential research has been highlighted by Klein & Swabey (2001) and Spicer (2001), but currently the number of studies of the impact of cognitive style on classroom behaviours remains comparatively small:

> "There is widespread recognition amongst writers and researchers on cognitive and learning style of the potential at least for style to impact on learners' performance in educational settings...There has however, been less empirical research into the relationship between cognitive and learning style and performance, and what research has been undertaken appears to be inconsistent. The link between learning and cognitive style is complex and warrants further study." (Spicer, 2001: 311)

Clarifying the link between cognitive / learning styles and performance is certainly an avenue worthy of exploration as commented on by Rayner and Riding (1998:74) and Sternberg and Grigorenko (1997), who suggest that a knowledge of cognitive styles "...may provide as promising an inroad to predicting school and other kinds of performance as do abilities." And as Matlin (1989:237) commented a decade earlier: "our knowledge about our own cognitive processes can guide us in arranging circumstances... to improve future cognitive performance." Sadler-Smith, in Riding and Rayner (2000) also suggests that a knowledge of cognitive styles may enable individuals to make better use of learning strategies. The link between cognitive / learning styles and performance has been documented by many researchers (Lynch, Woelfl, Steel & Hanssen, 1998; Davies, Rutledge & Davies, 1997; Sobral, 1995; Riding & Douglas, 1993, Riding & Sadler-Smith, 1992; O'Donnell, 1982; Scott, 1981; Hart, Payne & Lewis, 1981).

On a more specific level, Riding and Pearson (1994:416) examine the effect of cognitive style on a wide range of areas such as **the mode, structure and context of learning** to affect performance and attainment (Messick, 1984; Riding and Cheema, 1991; Riding

and Sadler-Smith, 1992; Riding and Douglas, 1993; Hayes and Allinson, 1996); **the learning strategies** which individuals adopt in particular contexts (Riding and Sadler-Smith, 1997); **training preferences** (Riding and Douglas, 1992), **knowledge acquisition** (Grieve and Davis, 1971); **performance in public examinations** (Riding and Caine, 1993); **occupational stress** (Borg and Riding, 1993); **decision-making** (Spicer & Sadler-Smith, 2000) and the **nature of social interactions** in the learning process (Goldsmith, 1989; Hayes and Allinson, 1994, 1996; Riding, 1994; Sternberg and Grigorenko, 1997).

If cognitive style does indeed affect so many areas of human performance as mentioned above and is so pervading, why is it that individuals are so unaware of their own style as suggested by Rayner and Riding (1998:129)? The evidence base to date, suggests that people differ consistently from each other in their preferences for certain ways of processing information and that these differences are measurable (Gorham, 1986; Moran, 1991:240). What are the beneficial outcomes of knowing one's own cognitive style and to what extent is the notion that people are unaware of their preferred ways of processing a reality? In an attempt to answer the first question, Cooper (1996, 1997) found that students who were the least successful were those who lacked awareness of their own learning style, whatever it was. In answer to the second question, it may be that the cacophony of labels used to describe cognitive style and contradictory evidence of existing research, along with the lack of classroom based studies on a big enough scale, has meant that such ideas have not permeated into schools and what information has trickled through, has been bewildering.

With the current emphasis on 'learning how to learn' (Pask, 1977; Entwistle, 1981; Covey, 1992 and Ertmer and Newby, 1996), by becoming self-regulated, reflective practitioners engaged in self-analysis (Tanova, 2000; Claxton and Murrell, 1996), it is still surprising that so little is known about cognitive and learning styles information within the school context. The drive towards greater self-awareness may hopefully lead to greater acknowledgement of cognitive style (Murphy et al, 1998). The goal should also be, as commented on by Rundle and Hankinson (2001:198), "for individuals to develop confidence so that they are able to advocate their own learning strengths and

preferences, and … by doing so, individuals are more able to build an environment where they can be most effective." To gain such confidence, both teachers and students require training if they are to be able to identify/understand and articulate their learning styles and preferences. Thus in order to effect change, learners need to be aware of their style so that they can apply this awareness to the range of situations in their lives leading to increased self-actualisation. Increased self-awareness should enable individuals to make more informed choices when engaging in learning activities.

Having been made aware of their own cognitive/ learning styles, to what extent are individuals able to modify and develop their style? Whilst Riding (1997, 2002) acknowledges that some individuals have the benefit of having complementary as opposed to unitary styles, (discussed in later chapters), giving them greater flexibility from the outset, is it possible for an individual to develop/modify his/her cognitive style? Many researchers have been able to identify those with specialised and those with more versatile styles (Entwistle, 1981; Miller, 1991 and Evans, 2001), raising the question 'what is it that enables some learners to have greater stylistic flexibility than others?' Many would argue that a first step towards this is an awareness of one's own style (Presland, 1994:182). Even if an individual is unable to modify his/her cognitive style, Hayes and Allinson (1996:7) note that it may be possible to develop strategies that may themselves be alien to the individual's style but may nevertheless be useful coping behaviours in particular sets of circumstances. Even if one accepts Miller's views (1991:236) that encouraging versatility in some students may be both damaging and dangerous (given that styles may be forms of psychological defence), it is even more essential that the 'proto-versatile' and the 'specialised' should be identified using valid and reliable measures if one is to attend to their needs in a classroom.

Riding and Rayner (1998:87) argue that a crucial aspect of personal development is the building of a 'more specific self-awareness of cognitive style and the development of learning strategy' and present a case for its introduction into pedagogical practice. Certainly a knowledge of cognitive styles will assist an individual in making appropriate choices as commented on by Sadler-Smith (2001a: 300): " One attribute of an effective learner is that she or he can select an appropriate learning strategy from a range of

possible approaches to suit the demands of the learning situation". The importance of allowing for individual learning and cognitive style has been recommended widely (Entwistle, 1981; Riding and Douglas, 1993; Riding and Watts, 1997; Riding, 1997). To this end, Hamblin (1981:21) suggests that: "To try to impose a learning style is the pedagogic equivalent of imposing a false self upon someone – an act which is inevitably as destructive in the long run."

Moving on to the classroom context, an enhanced understanding of cognitive styles may enable both teacher and student to understand why individuals do better in certain educational settings and with certain approaches and allow consideration as to the extent to which schools, both directly and indirectly, shape the learning styles of students. At the whole school level, Noel (2000:26) comments on the need for schools to consider what patterns of thinking, believing, communication, and acting they are promoting. In connection with this, teachers may need to consider the impact of their own teaching style on student attitude, performance and behaviour. Which also leads to a consideration as to how cognitive style may affect a teacher's teaching style as commented on by Entwistle (1981) and Smith (2001). Riding (2002:103) notes: "a…teacher's natural teaching style will be a reflection of their own cognitive style." To date, there are few studies which examine such a link as noted by Riding and Read (1996:104):

> " A teacher's cognitive style is likely to affect their preferred teaching style forming a 'format preference'. The extent to which this skews their choice of class presentation mode, classroom organisation and design of student tasks is unknown."

This study attempts to identify such a link between cognitive style and teaching style, accepting the inherent problems in such a task as identified by Galloway et al. (1998) who comment, it may be extremely difficult to identify discrete teaching styles which are used consistently in the classroom by any one teacher. Lawrence (1997:168) also argues that the learning style of a teacher may affect how versatile he/she is in relation to being prepared to employ a range of teaching methodologies. This again raises questions as to the extent to which teachers follow their own learning style when

teaching and to what extent they adopt extreme approaches (Entwistle, 1981:95). An examination of the impact of teaching style in the classroom context is overdue as noted by Mortimore (1999:6), there has been little work done on how teachers organise subject matter in their own minds and how they apply it in different ways: "The learner and the process of learning remain relatively unexamined."

In attempting to identify links between cognitive style and teaching style one also needs to be mindful of oversimplistic solutions to dissidence between teacher and student cognitive styles. The evidence regarding the impact of matching or mismatching teacher and pupil cognitive styles on learning remains inconclusive (Evans, 2001). Although Riding and Watts (1997) and Riding and Reed (1996) do provide evidence to suggest that individuals who engage in a learning environment compatible with their cognitive style do better, Joyce and Weil (1996) argue it " may be desirable to encourage children to learn in a different way and go against preferences and familiar habits." Whilst the jury is out on whether matching has direct positive or negative impacts on performance, it is a highly plausible idea that teachers and students with congruent cognitive styles may interact more positively in the classroom with important consequences for the learning process as suggested by Witkin (1976:57).

Another unresolved question is that of the impact of subject on teaching style. In trying to identify the link between cognitive style and teaching style, the influence of specific subject disciplines should not be overlooked as mentioned by Lawrence (1997:168): "Whether it is the teacher's own learning style preference which influences decisions, [regarding] the way they teach or the nature of the subject itself which influences decisions over the curriculum remains an important and unresolved question". On a larger scale, the impact of government initiatives (curriculum, literacy, numeracy, assessment) has certainly impacted on classroom practice (Bassey et al., 2001; Richards, 1998). It also begs the question as to which way is up, does cognitive style influence selection of subjects on the part of the individual or does a specific subject attract those with a particular cognitive style thus reinforcing the established style?

Finally, to assist in improving pedagogy in schools, organisations have a responsibility to consider the importance of cognitive style at a whole school level. It has been noted by Grigorenko & Sternberg (1997:709) that "...In sum, teachers' styles tended to match the ideology of the teachers' schools..." The extent to which an organisational climate promotes inclusive learning does depend on an awareness of individual learning styles and needs. As suggested by Kirton and DeCiantis (1986:84): "the overall organisational climate stems from a consensus group sharing a very similar cognitive style [producing] a cognitive climate." It may, therefore, follow that the cognitive style of the main stakeholders will exert a large influence regarding approaches to learning which may or may not be appropriate or acceptable to members within the organisation with a different cognitive style. Thus the ultimate goal must surely be to use the strengths associated with all cognitive styles and a knowledge of this area can be seen as a useful way to address such an issue.

Furthermore, if the main stakeholders; teachers and students, are to work collaboratively in the classroom, an increased understanding of style should enhance the learning partnership. Beckwith (1991) suggests knowledge of individual differences could enable teachers to adapt their teaching style to whatever learning style or approach was dominant in their students; could enable students to be counselled as to the ideal approach they should adopt; could establish consistency between teaching and learning; and could improve the ability to predict performance. Within such a partnership, teachers have a dual responsibility to understand their own style and how it impacts on their teaching approach as well as identifying the needs of individual students and the selection of suitable strategies to suit individual learners. Whilst learners are charged with taking more responsibility for their own learning through their own identification of needs and selection of suitable strategies as suggested by Smith (2001: 339):

> " Teaching methods should encourage students to investigate their learning styles and manners in which they can accentuate their learning outcomes. Whatever the learning style, as long as it leads to better understanding of concepts it should be jointly investigated by the teachers and their students."

The ultimate challenge must, therefore, rest with researchers to make the concept of cognitive style accessible and plausible for teachers and students in/outside of the classroom. As Rayner and Riding (1997:24) comment:

> "The teacher's role in learning must then surely be to incorporate an awareness of style in their approach to the task of teaching and learning. The final purpose of an assessment of learning style will be the enhancement of individuality in the process of teaching and learning."

Development of reliable tools to measure cognitive style, an increased research base and an understanding of teaching style must surely assist understanding in this field. Engaging teachers in such classroom based research is also a challenge for the new millennium.

1.2: Thesis Outline

Chapter 2 opens with a discussion on style, exploring the plethora of labels that currently abound in the literature. Key models which attempt to provide a more unified concept of style are reviewed. The numerous labels used to describe cognitive and learning style are identified in Chapter 3; within this chapter, the links between cognitive style, learning style and strategy are considered. Issues surrounding the characteristics of cognitive style and the measurability of style are also addressed. Chapter 4 specifically looks at the wholist-analytic dimension of cognitive style as identified by Riding (1991) and reviews the attempts of Riding and Cheema (1991) to conflate the numerous cognitive style labels down into two principal dimensions: those of wholist-analyst and verbaliser-imager. The implications of cognitive style in relation to learning and how the nature of instruction, mode of presentation, organisation of information affects cognitive style groups differently is also examined. In Chapter 5, the concept of wholist-analytic style in relation to teaching is explored along with a discussion regarding the difficulties inherent in classifying teaching style. The arguments regarding the influence of subject

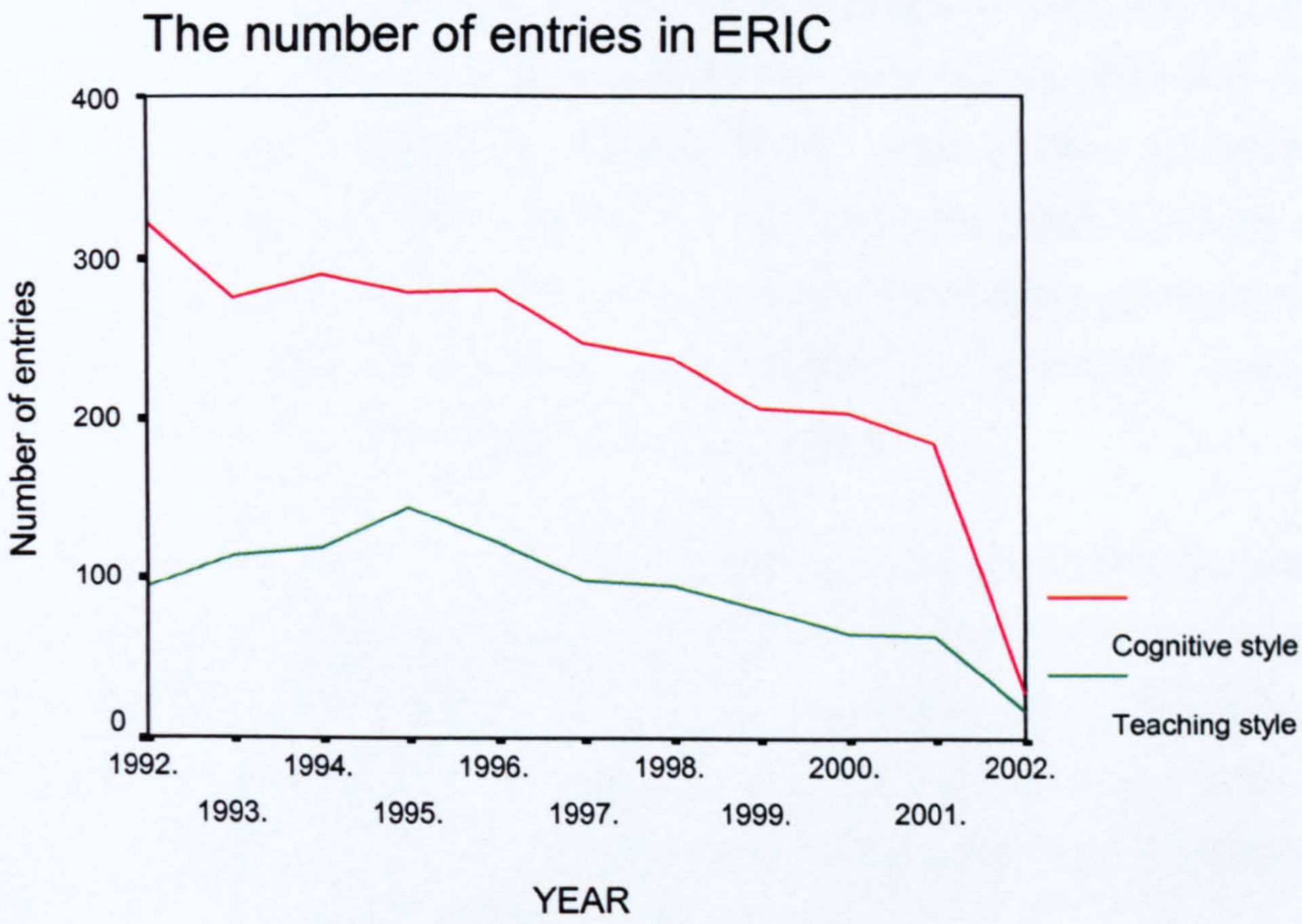
on cognitive and teaching styles are raised. Having placed the literature review in context, Chapter 6 outlines the main research questions, the principal one being the impact of cognitive style on teaching style. The chapter takes the reader through the justification for the approach adopted, choice of instruments used, the process involving a cohort of teacher trainees and limitations associated with the methodology and tools of analysis. The research findings are discussed in Chapters 7, 8 and 9, beginning in Chapter 7 with a discussion of the nature of the relationship between cognitive and learning style results for the trainee teachers involved in this study. Chapter 8 then considers the relationship between results of cognitive and learning styles measures in relation to teaching style; detailed consideration is given to the difficulties associated with measuring teaching style and the nature of the teaching styles instrument. In Chapter 9, interview data concerning the beliefs about teaching of the teacher trainees from the four main cognitive style groupings is used to substantiate and develop the quantitative findings presented in the previous two chapters. The concluding chapter brings together the many strands of the research project and makes recommendations regarding future research and raises questions regarding the implications of the research for policies/practice and research regarding teacher education.

Chapter 2: A question of Style

2.1: Current situation

At present (March 2003), there are over 7095 references to cognitive styles on the ERIC database and 378 with regards to cognitive style and teaching style; very little can be found with regards to UK teaching experiences in secondary schools. Figure 1 charts the declining interest in teaching and cognitive styles research in the last ten years as indicated by entries on the ERIC data base indicating that such research is even less likely to impact on schools if this trend is to continue.

Figure 1: Current entries on the ERIC data base concerned with Teaching Style and Cognitive Style



Considerable confusion exists within the literature regarding the nature of cognitive and learning styles instruments; such perplexity is further increased by the incorrect use of terms. There is a need to clarify the differences between cognitive style, learning style, strategy and preference and also to consider to what extent cognitive style instruments are actually measuring the same dimensions. This chapter aims to demystify the concept of style and provide an overview of the models that attempt to unite the different facets of an individual learning profile.

2.2: Convergence- Divergence - A question of Style?

Describing style in the context of learning is ambiguous. Not only are there many different aspects of style to choose from, there are also differences of opinion over whether an individual has one style (Riding and Cheema, 1991), a profile of styles, Rayner (2000) and is stylistically specialised or versatile (Miller, 1991).

In defining style, the literature tends to focus on what people do when they are trying to learn: " Styles do not describe what people are like; they describe what they do when they are trying to learn" (Boulton-Lewis et al., 2001). Once a pattern can be observed that becomes habitual then this is considered a style. Schmeck (1988:ix) simply defines style as " ... any pattern we see in a person's way of accomplishing a particular type of task." In its broadest sense, style(s) are considered by Sternberg and Zhang, (2001:251) [as] "...approaches to learning and even to life..."

Whilst style is a relatively new area there are many permutations of style that one could consider. Within the educational arena, the word style is used in a number of contexts. There are indeed cognitive styles (Witkin, 1962), attribution styles (Abramson et al., 1978), learning styles (Kolb, 1976), thinking styles (Sternberg and Grigorenko, 1997), styles of remembering (Guilford, 1980), styles of thinking and judging (Kagan et al., 1963), multiple intelligences (Gardner, 1983).

A review of the available literature on style is in itself baffling, leading to comments from Allinson & Hayes (1994), Adrian Furnham (2000) and Adey (2000) respectively, suggesting that what we are left with is a 'large and often confusing body of literature, ' a 'mass of muddle' and no clear sharp answers. Roodenburg (2001:165) also comments:

> "While style has received serious consideration in psychology as a useful way of describing individual differences in the way people think since at least the 1930s (Allport, 1937), there currently still appears to be little unity among the plethora of definitions, conceptualisations and operationalisations."

Where confusion is certainly evident is in the inappropriate use of cognitive and learning style terminology, with the latter often being used misleadingly to describe the former, with researchers such as Peirce (2000) employing the two terms [cognitive and learning styles] synonymously with no distinction between the two. Sadler-Smith (2001a: 292) also comments that 'learning style' is used as a portmanteau term for a range of individual difference constructs encompassing...learning preferences, learning strategies, approaches to studying and cognitive style."

2.3: Plethora of Labels

There is no shortage of instruments purporting to measure different aspects of cognitive styles, creating a bewildering array of labels (Presland, 1994:179). This has led to criticisms that styles research has failed "to provide any conceptual framework and language for researchers to communicate with each other..." (Sternberg and Zhang, 2001:251). The number of learning style instruments identified over the last 20 years has been commented on by a number of researchers; Curry (1983) identified 21, Messick (1984) 19, Riding and Cheema (1991) over 30 different labels; Hayes and Allinson 29 in 1994 and Armstrong (1998, 2002) recognised 54 different conceptualisations of cognitive and learning style leading him to comment on the

'continuing cacophony of labelling.' Desmedt (2002) found over 125 different models of cognitive style and learning style, again, with little consistency being used to differentiate cognitive from learning style. This leads to a consideration of whether this reveals the complexity of cognition or whether the various styles are simply different conceptions of the same dimension. Or as Sternberg and Grigorenko (1997: 710) comment: " The various theories of style cover related ground from different stand points." Such confusion leads Roodenburg (2001:165) to raise questions concerning the validity, reliability and stability of such instruments echoing thoughts raised earlier by Curry (1987:16) about the failure of style researchers who have:

> "...not yet unequivocally established the reality, utility, reliability or validity of their concepts. Learning/cognitive styles may not exist other than as an insubstantial artefact of the person-environment interaction. Alternatively, learning styles may be real, stable, and potent enough to be useful to educational planners, particularly those with concern for truly individualised educational programming."

The challenge is to be able to identify and measure cognitive style reliably and be competent in the use of such information to inform the learning process. Issues of validity and reliability of cognitive style measures will be addressed in later chapters.

2.4: Moving towards consensus: locating Cognitive Style

In spite of such confusion regarding the number of labels and misuse of terms, much work has been done in the last twenty years to address such concerns, (Messick, 1976; Miller, 1987; Curry, 1983, 1987; Furnham 1995; Grigorenko & Sternberg, 1995; Riding and Rayner 1998; Yates, 2000 and Armstrong and Rayner, 2002) and to develop a more coherent theory of style. The work of Riding and Cheema (1991) demonstrates in the words of Rayner (2000:123) 'an attempt to " [boil] down" the plethora of various models and constructs existing in the field.'

Curry's (1983), Rayner and Riding's (1997) and Tanova's (2000) models, that are subsequently described, all attempt to clarify the differences between cognitive style,

learning style and strategy. Whereas cognitive style is viewed as not being affected by the external environment, learning style and strategy are seen as being more amenable to change and interaction with the outside environment. Thus cognitive style(s) are seen as higher order heuristics controlling information processing whereas strategies refer to how students approach school learning (Entwistle, 1988; Ramsden, 1988). Variations in degrees of consciousness with regards to style and strategy are also raised by Sternberg and Zhang (2001:3):

> "Styles operate without individual awareness, whereas strategies involve a conscious choice of alternatives...strategy is used for task or context dependent situations, whereas styles implies a higher degree of stability falling midway between ability and strategy."

2.4a: Curry's Onion Model (1983)

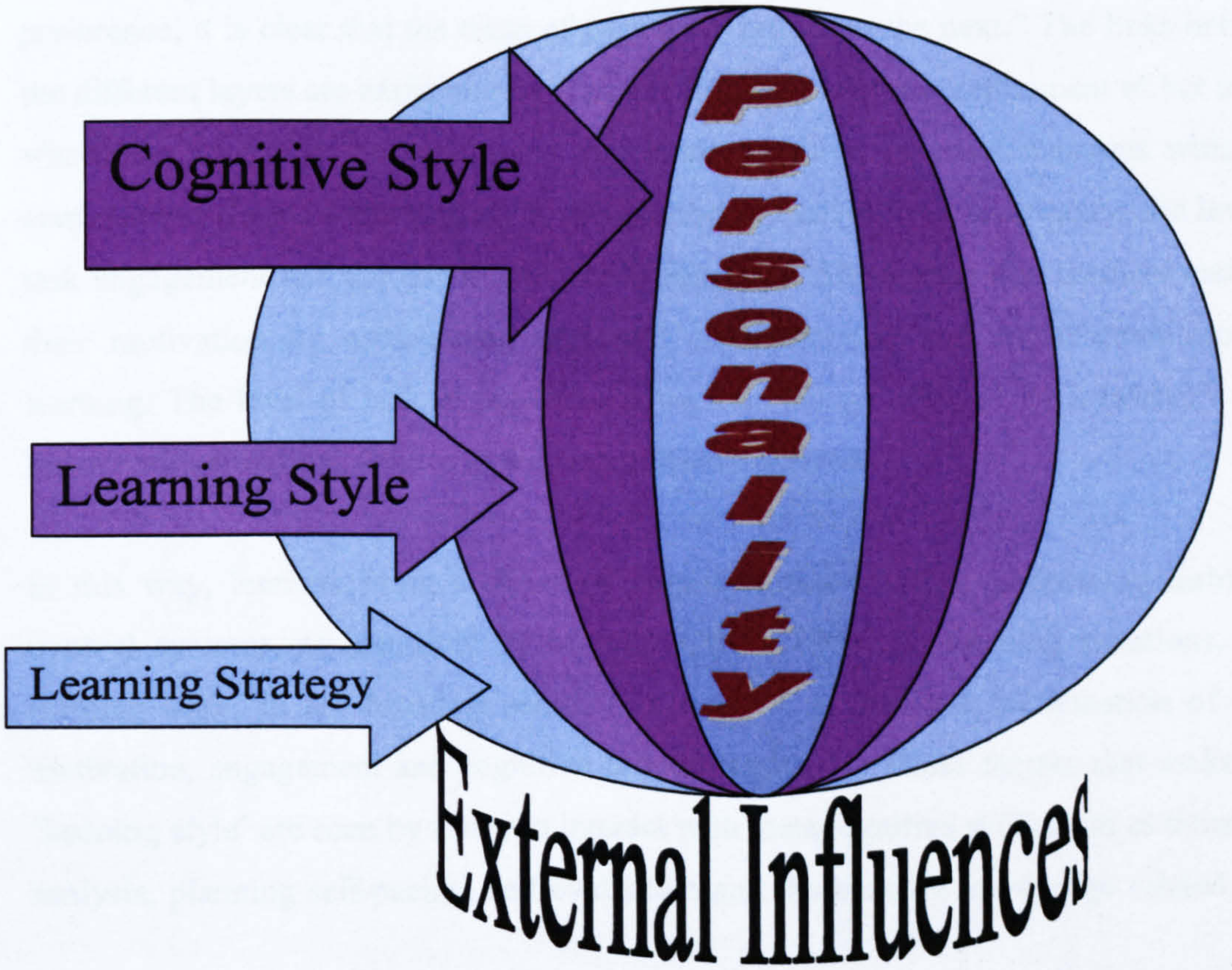
Curry's 'onion analogy' (1983) represents one of the earlier attempts to classifying styles instruments. The model, essentially, has three layers as demonstrated in Figure 2, the inner layer representing cognitive style and successive outer layers learning style and strategy respectively. By organising learning style measures like this, Curry argued that:

> "learning behaviour is fundamentally controlled by the central personality dimension, translated through middle strata information processing dimensions and, given a final twist by interaction with environmental factors encountered in the outer strata" (Curry, 1983 in: Riding, 1997:42).

Curry (1983) differentiates between 'information processing style', 'the individual's intellectual approach to assimilating information' and 'instructional preference,' the layer that interacts most directly with learning environments, learner expectations, teacher expectations and other external features. Within her model Curry, (1983) views the outer two layers, learning style and strategy, as less stable and more easily influenced than the more central 'cognitive personality.'

At the centre of Curry's onion and virtually unchangeable, Curry defined **cognitive personality style** as 'the individual's approach to adapting and assimilating information.' This dimension is viewed as not interacting directly with the environment; relatively permanent, expressed indirectly and apparent only when an individual's behaviour is observed across many learning instances. This factor examines the natural way in which a student adapts, assimilates and accommodates information, often considered to be a function of genetic and cultural traits developed early in life and remaining stable throughout an individual's life. This raises the question as to whether siblings have similar cognitive styles and to what extent cognitive style remains stable throughout an adult's life.

Figure 2: Curry's Onion Analogy



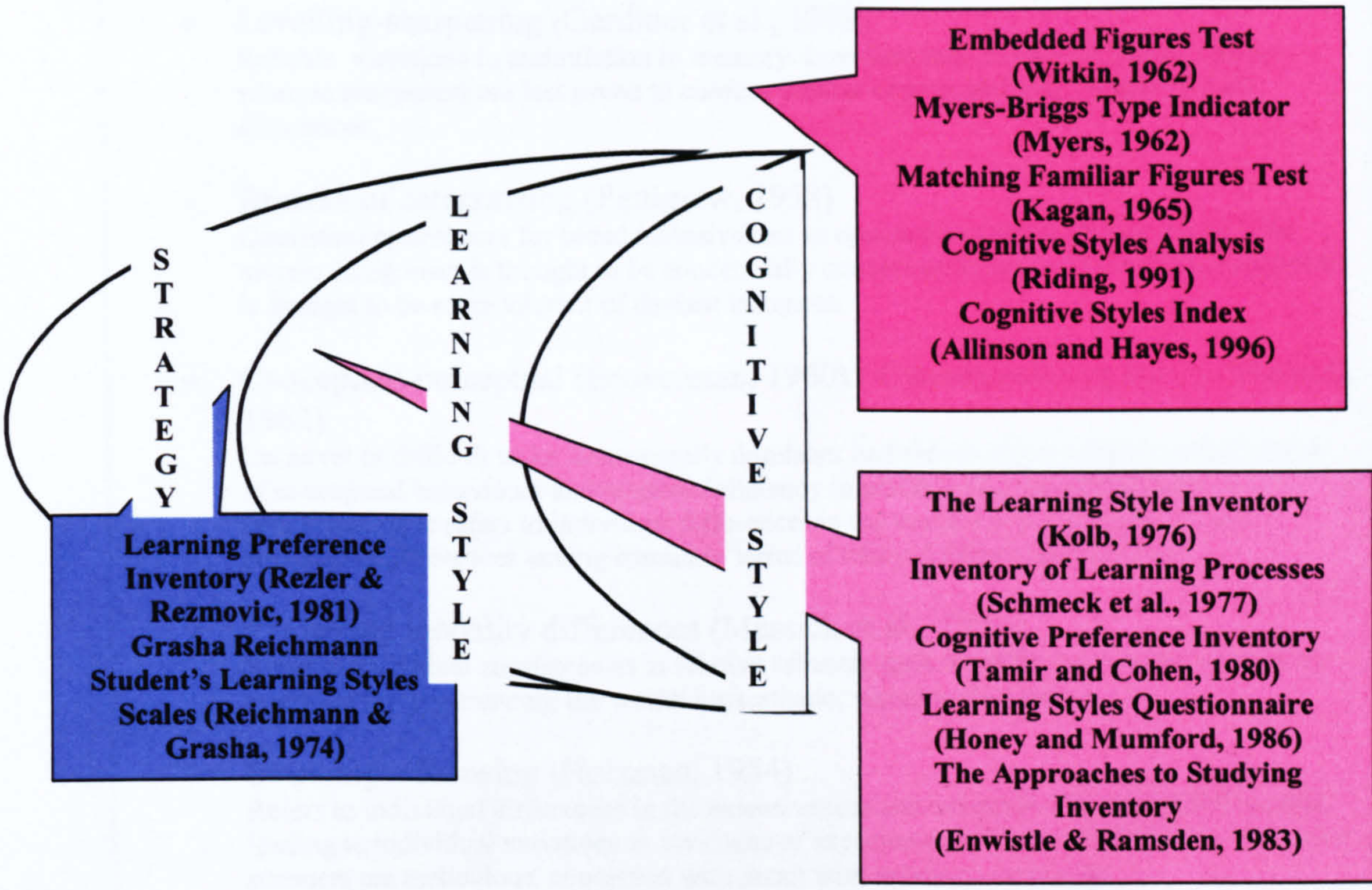
Curry's middle layer represents learning style or **'information processing style'**; this is seen as relatively stable but modifiable by learning strategies. Finally, in the outermost layer, Curry places **'instructional preference'** - an individual's choice of learning environment and most observable style. This style is perceived as the least stable of the three layers, most likely to change and to be influenced by external factors. Models measuring these three 'styles' are shown in Figure 3.

The discrete nature of the 'segments' of Curry's onion has been challenged. Whilst Curry (1987) treated the two dimensions, information processing (learning style) and instructional preferences (strategies) as distinct, Marshall (1987) and Hickcox (1995) discovered a positive correlation between the two elements. Similarly, Hashway and Duke (1992:59) comment: " the traits described at the different levels are not discrete and as one moves from the core level of personality to the fourth level of instructional preference, it is clear that the traits of each level influence the next." The links between the different layers are explained by Curry (1991:251) in a later refinement of her model where she comes to the conclusion that there are three essential elements which, in combination, define a learning style: the method of motivation maintenance, the level of task engagement and the cognitive control functions. She argues that learners maintain their motivation by establishing preferred environmental and social conditions for learning. The level of task engagement is seen as being affected by a learner's prior history with situations similar to the new one encountered.

In this way, learners bring a series of **cognitive information processing habits or control systems,** as identified by Messick (1970, 1976), to learning situations. Thus learning style, in the broadest sense, is conceived as being a combination of one's motivation, engagement and cognitive processing habits. These factors that make up a 'learning style' are seen by Curry to interact with metacognitive skills such as situational analysis, planning self-pacing, self-evaluation and the specific knowledge related skills

learned in the particular instructional situation to produce an observable learning outcome.

Figure 3: Measures of Cognitive Style, Learning Style and Strategy



Curry explicitly refers to Messick's (1970) 'nine cognitive styles,' as outlined in Table 1, as control systems that learners bring with them to learning situations. What is not made clear here, is the difference between cognitive style and cognitive control. Gardner (1983), Jackson (1977) and Messick (1960) differentiate between the two, arguing that cognitive control refers to the specific dimensions; such as levelling-sharpening, scanning, field articulation, conceptual differentiation, and constricted-flexible control and toleration for unrealistic experiences, where each cognitive control is independent of each other and seen as a process which we use to categorise reality and that are available to all individuals. On the other hand, cognitive style is seen as the extent to which control processes are exercised and organised within an individual.

Table 1: Nine Cognitive Styles / Controls (Messick, 1970, 1976:14)

- Field dependence-independence (Witkin et al., 1954)
  A consistent way of approaching the environment in analytical, as opposed to global, terms.

- Levelling-sharpening (Gardiner et al., 1959)
  Reliable variations in assimilation in memory. Levellers tend to blur similar memories whereas sharpeners are less prone to confuse similar objects and may magnify small differences.

- Breadth of categorising (Pettigrew, 1958)
  Consistent preferences for broad inclusiveness as opposed to narrow exclusiveness. The narrow categoriser is thought to be conceptually conservative, whereas the broad categoriser is thought to be more tolerant of deviant instances.

- Conceptual-perceptual (Broverman, 1960) / Conceptualising styles (Wallach, 1962)
  On novel or difficult tasks, conceptually dominant individuals show relative specialisation of conceptual behaviours and relative deficiency in perceptual-motor behaviours. A conceptual style refers to individual differences in the tendency to categorise perceive similarities/differences among stimuli in terms of many differentiated concepts.

- Perceptual modality differences (Messick et al., 1976)
  Refer to individual consistencies in relative reliance upon the different sensory modalities available for experiencing the world: kinaesthetic, visual and auditory.

- Scanning – focusing (Holzman, 1954)
  Refers to individual differences in the extensiveness and intensity of attention deployment, leading to individual variations in vividness of experience and span of awareness. Extensive scanners are meticulous, concerned with detail with extensive coverage.

- Cognitive complexity – simplicity (Bieri et al., 1966)
  Refers to individual differences in the tendency to construe the world, in a multidimensional and discriminating way. A complex individual's conceptual system is highly differentiated (large number of concepts), finely articulated and flexibly integrated.

- Reflectivity-impulsivity (Kagan et al., 1964)
  Involves individual consistencies in the speed and adequacy with which alternative hypotheses are formulated and information processed. This dimension is mainly concerned with the degree to which an individual reflects on the validity of hypotheses for solution in problems that contain response uncertainty.

- Tolerance-intolerance (Kelin et al., 1962)
  A dimension of differential readiness to accept perceptions and ideas at variance with conventional experience.

2.4b: Rayner and Riding's Cognitive Control Model (1997)

Another attempt to clarify the situation on style is that of Rayner and Riding (1997:22) who sought to develop the Curry model further:

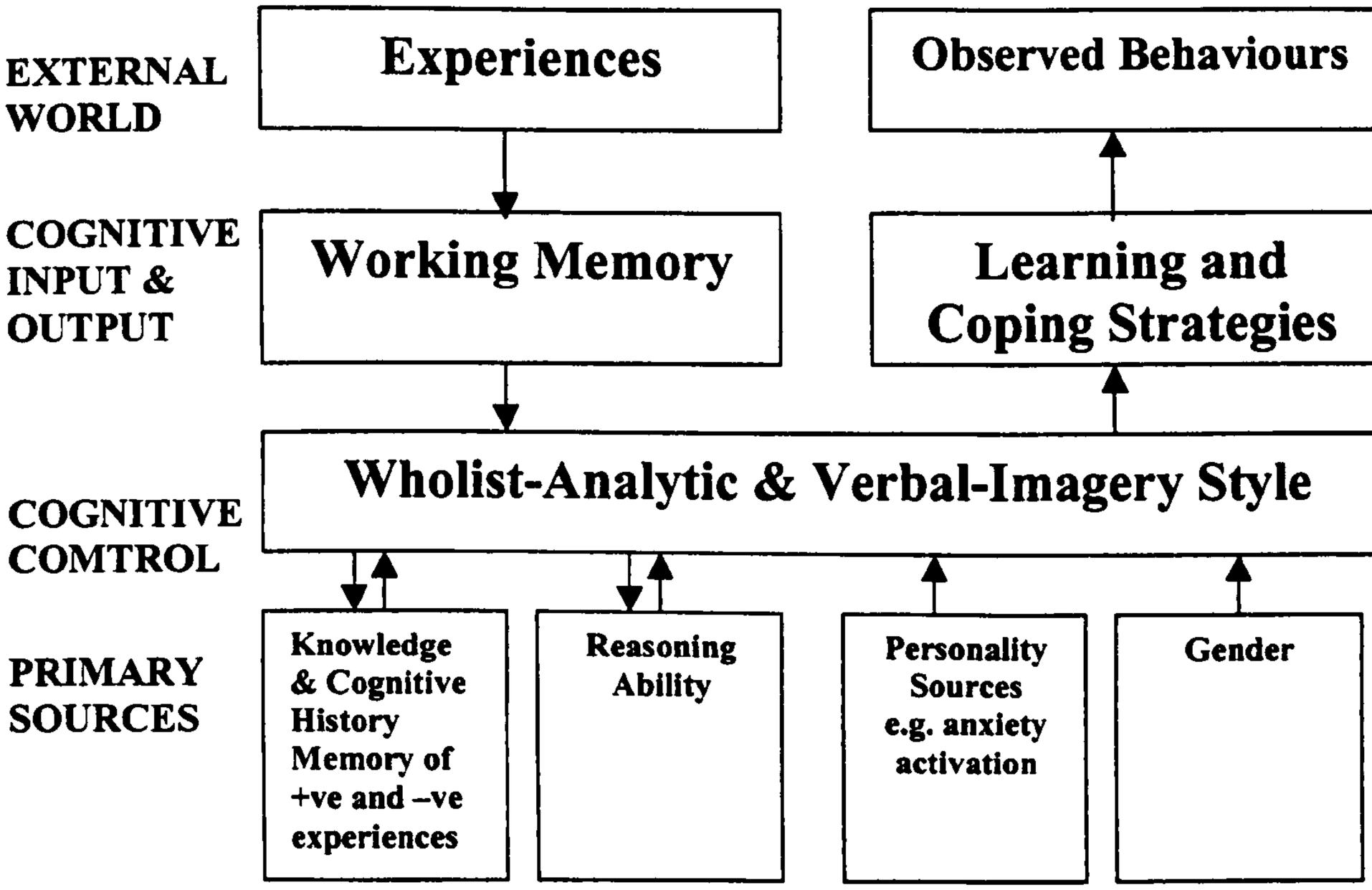
> "...The basic dimensions of learning style, together with associated learning strategies, need to be more clearly identified to enable an elaboration of a personal learning style for the individual learner. As part of this task contemporary cognitive and learning style models should be examined with an eye to distinguishing and integrating basic dimensions or features of learning style...The interrelationship between style, strategy and learning behaviour merits more attention, and the question of the exact nature of learning style, an answer."

The Cognitive Control Model (Riding, 1997:42) is another attempt to clarify the role of cognitive style in the learning process in relation to learning style and strategy. In this model, as demonstrated in Figure 4, Riding places personality, gender, memory of past experiences and knowledge at the centre with reasoning ability. Whilst Riding argues that intelligence is not directly linked with cognitive style he does acknowledge that, especially with extreme styles, those with lower ability will be affected far more when asked to complete a task in a style which is at dissonance with their own.

Riding notes that past experiences may impact on cognitive style, suggesting that socialisation has an impact on cognitive style development. Riding also suggests a physiological basis for cognitive style; this is not explicitly demonstrated in the model. The 'cognitive control level' of the model comprises his two dimensions of style: Wholist-Analytic and Verbal-Imagery; this is seen as providing an 'organisational and representational interface between the internal state and the outside world'; responses here are believed to affect attitude and behaviour. In the model, Riding has not chosen to consider cognitive tempo defined by Kagan and Kogan (1970) as: 'the degree to which an individual reflects over alternative response possibilities on problem-solving tasks involving some degree of uncertainty' (Hill et al., 2000:288); when viewing students completing the Cognitive Styles Analysis, this is much in evidence.

The outer layer of the model comprises both cognitive input, involving the perceptual and working memory processing system which analyses the incoming information, and output involving learning strategies. In this model, the term learning strategy is synonymous with learning style and preference. The link between cognitive style and learning style is seen as unidirectional. Riding places learning strategies at a different level to that suggested by Curry's earlier model where she separates learning style from strategy. If strategies vary according to context, what part does cognitive style play in this: a willingness to embrace alternative approaches? The model also suggests the influence of cognitive style on observed social behaviours and says little about the mobility of style.

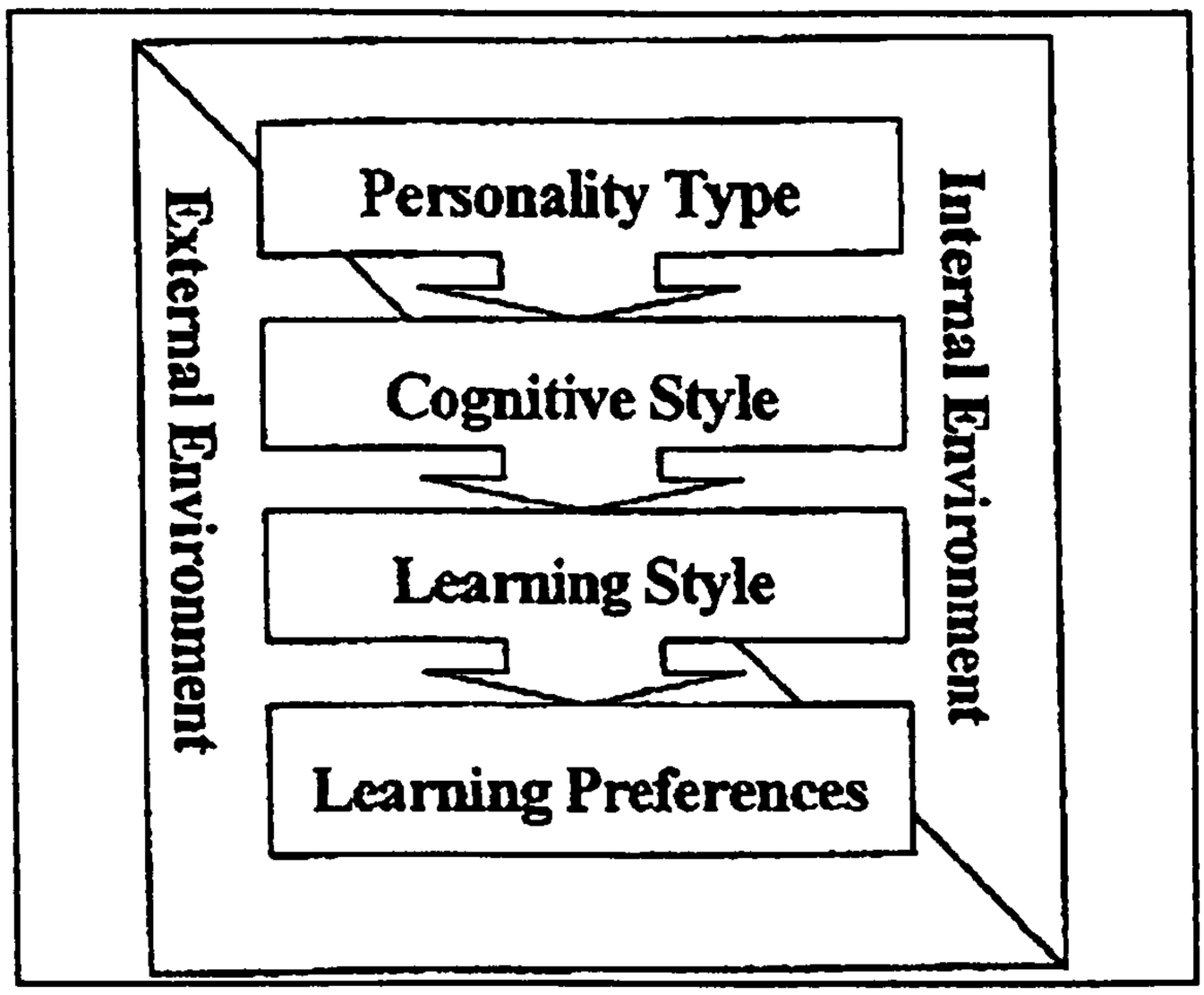
Figure 4: Cognitive Control Model



2.4c: Tanova Model (2000)

Another approach is that of Tanova's, based on the ideas of Curry (1983) and Sadler-Smith (1999). The Tanova model shows the relationship between cognitive style, learning style and learning preferences with the influence of internal and external environments. In this model, cognitive style is also seen as relatively permanent and stable influencing learning style, which is less stable and more open to the external context. The learning preferences are the behavioural responses to the interactions between the cognitive and learning styles and the external context. The model also suggests that cognitive style is amenable to some change from external environment in contrast to the Curry and Riding models. What is essentially shown, here, is a linear model with each layer affecting the next in a unidimensional manner. Is this too simplistic? Alternatively, Schmeck (1988) argues that style and approach interact dynamically in a developmental perspective, as style partially influences approach and approach determines the learning outcome which in time may change style.

Figure 5: Tanova Model



What these three models and the work of Grigorenko and Sternberg (1995), Hathway and Duke (1992), Richter (1992), Jonassen & Grabowski (1993), Rayner and Riding (1997) and Sternberg (1997) agree on, is a similar fundamental grouping of style traditions into three distinct types:

(i) **Cognitive style constructs** based on differences in cognitive processes and perception. According to Rayner & Riding (1997) what is significant is the attempt to clarify a coherent theory of cognitive style (Witkin et al., 1977, Curry, 1983, 1987; Miller, 1987; Riding & Cheema, 1991 and Grigorenko & Sternberg, 1995). There is also evidence of a growing desire to apply the theory in a variety of professional contexts.

(ii) **Personality style constructs** involving trait type measures such as the Myers-Briggs (1962) style model involving activity-centred theories of learning style associated with educationists addressing environmental and process based issues related to meeting individual differences in the classroom.

(iii) **Activity type constructs** defining learning and instructional styles to emphasize the educational perspective shared by researchers in this tradition. According to Rayner and Riding (1997:13) this approach is distinguished by three major features: the first, a greater interest in the impact of individual differences upon pedagogy; the second, the development of new constructs and concepts of learning style; and the third, the presentation of an assessment instrument as a foundation for the exposition of theory. Style is being used here differently to that used in the cognition centred approach. (Honey and Mumford, 1986; Kolb, 1976; Entwistle, 1979; Biggs, 1978, 1985; Schmeck et al., 1977; Price et al., 1989 and Riechmann-Grasha, 1974).

Within this thesis, consideration of cognitive style and activity type constructs will be explored in greater detail in the following chapters along with a discussion of the links between the concepts of cognitive style, learning style and strategy. In particular, in

relation to cognitive style, the ideas of Riding and Cheema (1991) and Allinson and Hayes (1988) will be developed further and possible links to learning styles approaches will be explored.

Chapter 3: Cognitive Style

Within this chapter, the key characteristics of cognitive style(s), learning style (s) and strategies are outlined. The interrelationships between these different components of a 'learning profile' are considered. Key issues such as the stability of style and the measurability of style constructs are also discussed.

3.1: Defining Cognitive Style

There are numerous definitions of cognitive style and what they generally share in common is an emphasis on a number of key characteristics as illustrated by the following quote; each of the highlighted characteristics will be considered in turn.

> " Consistent individual differences in these ways of organising and processing information and experience have come to be called cognitive styles...they are conceptualised as **stable attitudes**, preferences, or **habitual** strategies determining a person's typical modes of **perceiving, remembering, thinking, and problem-solving**" (Messick, 1976:5; 1984: 143).

Key principles of cognitive style are also summarised by Kirton (1994) who sees style as: bipolar and non-pejorative; non-evaluative; not readily changed. In addition to stability and bi polarity, Sadler-Smith (1999) adds to the list in making the following assumptions about cognitive style:

(1) The cognitive style is concerned with the form rather than the content of information processing.

(2) It describes "different " rather than " better or worse" thinking processes.

It may be useful at this juncture to examine the claims mentioned above with regards the nature of cognitive style. The non – pejorative nature of cognitive style is certainly open

to question. Within the educational context, certain styles have more negative connotations, thus wholists and imagers are generally associated with less good academic performance than analytics and verbalisers (Riding, 2002:50). With certain activities, the wholist approach is seen as weaker than that of the analytic with perceptions of the wholist attributes of students, in class, often viewed negatively by classroom teachers (Riding, 2002).

Secondly, whilst cognitive style is often described as stable, habitual, consistent, (Messick, 1976), opinion regarding the stability of style is very divided as commented on by Armstrong (2002). Temporal stability is often cited as a key difference between cognitive style and strategy, with the former seen as fixed and the latter as variable. Those supporting the stability of style include the Birmingham camp: Riding and Douglas (1993:298); Riding and Rayner (1998) and Riding and Cheema (1991:195). Riding in 1997 identified the 'temporal stability' of style – as a constant aspect of a person's psychology which does not appear to change. According to Riding & Rayner (1998:7) " [cognitive style] is probably... fixed early on in life ...". Support for this stance also comes from Kagan and Kogan (1970) who also see cognitive style(s) as pretty immutable: "...not simple habits...they develop slowly and experientially and do not appear to be easily modified by specific tuition or training". In addition, Allinson and Hayes (1996:122) note that "These right [intuitive] – left [analytic] patterns are not merely transient; people seem to have a rather permanent stylistic orientation to the use of one hemisphere." What is not evident in the literature is how many longitudinal studies actually test this assumption.

A number of researchers have questioned the stability of cognitive style (Oxford, 1990; O'Malley and Charmot, 1993; Cohen, 1998; Skehan, 1998 and Driver, 2000:42). Armstrong (2001) found, albeit with a small sample, that the stability of Allinson and Hayes' Cognitive Styles Index was questionable. Recent research by Peterson (2001, 2002), Parkinson and Redmond (2001) and Redmund et al. (2002) questions the stability of Riding's Cognitive Style Analysis over time; however these studies are looking at changes over a very short period of time and they question the reliability of the

instrument rather than cognitive style itself. Recent work by Waring and Evans (under review), looking at cognitive style variations in individuals over a year, found that whilst the wholist-analytic dimension was relatively stable, the verbaliser-imager dimension was not.

Cognitive style versatility has been broached by Schmeck (1988:xiii) who suggests that cognitive style is often very resistant to change; however, he acknowledges that in 'self actualising individuals' "... development of cognitive style proceeds from predominantly global to analytic and eventually...to an integration of the global and analytic modes..." It may also be that the study of certain disciplines encourages the development of stylistic versatility as Roberts (2001) referring to Lawson's (1997) work, suggests that the individual differences are determined or reinforced by the educational process that those students experience. Roberts (2001:229) in his study found that architect students became more wholist and less analytic over time in line with the demands of the course:

> " This is possibly related to the educational experience, where students are encouraged to think more holistically...it may be possible that students are developing all round skills in order to be able to switch between holistic and analytic thinking and between verbal and visual representation."

Sitko-Lutek et al. (2000:262) also question whether cognitive style and learning styles are fixed or malleable. Arguing that if style is innate, genetic and unchanging, educators should recognise the genetic 'hard-wiring' of the brain's preferences for perceiving and structuring information by matching the predominant style of the 'local gene pool.' If style preference is, on the other hand, largely shaped by processes of socialisation, and can therefore be broadened through training and education interventions, the treatment indicated could include measures that would encourage style flexibility. The extent to which change can be effected is commented on by Armstrong (2002:20) with reference to the work of Miller (1991), Messick et al (1976), Kogan (1980), Robertson (1985) and Kirton (1989):

> " [that] whilst superficial changes in behaviour are possible, it is likely that these are ephemeral and that the underlying cognitive style remains unchanged."

Further study is required in this area to ascertain how mobile cognitive style is. There appear to be no studies following students over a number of years to explore change/stability of cognitive style. Work carried out by Evans (2001) in a classroom based study did find evidence of students with specialised and more versatile styles and this was found to impact on educational performance as measured by GCE examinations.

There are still further gaps that need to be pursued to enhance our understanding of cognitive style. If one considers the argument that cognitive style is of a fixed nature when does this occur? At what age are our cognitive style preferences in place? What is the evidence for this? For Riding and Rayner (1998:7) cognitive style is: "an in-built and automatic way of responding to information and situations', [it is] **present at birth or at any rate is fixed early on in life**..." This does beg the question as to what grounds the contention that cognitive style is present at birth is based on. Ellis (1992:174) also questions whether style is inbuilt or develops with experience – are individuals born with a predisposition to use one mode of representation in preference to another? There are to date no studies tracing cognitive styles of infants into adulthood to clarify this, although Riding and Taylor (1976) found that the verbal-imagery dimension was strongly in evidence on 7 year olds. If in fact style is inbuilt, this leads Rayner & Riding (1998:186) to question how style is transmitted. Even if style genes do exist, a number of authors such as Witkin in Messick (1976) argue that socialisation may well affect cognitive style. There is evidence from O'Malley and Charmot (1993), Cohen (1998) and Skehan (1998) to suggest that preferences and styles can change as learners gain proficiency, or in response to pedagogical intervention in the form of strategy training. In addition, the relationship a growing child has with his mother is thought to be influential in determining his/her cognitive style (Dyk, 1969; Dyk and Witkin, 1965; Seder, 1957; Witkin et al., 1962; Hudson, 1966). Sternberg and Grigorenko (1997:708) also argue against the contention that style is fixed, but at the

same time acknowledge that some elements are difficult to change; unlike the views of Riding (1991) and Curry (1983), styles are seen as interacting with the environment:

> " Styles, like abilities are not etched in stone at birth. They appear to be largely a function of a person's interactions with the environment, and they can be developed and socialised. An individual with one style in one task or situation may have a different style in a different task or situation. Moreover, some individuals may have one preferred stylistic profile at one stage of life and another preferred stylistic profile at another stage. Styles are not fixed, therefore, but fluid."...More generally, a child's socialisation into a value system will probably reward some style more than others, leading to preferences for these styles. But the fact that some people retain less rewarded styles despite environmental pressure suggests that socialisation does not fully account for the origins of styles and that there may be preprogrammed dispositions that are difficult to change" (Sternberg and Grigorenko, 1997:708).

The preprogrammming that Sternberg alludes to is central to cognitive style definitions. The inbuilt nature of cognitive style has been widely cited by Riding et al. (1997). Styles are commonly referred to as 'architectural features' (Catell, 1967); 'high level heuristics' (Messick et al., 1976:9); 'hard wiring' (Rayner & Riding, 1997:22). According to Riding (1997) style probably has a physiological basis although Sitko-Lutek et al. comment that in their opinion (2000:262) " styles research has as yet failed to indicate conclusively the root causes for individual differences". Much has been written about neurological causes of cognitive style. Entwistle (1981) proposed a possible connection between cognitive style and the areas of neurological activity associated with the two halves of the brain. The left hemisphere emphasises a primarily linear mode of operation with information being processed sequentially, and being mainly responsible for logical thought, especially in verbal and mathematical functions. The right hemisphere emphasises synthesis and the simultaneous integration and the comprehension and iconic visual images. Riding and Pearson (1994:423) quoting Carroll (1993:56) argue cognitive style is simply a manifestation of a profile of ability – 'a style emerges from a difference between two complementary abilities. The individual will use which processor is fastest'. Furthermore, Riding, Glass, Butler, and Pleydell-Pearce (1997:232) in a study using EEG (electroencephalograph) to explore the

interaction of style and task-type in their effect on brain activity, found a clear distinction between different cognitive styles and types of brain functioning: "cognitive style can be related to brain localization/lateralization...[cognitive style acts as a] cognitive control area or interface between the external world and the internal world." Sadler-Smith (2001a:299) adds a note of caution suggesting that whilst a clear link does seem to exist between cognitive style and neurological indicators, further research using refined techniques as suggested by Springer and Deutsch (1998) is needed.

Having mentioned the, allegedly, fixed nature of cognitive style, it is time to turn our attention to what cognitive style actually allows us to do. There are many definitions of cognitive style that focus on the 'doing part' of the equation. At its most general, cognitive styles are seen as : "broad systematic features influencing a person's responses to a variety of circumstances" (Anastasi, 1988). Cognitive style according to Allport, (1937) and Messick, (1984:143) is concerned with "a person's **typical** or **habitual** mode of **problem-solving, thinking, perceiving and remembering."** Many researchers focus on the processing and organising part of the equation: Messick (1976:5), Harre & Lamb (1986), Tennant (1988), Borg and Riding (1993:272), Savvas et al. (2000) and Bonnano (2001:69). Evaluation of information is added to the list by Goldstein & Blackman (1978), Messick (1984) and Riding and Rayner (1998). Ackerman (1994) sees cognitive style as manifesting itself in the 'construction of personal expressions and cultural artefacts through alternative approaches to problem-solving, decision-making and the communication of ideas.' Saracho (1989, 1997) also stresses the processing role of cognitive style arguing that since students process different kinds of information, their cognitive styles influence how they employ various types of information. In contrast, Driver (2000) sees cognitive style as concerning the way we organise information and adds that our cognitive styles may conflict with information processing preferences in that we may, ourselves, question why we always go about something in a way we know not to be the best in a particular context. Wallach & Kogan (1965) view cognitive styles as adaptive control mechanisms of the ego that mediate needs and the external environment. Whereas Cellerier in Kaffai and Resnick (1996) argues that cognitive styles influence 'reflexive abstraction' and reflective

concretisations' (Ackermann, 1994). The former refers to the construction or prior knowledge from memory and the subsequent understandings gained to enable an individual to go beyond the information given; the latter, refers to the process of using memory based information to reconstruct and 'give form to ideas, and how these forms, once built, inform back learners' ideas (Bonanno, 2001: 69).

Relating to others is also seen as being connected to cognitive style. Witkin, Moore, Goodenough and Cox (1977) see cognitive style in a broader context and in terms of interrelationships: "individual differences in how we perceive, think, solve problems, learn and ***relate to others".*** Kogan (1971) views cognitive styles as impacting on behaviour across a wide variety of situations. Witkin et al. (1977) stated that cognitive style "in turn affects interpersonal functioning and the way one interacts with and relates to others". These views are consistent with those of Riding (1991a) who sees cognitive style as impacting on decision-making and human relationships in so far as it affects an individual's ideas and attitudes, the way an individual responds to events in his/her life and the ways in which individuals relate to others.

3.2: Identifying the key dimensions

Whilst Desmedt in 2002 was able to identify over 125 different cognitive and learning styles instruments, she also concluded, through citation analysis, that there were only a few dominant cognitive style models including Witkin's (1971) Group Embedded Figures Test measuring field-independence/dependence, and Ridings (1991) Cognitive Styles Analysis measuring wholist/analytic and verbaliser/imager tendencies. The most cited learning styles models were those of Entwistle's Approaches to Studying Inventory (ASI) (1979), Kolb's Learning Styles Inventory (LSI) (1985), Biggs' Study Process Questionnaire (SPQ) (1978) and Dunn and Dunn's Learning Style Inventory (LSI) (1989).

If one considers cognitive style models in the first instance, Riding and Cheema (1991) and Rayner and Riding (1997) found over 30 such labels which could be grouped into two principal dimensions of cognitive style; the wholist-analytic dimension and the verbal-imagery dimension. As demonstrated in Table 2, the nomenclature used to describe aspects of cognitive style are profuse leading to questions as to how many dimensions of style there are. Whilst some researchers are in agreement that there are 'two superordinate dimensions, of cognitive style' (Witkin, 1950; Riding, 1991; Entwistle, 1981; Biggs, 1978; Schmeck, 1988; Riding and Cheema, 1991; Sadler-Smith 2000a:191), this view has been questioned by others. These two style families: include: 'wholist-analytic and 'verbaliser-imager.'

> " I feel that all cognitive styles can be encompassed by one broad, inclusive dimension of individual difference, labelled "global versus analytic"...I am arguing that all of these, at some level of abstraction are reflections of a single dimension" (Schmeck, 1988: 327).

Arguing against this standpoint, Moore (2000) considers visual and verbal thinking to not be separate cognitive styles and the stability of the verbaliser-imager dimension of the Cognitive Styles index has been questioned by Redmond et al. (2001, 2002), Peterson (2001, 2002) and Waring and Evans (under review). Others such as Allinson and Hayes (1996), initially regarded cognitive style as consisting of a single intuitive/global- rational/analytical dimension. Their single dimension shares some of the features of other style dimensions such as Kirton's (1976) 'innovation–adaption dimension, Miller's (1991) intuition/feeling (holistic)- sensation/thinking (analysis) and Sternberg's (1997) 'global and local thinking styles. Like Riding's wholist-analytic dimension these too describe the way in which an individual processes and organises information. Whilst many models purport to measure the wholist-analytic dimension albeit using slightly different nomenclature there are few measures of the verbaliser-imager style which is thought to be related to the field of abstract-concrete (Harvey, Hunt and Schroder, 1961). Riding and Cheema (1991) in addition to the CSA verbaliser-imager dimension found only three other key measures for assessing this: The Individual

Difference Questionnaire (Pavio, 1971); Verbaliser-Visualiser Questionnaire (Richardson, 1977) and the Verbal-Imagery Code Test (Riding and Calvey, 1981).

Table 2: Cognitive Style Labels

WHOLIST	ANALYTIC	RESEARCHER
1. Retains a global view of information	Process information into its component parts	
1. Levellers	Sharpeners	Holzman & Klein, 1954
2.Field Dependence	Field Independence	Witkin and Goodenough, 1962, 1981
3. Divergers	Convergers	Hudson, 1966
4. Impulsive	Reflective	Kagan, 1965
5. Holist	Serialist	Pask, 1976
6. Right brain	Left Brain	Torrance and Rockerstein, 1988
7. Innovators Innovators: undisciplined thinking, tangential approaches to tasks and problems that cut across expected paradigms (Kirton, 1989).	Adaptors Adaptors: precision, reliability, efficiency, discipline and conformity (Kirton, 1989).	Kirton, 1976, 1987
8. Global	Analytic	Kirby, 1988
9.Holist: "seek certainty in flights of fancy, elaborate schemes that provide an illusion of control and an escape from troublesome empirical reality" (Miller, 1991:234).	Analyst: "seeking certainty through the pursuit of detail within a circumscribed domain, thereby avoiding the uncertainty and attendant anxiety generated by the larger reality" (Miller, 1991:234).	Miller, 1991
10. Wholist	Analytic	Riding, 1991
11. Intuition: right brain thinking – immediate judgement based on feeling and the adoption of a global perspective (Allinson and Hayes, 1996:122).	Analysis : left brain thinking – judgement based on mental reasoning and a focus on detail (Allinson and Hayes, 1996:122).	Allinson and Hayes, 1996:122
12. Global style	Local style	Sternberg and Grigorenko, 1997: 70

With reference to the wholist-analytic dimension of cognitive style, Hill, Puurula, Sitko-Lutek & Rakowska (2000) suggest that there are 4 major categories of cognitive behaviour as demonstrated in Table 3.

Table 3: Categories of Cognitive Behaviour (Hill, Puurula, Sitko-Lutek and Rakowska, 2000)

1. **Field-Dependence/ Independence**: whether people rely on context in sense-making;
2. **Visual/Verbal**: whether people prefer to take in and process information visually or by other means;
3. **Wholist/Analyst**: whether people prefer to take in and process information as a whole or in bits;
4. **Cognitive tempo/reflectivity v impulsivity**: whether people prefer to take in and process information quickly or more slowly with greater or less informational input and greater /less concern for accuracy.

Links between the 4 categories of cognitive behaviour are explored in Figure 6. The first mentioned measure of cognitive style, field dependence-independence, has also been found to be linked to ability and therefore not considered a true measure. Visual-verbal and wholist –analyst comprise Riding's Cognitive Styles Analysis (1991) and cognitive tempo is perceived by Hill et al. to be measured by Allinson and Hayes Cognitive Styles Index (1996). This introduces an area of uncertainty for the intuition-analysis scale of Allinson and Hayes could easily be considered to be measuring the same dimensions as the CSA although according to Hill et al. (2000) and verified by this study, it is not.

Three models: Riding's CSA (1991) Allinson and Hayes CSI (1996) and Witkin's (1962, 1981) Group Embedded Figures Test (GEFT) to measure field – dependence/ independence, all claim to measure analytic and wholist tendencies and to be measures

of cognitive style. The research presented in this thesis suggests that there is no statistically significant correlation between the CSA and CSI which there should be, if they both purport to measure analytic and wholist tendencies. In addition, Hill et al. (2000) see 'cognitive tempo' as measured by the CSI as being malleable, not fixed or innate as one would expect with cognitive style measures, but learned through personal and cultural socialisation. In this thesis, statistically significant correlations between the CSI and approaches to studying as measured by the Approaches to Studying Inventory (ASI) (Entwistle and Ramsden, 1983) were found, suggesting an overlap between cognitive and learning styles models.

Figure 6: Linking the 4 categories of cognitive behaviour as identified by Hill et al.

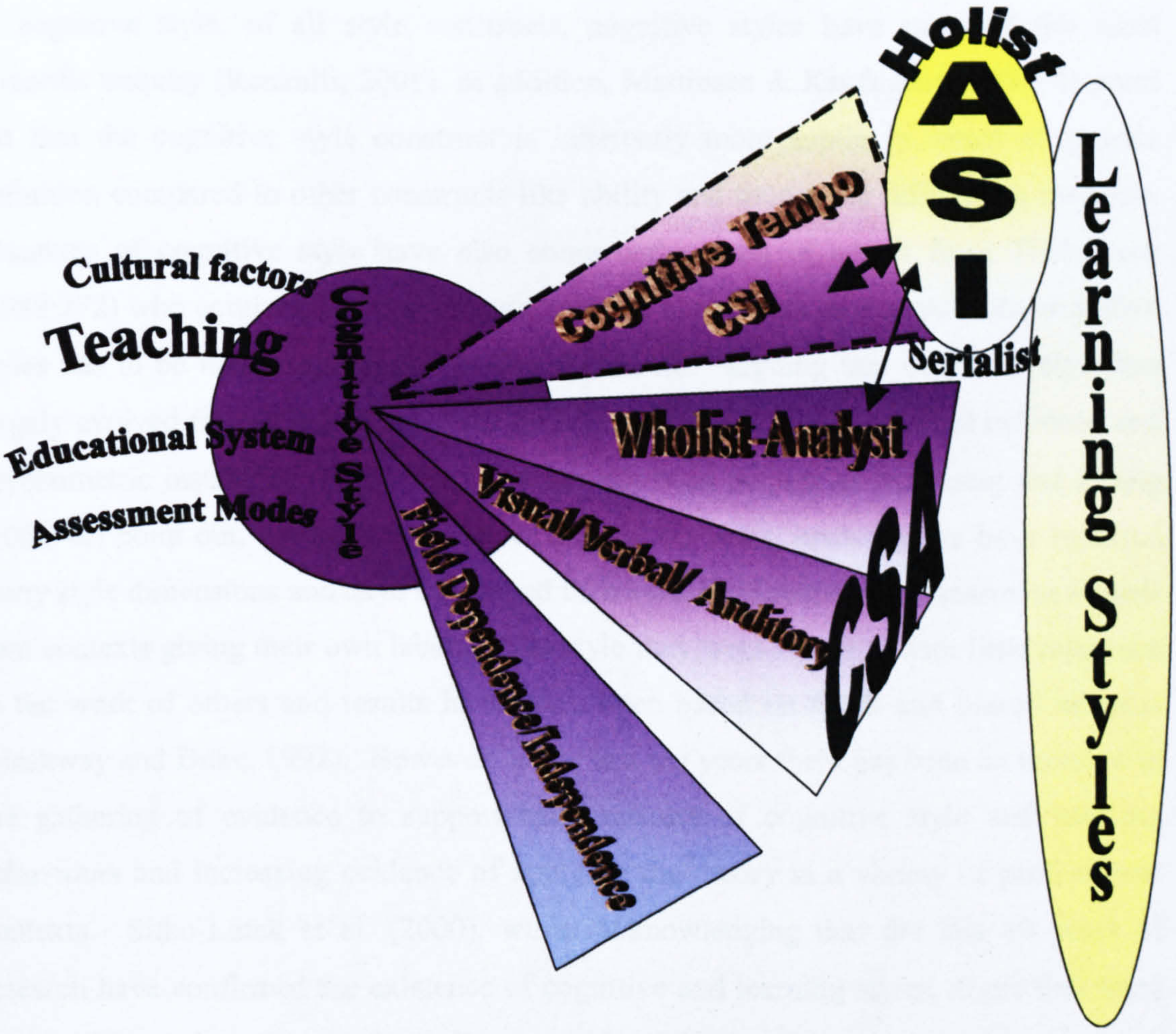


Figure 6 also suggests that a number of factors can affect cognitive style, notably cultural factors, teaching, educational systems and assessment methods; these will be explored in subsequent chapters.

3.3: Measurability of Cognitive Style

Particular concerns are raised in the literature regarding the reliability and validity of cognitive style instruments. Sadler-Smith (2000, 2001a:299) suggests that there are a number of psychometrically sound report measures of cognitive style, principally the work of Kirton (1976), Riding (1991, 1994) and Allinson and Hayes (1996). In defence of cognitive style, of all style constructs, cognitive styles have received the most scientific enquiry (Renzulli, 2001). In addition, Martinsen & Kaufmann (2000: 4) point out that the cognitive style construct is inherently more subtle in terms of precise definition compared to other constructs like ability and thus more difficult to measure. Measures of cognitive style have also come under a lot of attack from Tiedemann (1989:272) who comments: " my personal opinion of the state of research into cognitive styles has to be there is no point chasing a chimera!" arguing that cognitive style has largely evolved from theories based on single experiments, little empirical evidence and psychometric instability. This view point has not been helped, as Sternberg and Zhang (2001:48) point out, by the fact that over the last 60 years, investigators have reported many style dimensions and have developed their own instruments for assessment in their own contexts giving their own labels to the style they were studying with little reference to the work of others and results have often been based on small and biased samples (Hashway and Duke, 1992). However, in the last ten years there has been an increase in the gathering of evidence to support the construct of cognitive style and learning behaviours and increasing evidence of applying the theory in a variety of professional contexts. Sitko-Lutek et al. (2000), whilst acknowledging that the last 40 years of research have confirmed the existence of cognitive and learning styles, argue that there remains in question what they actually are and how they work.

The methodologies employed by various researchers have also been called into question as Messick (1984:59) states:

> "sometimes quite disparate measures are used to assess ostensibly the same style in different studies, while on other occasions, highly similar instruments serve to tap purportedly distinct styles."

Difficulties may also lie in the elusiveness of cognitive style and the fact that it may well be inextricably linked with other measures of individual difference. When it comes to identifying cognitive style, as Rayner and Riding (1998) acknowledge, it is not likely to be critical when the task is simple. In addition, as mentioned by Hashway and Duke (1992:2) "the same individual may use different cognitive styles when processing information from different content areas."

Furthermore, the nature of most paper and pen cognitive style inventories limits their usefulness in as far as 'can individuals report their behaviour accurately and objectively and do they actually know?' Is the bias due to the pressure of social desirability in making responses, willingness to make the necessary effort and own self-awareness substantial issues? In one of Laurillard's (1979) studies, 19 of 31 students could not be classified as to their style of learning because they were thoroughly sensitive to situational demands, varying their strategies in response to the specific task requirements. In defence of measures of cognitive style, this criticism is most heavily laid at the learning styles market. Similarly, Schmeck (1983) and Entwistle, Hanley and Hounsell (1979) note that both consistency and variability can be seen in a student's approaches to learning. These concerns may be more relevant to learning styles instruments where one would expect variability because of the interaction with the external environment rather than cognitive style measures. Such contextual factors as when the test was done, where, what mood the subject was in, how tired, could possibly affect results. Furnham (2000) also asks why does learning style not predict as well as you think it should? He argues that people choose/ select environments/subjects in

which they will study and in so doing the variability is lost; he contends that to observe differences you need to force people to work in environments / situations they don't want to. It also leads to questions as to whether such instruments will be systematically applied to all age groups, abilities, gender and across cultures?

Whilst much of the research base on cognitive style has come out of the Birmingham school and the work of Richard Riding et al. (1991), there is a need for further studies, particularly, in educational settings to verify and extend such work. Roodenburg (2001:165) has expressed the need for greater rigour with regards to cognitive style research:

> " A literature search of refereed journals shows an alarming number of articles which report measuring cognitive style as a significant aspect of their investigations. Most gave no rationale...for selecting a particular instrument as a measure of style...Despite these difficulties, the literature increasingly makes reference to cognitive style as if it is a well established and unambiguous construct."

In the last 10 - 20 years a considerable amount of work has been done by Richard Riding (1991) and Allinson and Hayes (1996) on their respective cognitive style instruments: the Cognitive Styles Analysis (CSA) and the Cognitive Styles Index (CSI) to answer these questions. A further question lies in the extent to which style measures such as Riding's (1991) Cognitive Styles Analysis and Allinson and Hayes' (1996) Cognitive Styles Index address such concerns. According to Jones (1997:66):

> "perhaps the most gainful effort ...has come from Richard Riding....., where a clear move has been made not only to summarise findings but give a structure that has then been investigated and applied in real settings: Riding and Mathias (1991); Riding and Pearson (1994) and Riding and Sadler-Smith (1992)."

Consequently, this study will adopt the CSA and use the CSI for validating purposes. Having acknowledged the tools that will be employed in this thesis to measure cognitive

style, it is essential that the distinction between cognitive style, learning style and strategy be explored further. By defining learning styles and learning strategy the relationship with the previously defined cognitive style will then be clarified to minimise unnecessary ambiguity.

3.4: Defining Learning Style

Defining learning style is fraught with difficulty given the sheer number of instruments purporting to measure this attribute and/or different aspects of it. We have models focusing on the learning process, orientations to study, preferences etc. Furthermore, the diversity of learning styles measures makes any connections with cognitive style all the more difficult as commented on by Sadler-Smith (2000a:191):

> "... it is argued that learning style is characterised by considerable divergence of perspectives. There is no taxonomy that enables practitioners to distinguish between style, strategy, and preference in order to decide when each should be applied in organisational settings. The evidence in favour of reliable measurement of learning style is less robust than proponents of the theory may have liked."

On the learning profile 'continuum', Curry (1983) and Schmeck (1988:175) locate learning style between cognitive style and learning strategy. Whilst cognitive style is often described as immutable, learning style is seen as being more malleable (Curry, 1983; Riding, 1991; Schatterman, 1997) although in the literature, Kolb (1976, 1984), McCarthy (1982) and Honey and Mumford (1986, 1992) see learning styles as a permanent part of human behaviour.

Learning style is viewed by Allinson and Hayes (1998) as a 'subcategory of cognitive style' defined as " the organising and processing of information that leads to changes in knowledge and skill" and Valley (1997:43) adds the context: " the preference that an individual may have for processing information in a particular way when carrying out a learning activity." Thus learning style is described as the translation of cognitive style traits into study behaviour:

> "It is probably true that an individual's learning style is the translation of personality and cognitive style characteristics into study behaviour...one could argue that individuals' learning styles are simply the cognitive styles that they evidence when confronted with a learning task" (Schmeck 1983:234.

Learning styles are also viewed as being wider than solely focusing on cognitive processing, they are perceived as being **broader and more focused** than cognitive styles, including not just cognitive but also affective, sociological and physiological factors. Keefe (1979), cited in Ellis, (1994:499) and Matthews (1996:249) define learning styles as "characteristic cognitive, affective and physiological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment." Curry (1991:252) neatly points out that 'learning style can be conceived as a combination of one's motivation, engagement and cognitive processing habits'. Thus learning style incorporates traits relating to attention, emotion and valuing and how the person motivates him/herself and sustains behaviour. Learning preference models also embrace the physical environment and the visual, auditory and kinaesthetic needs of the learner, however cognitive models also address visual and auditory preferences.

Clark (2001:1) describes a learning style as: "a student's consistent way of responding to and using stimuli in the context of learning." This definition is in itself over simplistic as context may well affect chosen approach and such 'consistency may depend on the 'type of learning style' being measured. In this respect, it may be useful to consider the work of Riding and Rayner (1998:49), who classify learning style instruments into 4 main areas, according to focus, as demonstrated in Table 4.

Kolb (1976) developed the learning style inventory (LSI) which describes a learning process and style. Whilst this model is widely cited in school management textbooks, its validity and reliability is open to question. The apparent lack of congruence found between the Learning Styles Questionnaire (LSQ) of Honey and Mumford (1986) and the Learning Styles Inventory of Kolb (LSI), (1976) found by Sims, Veres, and Shake

(1989:232) is worrying, when both instruments purport to measure the same thing. In the same vein, learning process models should not significantly correlate with those measuring approaches to studying but significant correlations have been found between certain learning styles instruments such as the LSQ of Honey and Mumford (1986) and the Revised Approaches to Studying Inventory (RASI) (Entwistle & Tait, 1994), suggesting overlap in the dimension which the respective instruments purport to assess (Sadler-Smith, 1997).

Table 4: Learning Style approaches (Riding and Rayner, 1998)

Focus	References
1. Focus on learning process	*Kolb (1976)* *Honey and Mumford (1986, 1992)*
2. Orientation to study	*Schmeck (1977)* *Entwistle (1979, 1983)* *Biggs (1978, 1985)*
3. Instructional preference	*Price (1976)* *Dunn (1989)* *Grasha and Reichmann (1975)*
4. Cognitive skills development	*Reinert (1976) / Letteri (1980)*

The cognitive style/ learning style distinction is muddied when instruments purporting to measure each of these styles overlap. One would also not expect learning styles models and cognitive styles models to significantly correlate; however, Entwistle does refer to serialist and holist thinking which cognitive style instruments do purport to measure. Thus the noted overlap by Allinson and Hayes' (1998), between learning styles models such as the Revised Approaches to Studying Inventory (RASI) of Entwistle & Tait (1994) and Allinson and Hayes own Cognitive Styles Index (CSI), does not come as a complete surprise. What is more surprising, is the association

Allinson and Hayes (1998) and Furnham (1992) found between the Learning Styles Questionnaire of Honey and Mumford and cognitive style instruments. Furnham (1992) also found strong and significant correlations between Kolb's LSI and a cognitive style instrument. In addition, some links were found between Gregorc's (1982) cognitive style measure and Kirton's (1977) learning styles instrument by Joniak and Isaksen (1988).

With respect to the increasing number of 'learning preference models,' there is even more scepticism over their reliability and validity. The proliferation of such models on the internet does nothing to enhance the status of learning styles models. Smith (2000:186) comments on the lack of rigorous analysis of these compared to what he considers to be learning styles models. The learning style/ learning preference models of Dunn (1984) and Reichmann and Grasha (1975) encompass student attitudes towards learning, their views of teachers and/or peers, reactions to classroom procedures, and physiological stimuli such as "time of day." Sadler-Smith (2000a:183) argues that these models may be more accurately described as learning preferences rather than learning styles models; defining them 'as the favouring of one particular mode of learning over another'. Unlike cognitive styles, the learning preferences are less stable and may show difference in different contexts such as school, subject, teacher, time of day etc. Sadler-Smith (1999) identified three learning preferences as:

(1) **Active**: preference for role play, case analysis, workshops , problem solving exercises, giving presentations and seminars;
(2) **Reflective**: preference for lectures on facts and theories, lecture on examples, self study, studying from the text, and computer based methods;
(3) **Individually oriented methods**: Preference for individual work and dislike of group work and role play exercises.

This leads, naturally, to a consideration of how learning styles/preferences and strategies differ.

3.5: Learning Strategy

If one accepts the stability argument regarding cognitive style, one of the key differences between style and strategy is the changing nature of the latter. Strategies are learned and developed as ways of coping with tasks and are subject to revision, evolution and change and thus are seen as dynamic and mutable. Learning strategy explicitly addresses the learning context as an important factor. Strategies can include asking questions, planning, monitoring, checking, revising, reasoning etc. According to Schmeck (1983:233) "... a learning style is a predisposition on the part of some students to adopt a particular learning strategy regardless of the specific demands of the learning task." Thus a style is simply a strategy that is used with some cross-situational consistency:

> "Learning style describes basic and generalised dimensions of individuality in learning, while a learning skill is more situational and subject to intentional development" (Boyatzis and Kolb, 1991:279).

According to Riding and Douglas (1993:298) "strategies are the ways that may be used to cope with situations and tasks, they vary temporally and may be learned and developed." They are thus seen by Riding and Agrell (1997:315) as "methods of using style to make the best of situations for which the style is not ideally suited." Schmeck (1988:17) also differentiates between style and strategy:

> "learning strategies are combinations of cognitive skills implemented when a situation is perceived as a learning situation, and style relates to the student's prior experience and personal motives."

As already discussed, whilst cognitive styles are viewed by Messick (1976:9) as 'high level heuristics,' or by Royce and Powell (1983) as 'metastrategies,' strategies are regarded as lower level functions or 'lower order abilities' that are organised by cognitive style processes. This view is also echoed by Rayner and Riding (1997:22): "A distinction is required between the 'hard-wiring' of an individual's style and the 'soft-wiring' of learning strategies by which make up an individual's learning repertoire..." Schmeck also adds that whilst strategies can be seen as the implementation of a set of

procedures (tactics) for accomplishing something, they can go wrong even though the performer has the cognitive style that would facilitate task solution; strategies may thus not reflect style accurately.

3.6: Inherent problems with measuring Learning Style

Whilst the measurement and identification of cognitive style has been fraught with difficulty, the lack of robust measures of learning style severely limits the applicability of such models, which in itself is ironic as this area of research has permeated schools far more than that of cognitive styles. Whilst the notion of learning styles has great intuitive appeal, there is inconclusive evidence regarding their existence and the fact that they have been used, sometimes, inappropriately with mixed results, limits their currency and potency (James and Blank, 1993 and Stellwagen, 2001). In addition, the fact that learning style is perceived to be less stable than cognitive style and amenable to change and interaction with the environment, makes any measure of this construct only valid to the particular situation in time and context that it is purporting to measure.

The proliferation of learning style instruments has served to weaken the validity of this construct as commented on by Hudak (1985) who argues that learning style researchers must demonstrate that the construct has reality and relevance and Moran (1991:243): "rigorous conceptual and empirical analysis (including psychometric validation) of the construct of learning style... [is] necessary because...overextension of the term will weaken its theoretical foundations." O'Malley & Chamot (1993:109) add: " there has been no unifying theoretical framework for variables cited under the rubric of learning style." With regards to learning style, Ellis (1992:161) also refers to "the looseness of the construct and the uncertainty about how to measure it." The multitude of relatively untested internet sources of learning styles instruments does nothing to help the credibility of the construct.

Nonetheless, there are measures of learning style that have greater currency such as Enwtistle's Approaches to Studying Inventory which has been subjected to serious

scrutiny since its inception in 1983 and will be discussed in greater detail in later chapters.

3.7: Linking Cognitive Style, Learning Style, Learning Preference and Strategy

The models of Curry (1983), Riding and Rayner (1998: 114) and Tanova (2000:344) discussed in Chapter 2, demonstrate the links between cognitive style(s), learning styles and strategies; however the relationship of the individual elements to each other remain somewhat obfuscate. If cognitive style represents the core of an individual's learning style, how do the various pieces of the jigsaw fit together? Rayner's Learning Style Model (2000:117), as shown in Figure 7, represents an attempt to clarify this situation. He suggests that cognitive style reflects the fundamental makeup of a person; as a higher order construct it is 'more internalised, very stable, predictable, and related to the way a person thinks or processes information' whereas what he refers to as 'learning activity' (learning styles and strategies together) are presumed to be 'more external, embracing a less stable, less predictable set of functions that relate to a continuing adaptation of the environment.' In this way each individual has their own **learning profile** / individual approach to learning. Rayner argues that the learning skills and strategies that are developed are regulated by a person's underlying cognitive style. He describes the relationship between the components of a personal learning style as follows:

> "A personal learning style ...is understood to comprise a set of dimensions that reflect a developing repertoire of processes, strategies, and behaviour....the cognitive/learning dimensions might usefully be construed as architecture made up of the "hard-wiring" of an individual's cognitive style and the "soft-wiring" of learning strategies, preferences, and processes that make up an individual's learning repertoire" (Rayner, 2000:168).

Rayner also argues that whilst cognitive style and learning strategies combine to form the basis for difference, it should be remembered that this individual difference will also interact with other related differences such as intelligence and personality. Also of

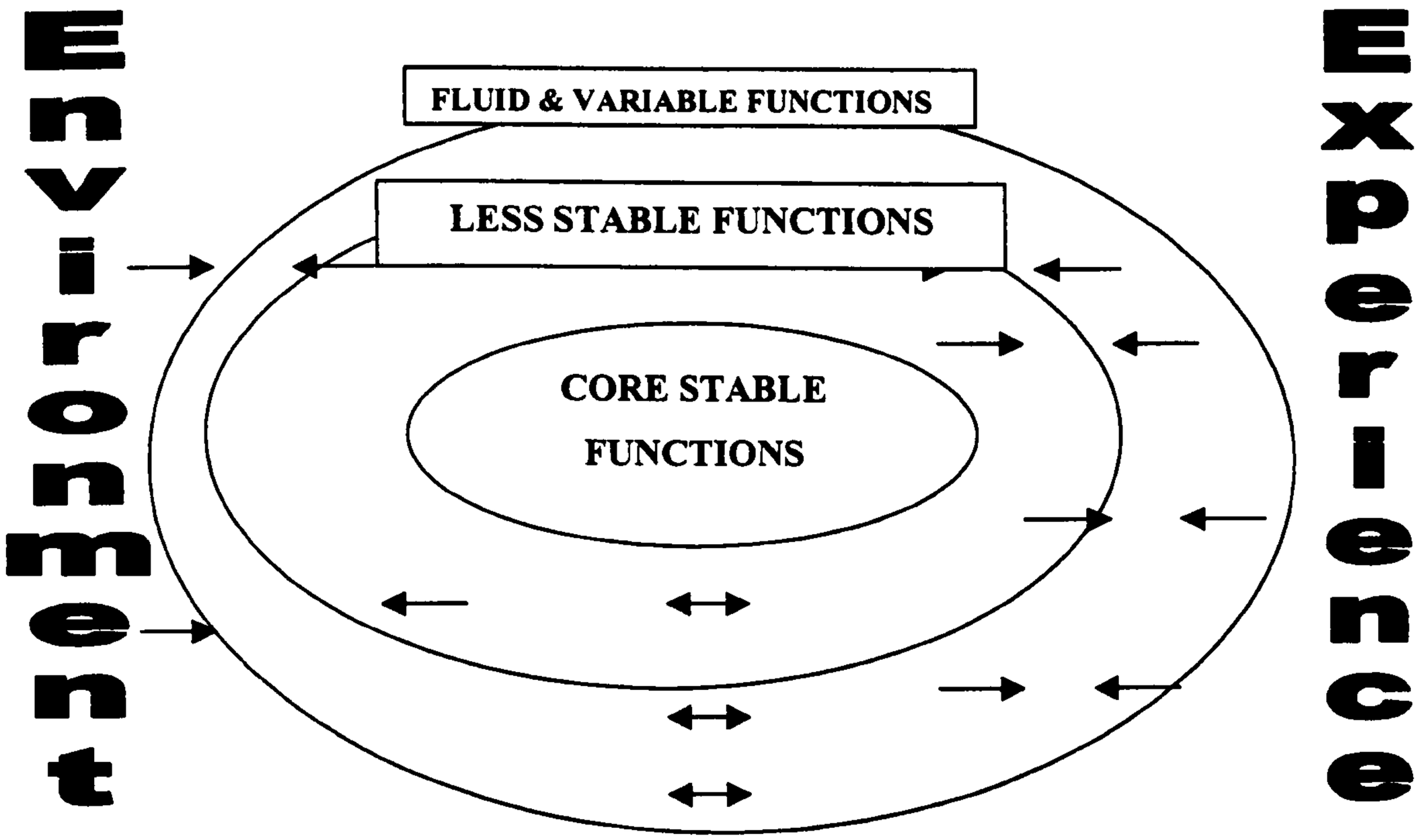
interest is how cognitive style and strategies combine. In defining a person's learning style, Rayner (2000:118) states:

> " A person's learning style...is understood to be an "**umbrella construct,**" defining several aspects of an individual's approach to learning. It is made up of a "core," a cognitive style, which in turn influences a secondary set of processes including learning strategies, learning preferences, motivation, and self-perception as learner."

Thus Rayner, sees learning style in a broader context and this should not be confused with the more narrow definitions of learning style described earlier. Links with personality are not described.

Whilst Sternberg (1997) and Bonanno (2001:69) both propose that cognitive styles can serve as an important interface between personality and cognition, Witkin (1959:51) and

Figure 7: Style functions in the individual learner (Rayner, 2000:117)



Cattell (1973), at a much earlier date, suggested that personality and cognitive style were inextricably linked, as did Witkin (1959:51) who initially asked the question: 'how do we know which way is up – the way in which we perceive is related to what we are like?' And whilst Schmeck (1983) contends that attempts to link personality and cognitive style to learning have not been very informative, Saracho (2000: 297) comments: " cognitive styles are intrinsically intertwined with an individual's complete personality. They are a segment of the structure that determines the nature of adapting attributes and defence mechanisms." And whereas Riding (1997) sees affective and motivational aspects of learning as additional dimensions of learning style, Shapiro (1965) and Messick (1976:7) see cognitive styles as interwoven with affective, temperamental, and motivational structures as part of the total personality. Rayner and Riding (1998:190) suggest:

> " It appears very likely that cognitive style is a missing piece in the jigsaw of understanding the self....It is a key element in a Personal Style Profile. Such a profile could include cognitive style, intelligence, personality, gender, and prior knowledge."

For Sadler-Smith (2001:614), whilst cognitive style is viewed as being independent of the personality source, he sees it as interacting with personality. In Figure 8, whilst learning style and strategy are shown as modifiable, an important question hangs over the issue as to whether cognitive style is also malleable. If strategies can be learned and developed, what about cognitive styles; can they also be learned and developed? Riding (1997) identified the 'temporal stability' of style as a constant aspect of a person's psychology which does not appear to change but this characteristic has been questioned (Oxford, 1990; O'Malley and Charmot, 1993; Cohen, 1998; Skehan, 1998; Driver, 2000 and Armstrong, 2001).

The relationship between cognitive style and learning style is ambiguous. Rayner and Riding (1997:22) considered that the motivational aspect of learning style "...might well

represent a 'bridge' between a person's cognitive style and formation of learning strategy". A two-way relationship is in evidence here as learning style affects learning strategy and learning styles are modifiable by learning strategies (Curry, 1983). Whilst Sadler-Smith (2001:615) found cognitive style and learning style to be independent using Riding's (1991) CSA and Kolb's Learning Inventory (LSI), Allinson and Hayes (1998) have suggested that cognitive models overlap with learning style / preference ones, finding that an individual scoring high on analysis in the CSI preferred a setting that was 'quiet, private and impersonal, oriented towards careful routines, governed by logic with a clear structure.' Whilst those scoring high on intuition prefer a setting that is 'actively oriented, offers new experiences, provides opportunities for relationships and is flexible and open to change' (Tanova, 2000:345). It needs to be noted here that the suggestion is that the CSA and CSI cognitive style models must be measuring different aspects of cognitive style; this question will be pursued further.

With regards to **'learning preferences'**, these are seen by Sadler-Smith (2000a:186) to be related to personality and cognitive style constructs. Sadler-Smith, Allinson and Hayes (in press) have observed some relationship between learning preferences and the intuition-analysis dimension of style. Tanova (2000) sees the learning preferences as the behavioural responses to the interactions between the cognitive and learning styles and the external context.

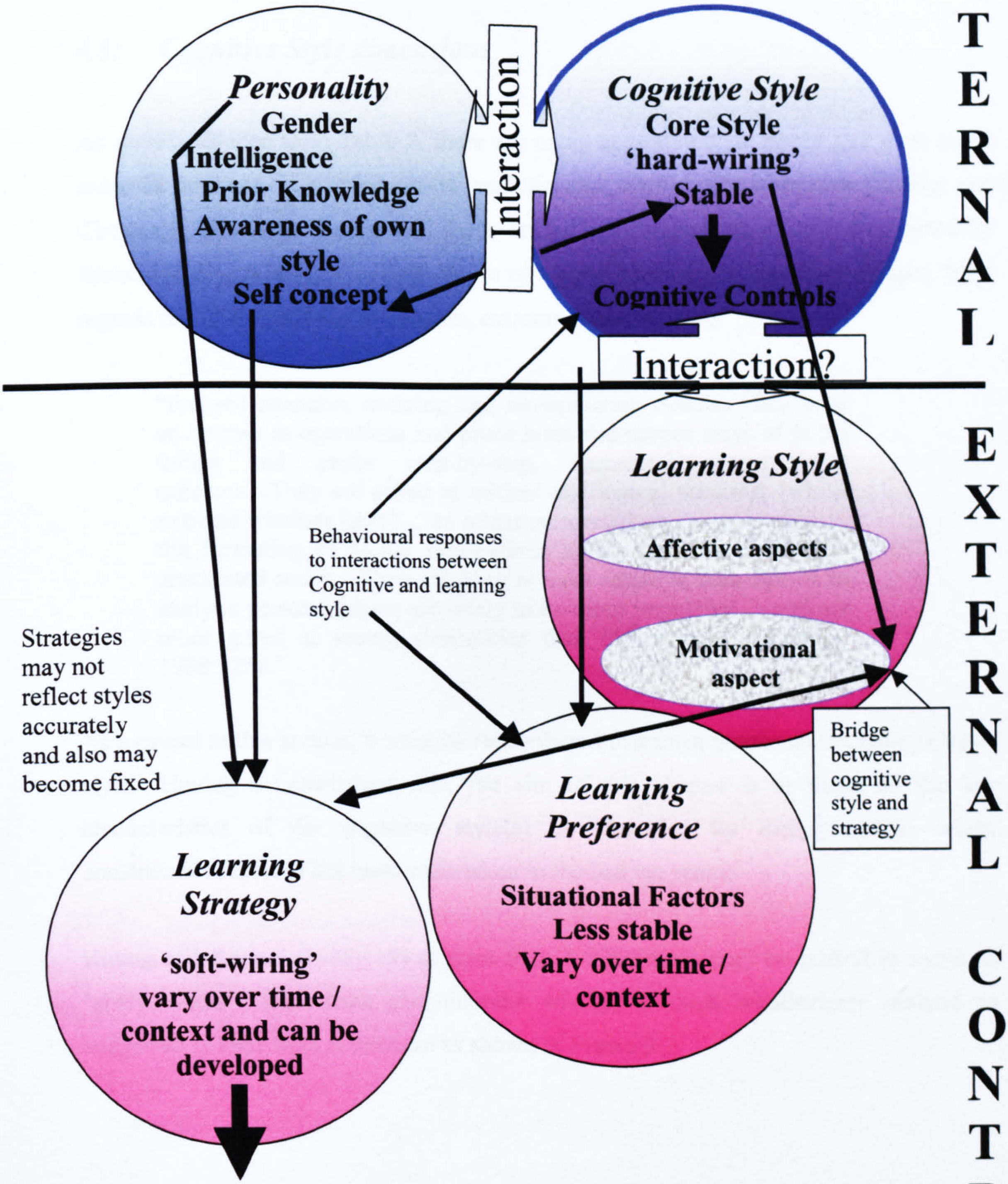
Turning finally to **'learning strategy'**, the link with cognitive style is noted by Cohen (1998:15) and Dickenson (1990:200). Strategies are seen as inextricably linked to learning and cognitive styles. Royce and Powell (1983) view cognitive style as a metastrategy that 'recruits' lower order abilities such as strategies. Dickenson (1990: 200) talks of a 'likely relationship between cognitive style and preferred learning processes and strategies in language learning' and Cohen (1998:15) also comments: "learning strategies do not operate by themselves, but rather are directly tied to the learner's underlying learning styles (i.e. their general approaches to learning) and other personality-related variables (such as anxiety and self-concept) in the learner..." Sadler-Smith (2001:296) also states: "The argument here is: (1) cognitive style and learning

strategy are related; (2) style has an internal locus; and (3) strategy represents the interface between cognitive style and the external learning environment..." Renzulli & Yun Dai (2001: 345) also add that strategies can become fixed in nature and thus can operate as styles:

> " When a strategy is so contrived and overused that it becomes spontaneous and indiscriminate, this is a case of a strategy turning into a style, that is, a stable, self-consistent disposition."

Figure 8 attempts to summarise suggested linkages between the different components of style such as between personality, cognitive style, learning style and strategy. The waters, here, remain somewhat turbid as the nature of the various links is still open to debate. The diagram suggests two-way linkages between aspects of style and the moderating influence of other factors, in addition to cognitive style, on strategies adopted. Whilst it is generally accepted that learning style and strategy are amenable to change; many questions are left unresolved such as 'what are the mechanisms that enable some individuals to modify their own cognitive style and how are cognitive style(s) and controls interlinked?'

Figure 8: Linking Cognitive Style, Learning Style, Learning Preference and Strategy



Chapter 4: Cognitive Style characteristics

4.1: Cognitive Style dimensions

As already alluded to in Table 2, there are many cognitive style labels and what many share in common is a reference to analytic and wholist characteristics (Riding and Cheema (1991). This chapter will focus on the two dimensions of style recognised by Richard Riding (1991); principally those of wholist-analyst and verbaliser-imager. With regards the first mentioned dimension, extreme analytics have:

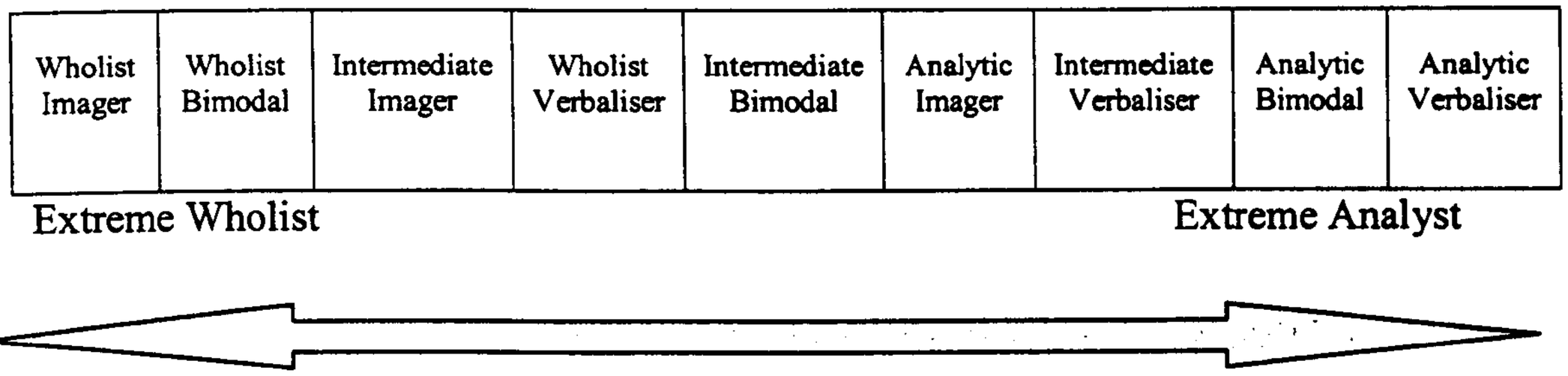
> "focused attention, noticing and remembering details. They have an interest in operations and procedures and proper ways of doing things and prefer step-by-step, sequential organisational schemes...They are gifted at critical and logical thinking, [whilst extreme wholists have]... an attention toward scanning, leading to the formation of global impressions rather than more precisely articulated codes...Their thinking is more intuitive than that of an analytic person...[they] are likely to be more impulsive ... and are more gifted at seeing similarities than differences" (Schmeck, 1988:328).

As a caveat to this section, it must be remembered that most people do not have extreme styles. Having acknowledged this, the aim of this chapter is to focus on the key characteristics of the cognitive style(s) as identified by Riding (1991) where considerable research has been undertaken in the last ten years.

Riding and Rayner (1998:119) suggest that: " individuals may be ranked in terms of 'analytic-ness'...from least analytic/most wholist to most wholist/least analytic as suggested in their style continuum as shown in Figure 9.

Thus, characteristically, analytics are perceived to be adept at seeing the detail but not the overall picture whilst wholists are able to retain a global view of information but may not be able to see such detail. Riding (1991) describes this dimension as assessing " whether an individual tends to organise information into wholes or parts". The second dimension of Riding's (1991) Cognitive Styles Analysis is verbaliser-imager. This dimension is seen as completely distinct from and independent of the wholist-analytic one and assesses "whether an individual is inclined to represent information during thinking verbally or in mental pictures" (Riding, 1991).

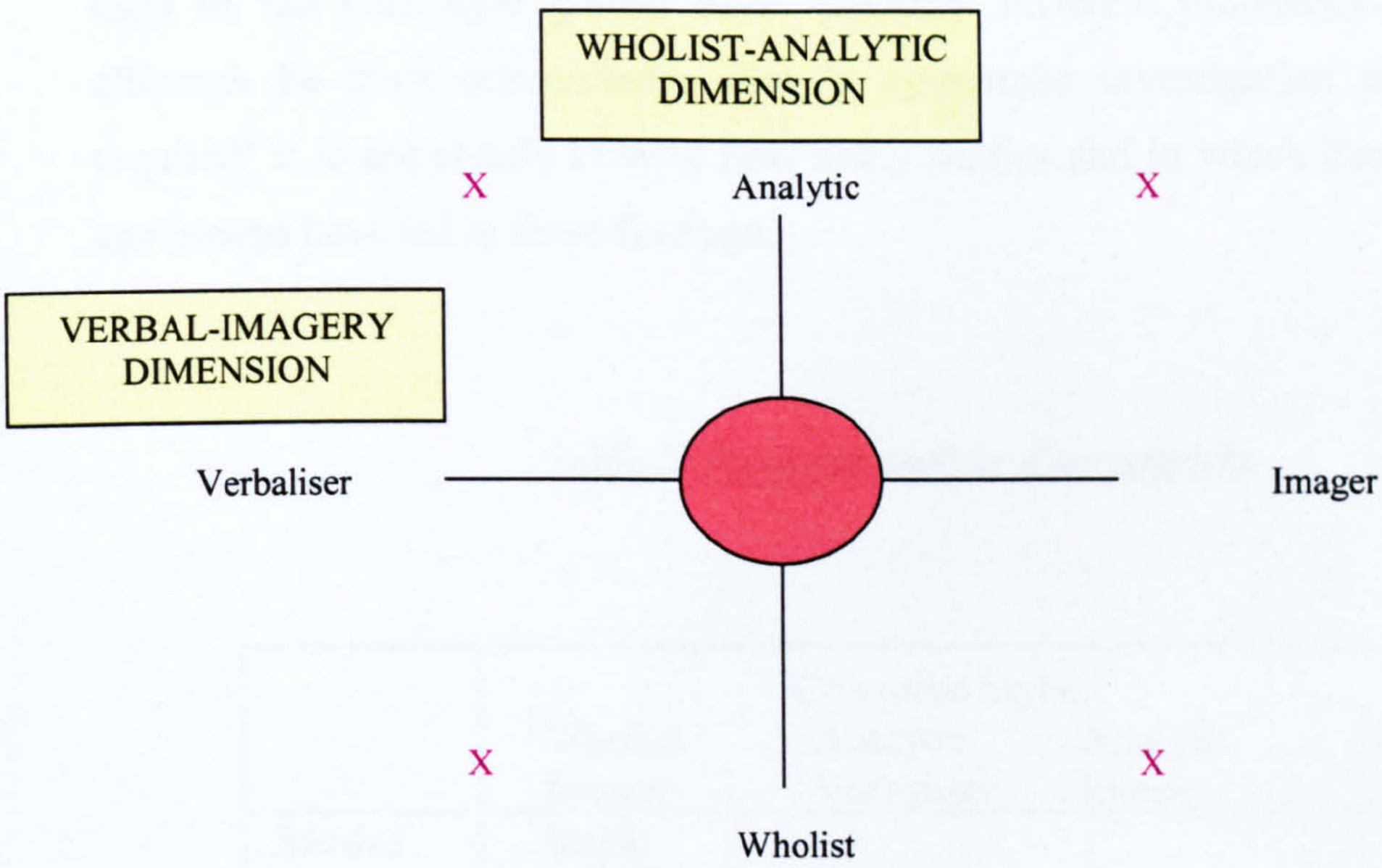
Figure 9: The Wholist- Analytic continuum (Riding and Rayner,1998:119)



With reference to the Cognitive Styles Analysis (1991), using the two dimensions of wholist-analytic and verbaliser-imager, Riding assigns individuals to one of nine groups by dividing the data on each continuum into three groupings as identified in Figure 9. Given the numbers involved in the present study, data was subdivided, using the median value, into groups along each of the two dimensions, (wholist-analytic, verbaliser-imager), to give the four main groupings of wholist-imager, wholist- verbaliser, analytic-imager and analytic-verbaliser as displayed in Figure 10. Riding and Rayner (1998) acknowledge that style dimensions are continuously distributed, (in this study, they were found to be normally distributed), and the use of group labels merely serve as convenient descriptors of a dimension. Cognitive style effects may be far more apparent at the ends of the spectrum as indicated by the Xs in Figure 10 and far less apparent in the areas as suggested by the orange circle.

Having established the four main cognitive style groupings, Riding (1991) distinguishes between complementary and unitary styles in that styles may either complement or intensify one another. Thus analytic-imagers and wholist-verbalisers have complementary styles and wholist-imagers and analytic-verbalisers have unitary ones. Thus in the case of an analytic-imager, the analytic dimension of style would give an individual the detail of a situation and the imagery dimension could give them the overview not provided by the former dimension.

Figure 10: The four main Cognitive Style groupings (Riding, 1991)



When considering characteristics assigned to the four main cognitive style groups, Messick (1976) and Sternberg and Grigorenko (1997) warn of the danger of simplifying cognitive styles by describing them as if they were types:

> " Realistically, people are probably not 'types'…but rather vary continuously and somewhat differently as a function of diverse person-situation interactions… Even studies labelling children as, say, impulsive or reflective have assigned labels on the basis of

discrete cut offs assigned to values on continuous numerical scales...Rather, the discrete categories were simplifications for purposes of research" (Sternberg and Grigorenko, 1997:706).

4.2: Cognitive Style and learning preferences

Bearing in mind concerns regarding the oversimplification of style through the use of style labels, a significant amount of research has been generated by Riding et al. to ascertain the implications of cognitive style for learning, which are worthy of note. Whether the results of such studies can be replicated with larger samples and varying age groups is still open to question. Table 5 shows, according to Riding (2002: 46), that each of the four style groups have 'possible' different preferences for expression, although he does acknowledge that 'a systematic investigation of preferences is required' it is not clearly evident how many studies and in which contexts with which age groups have led to these findings.

Table 5: Preferred modes of expression

	Cognitive Style			
	Wholist Imager	Analytic Verbaliser	Analytic Imager	Wholist Verbaliser
Modes	**Rank**			
Text	**1**	2	2	**3**
Speech	2	2	**3**	**1**
Diagrams	2	**3**	**1**	**3**
Picture	1	**3**	2	2

Thus, typically in the context of learning, whilst wholist-imagers exhibit a preference for text, analytic-verbalisers prefer text and speech, analytic-imagers, diagrams and wholist-verbalisers, speech. Wholists are purported to prefer structured learning situations whereas analytics are viewed as able to provide their own structure. Verbalisers are reported as preferring and performing better on verbal tasks with imagers preferring and performing better from visual cues. The research base demonstrates such findings with particular students in specific contexts; whether individuals would maintain these observed preferences in different subjects and contexts needs to be verified. Preferred mode of expression may also depend on familiarity with the subject matter, knowledge of other students and learned behaviours based on prior learning which may conflict with natural cognitive style. Askew and Brown (2001) and Hill et al. (2000) also comment on the role of cultural differences through their examination of teaching practices in different countries.

In support of the findings demonstrated in Tables 5 and 6, a number of studies have identified a link between learning approaches/tools, cognitive style and performance. The findings are also summarised in Figure 11, which shows similarities and differences between the 4 cognitive styles. The pattern shown is simplistic as it does not take into account the interaction effects of cognitive style with other factors, namely, intelligence and gender which have been identified, leading Riding (1991), to comment, in relation to the link with intelligence, that those of lower ability will be more constrained by their cognitive style especially if it is an extreme one.

If mode of presentation, nature and organisation of material can be observed to differentially affect performance with regards to cognitive style, it is reasonable to suggest that such learner preferences may also be exhibited in teaching behaviours which leads to a later discussion of whether an individual teaches in the way that they like to learn; caution in this respect is raised by Askew and Brown (2001:47) who argue that:

"Differences in pedagogic practices are as much to do with macro influences as variation amongst individual teachers."

Table 6: Cognitive style and the learning context

Research evidence – influences on performance

Mode of presentation

1. Riding and Rayner (1998) and Riding and Watts (1997) found that imagers almost doubled their learning performance if presented with the same information in a **text-plus illustration format** compared to just text whereas verbalisers were not affected and verbalisers chose textual versions, and imagers chose illustration ones.

2. **Imagers learn best from pictorial presentations, while verbalisers learn best from verbal presentations.** (Riding & Ashmore,1980; Riding & Buckle, 1990; Riding, Buckle, Thompson and Hagger, 1989; Riding and Calvey, 1981; Riding and Dyer, 1980).

3. **Pictorial versions of information were more attractive and interesting for wholists** whereas analytics were more attracted to a neat and tidy verbal format. Riding and Watts, 1997; Riding and Agrell, 1997).

4. **Imagers particularly if wholists, reported that they used less writing and more pictures than verbalisers** (Riding and Read, 1996).

5. **Imagers like to learn by observation, prefer practical activities and have superior visual recall** (Boulton-Lewis & Wilss, 2001:114).

6. **For wholists, the reading attainment is superior for the verbalisers.** Riding and Dyer (1980) also found verbalisers to be superior in speech but inferior in writing, **whilst imagers were superior in written mode**, but inferior in the spoken mode.

7. Riding and Sadler Smith (1992) found that **the least effective method of teaching for all groups appears to be by presenting the information in a highly verbal manner with abstract diagrams.** The improvement in learning performance by the inclusion of more pictorial information in diagrams confirms findings of Winn, (1981, 1982) and Holliday (1976).

Structuring

8. The two cognitive styles most affected should be analytic-verbaliser and wholist-imager. Analytic–imagers and wholist-verbalisers are able to generate both an overall

wholist and a more specific analytic view of information. By contrast, the analytic-verbalisers will have no alternative means available to them of obtaining an overall view, but will be limited to an analytic structure. Also the wholist- imager will not be able to generate an analytic structure but will be restricted to an overall perspective. The structure of the learning material is thus likely to affect the groups differently. **The analytic-imagers and wholist-verbalisers will be able to keep a balance between the whole and the parts. The analytic-verbalisers will benefit from an emphasis in learning from spoken information.** Riding (1979) found **that imagers are superior to verbalisers on spatial and directional** information, while verbalisers are better on details dealing with actions, time and abstractions.

9. Douglas & Riding (1993) found that 11 year old **wholists did better when the title of the passage was given before the passage was presented rather than at the end** although this had little effect on analytics. This was explained as being because wholists are less able to structure material; thus a title at the beginning could give some organisation to the material. Riding and Sadler Smith (1992) **found that giving an introduction to a topic and a summary at the end improved the recall performance for analytic-verbalisers and wholist-imagers but the additional material reduced performance for wholist-verbalisers and analytic imagers.** Wholists will benefit from help in structuring material, while analytics should be able to impose their own structure upon it.

10. **Information presented in smaller steps facilitated the learning of wholist-verbalisers and analytic-imagers (complementary styles) but unitary styles wholist-imager and analytic-verbaliser did better when large chunks of information were given to them** (Riding and Read, 1996; Riding, 2002).

Content

11. Riding and Calvey (1981) and Riding and Dyer (1980) found that imagers did best on the material which was highly descriptive and contained very few unfamiliar terms whilst verbalisers were superior on the understanding and recall of information containing the unfamiliar and acoustically difficult terminology. The researchers concluded that the cognitive style of the verbaliser would appear to be more appropriate to coping successfully with learning from text and definitions, than that of the imager.

12. Research shows wholists were superior on geography (Evans, 2001) and French, Intermediates on English, history and science, with analytics doing poorly on science, geography and French (Riding and Rayner, 1998; Riding and Agrell, 1997).

Locus of Control / Behaviour / Motivation

13. Sadler-Smith and Riding (1997) from a study of 245 university business studies students found **analytics preferred to have control themselves rather than to be controlled, whilst the wholists had no preference.**

14. Riding and Burton (1995) suggest that when considering social behaviour, it might be expected that the **conduct behaviour of wholists would be worse than analytics,**

since the former are less well organised with respect to both self-control and learning, and more outgoing than the latter. Verbalisers would find school learning easier, with its verbal bias, but imagers would be more inward and restrained, so there should be little difference between them in behaviour.

15. Evans (2002) found that **wholist-verbalisers were more prone to self-worth motivational style than the other cognitive styles.**

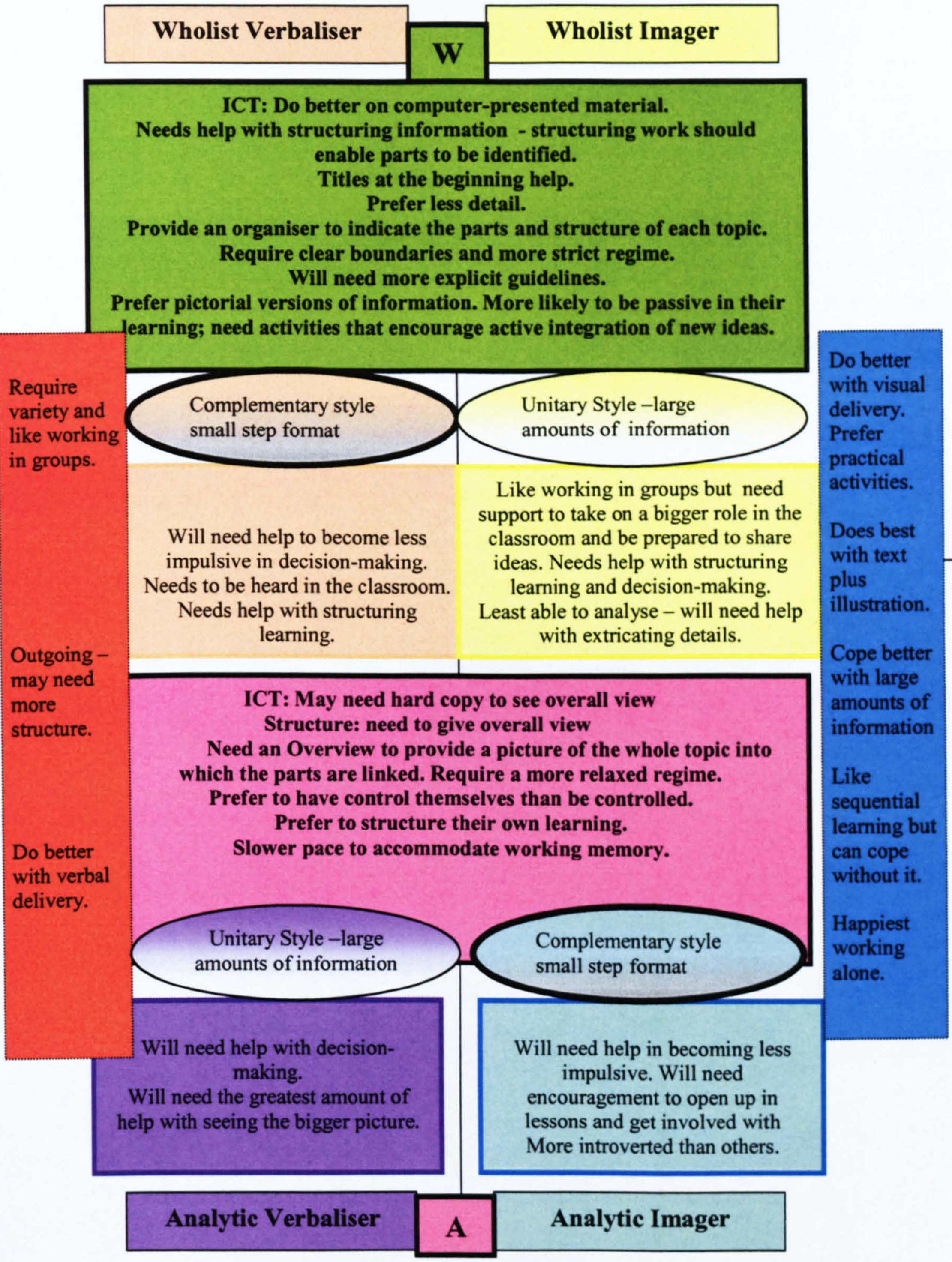
16. **"verbalisers may be good at relating/overwhelming and delegating/leaving too much to others, while imagers are typically restrained/poor at relating and have good controlling skills/poor delegations skills"** (Sadler-Smith, 2000a).

Figure 11 summarises the varied learning needs of the four cognitive styles. The pattern presented can appear confusing. With reference to analytic-verbalisers, whilst analytics are perceived as preferring to work alone, analytic-verbalisers may prefer group work and are perceived as more outgoing than analytic-imagers; the unitary aspect of this cognitive style also adds another requirement that this style can deal with large amounts of information. Whether such needs as demonstrated here, hold up under scrutiny or are only relevant to those with more extreme styles or more limited ability, needs verification through the application of more extensive and more in-depth studies. In addition, a further question arises as to the extent to which the needs of the learner are translated into teaching behaviours.

4.3: Cognitive Style dimensions and teaching

The aim of this section is to outline the links identified between teaching behaviours and cognitive style. Work carried out by Messick (1976), Riding et al. (1991) and Riding, (2002: 103) suggests that " a...teacher's **natural** teaching style will be a reflection of their own cognitive style". Identifying 'natural' teaching style is inherently difficult given the vast number of factors that impact on delivery in the classroom. Links between cognitive style and teaching style have been insinuated by a number of researchers such as Witkin (1976), Riding and Rayner (1996), Capel, Leask and Turner (2000) and Saracho (2000:300) who comments:

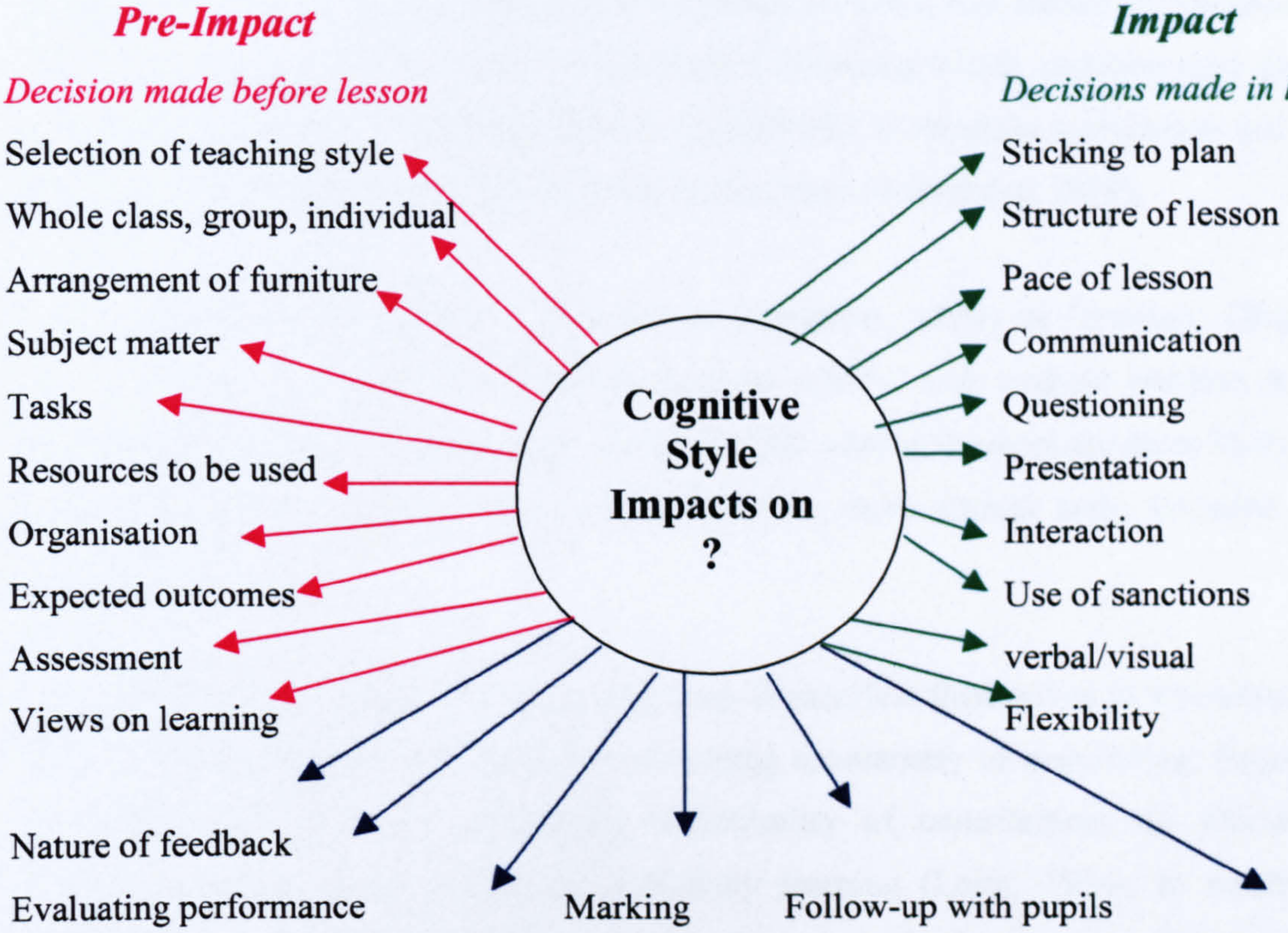
Figure 11: Learning Preferences and Cognitive Style



" Teachers have their own personal instructional style. This may reflect the specifics of their preparation, their instructional situation, and how they process information. Individual teachers respond to their students in their own unique way. The teachers' cognitive style motivates their selected teaching style, acquiring a 'format preference' [Riding and Read], that has an impact on their distinctive qualities."

In consideration of the first point, the relationship between teaching styles and cognitive styles, there is very little evidence of research in UK classrooms to support or repudiate such a link and Riding (2001) claims to know of no current research in this area. There are frequent references in the literature suggesting such a link: "...teachers have been found to promote the use of approaches which fit most easily with their styles" (Capel, Leask and Turner, 2000:245). And Sternberg (1999:111) comments " my style of teaching was reflecting my own style of thinking, as is the case with most teachers". But there is, in fact, little to no empirical evidence cited by such authors in support of their claims. Pursuing the link between cognitive styles and teaching styles raises a number of issues/ questions. Firstly, in relation to teaching styles, how easy is it to identify discrete styles, to what extent do teachers work in predominantly one style/mode of instruction, adopt an extreme style and to what extent does subject context affect delivery? With reference to adopting an extreme style in teaching, Entwistle (1981:238) argues that 'the decision to adopt an extreme teaching style will be a reflection of [the teacher's] own preferred learning style'. Secondly, to what extent are teaching styles the result of training, enculturation into a school? Is it possible to isolate cognitive style as a major factor impacting on teaching behaviour? Thirdly, how objectively can teaching style/cognitive style be measured and identified bearing in mind that the observer's own cognitive style will impact on what is observed and subsequently interpreted? If one accepts Riding's (2002) contention, that cognitive style does affect teaching style as previously alluded to in this chapter, there are many ways in which this may manifest itself as illustrated in Figure 12.

Figure 12: Cognitive style and teaching behaviours



Post-Impact: *Decisions made after performance*

Riding (2002:61) defines teaching style as consisting of style of delivery and pupil management and this needs to be unpicked to consider possible impacts. It may be useful here to consider such factors by referring to Mosston's and Ashworth's (1986) 'anatomy of a style' concept whereby teaching behaviour is perceived as being the result of a chain of decisions which are organised into three sets: pre-impact, impact and post-impact. Under these three headings, Figure 12 has attempted to identify specific behaviours which may be affected by cognitive style; this is probably a far from exhaustive list.

It could be argued that with regards to many of the behaviours shown in Figure 12, it may be difficult to observe differences between wholist and analytic teachers given the prescriptive nature of national curriculum schemes of work and modes of assessment currently in use in the UK, amongst other factors. Selecting which variables may show up difference and discerning the subtleties of difference is certainly a challenge and an area where little research has taken place in recent years (Alexander, 1999).

When considering 'preimpact' (Mosston & Ashworth, 1986) or 'presage' (Biggs, 1993a) factors, a number of differences between wholist and analytic teachers have been cited. A research of the literature suggests that wholist teachers are more likely to adopt an informal teaching style compared to the more formal style favoured by analytics.

In teaching, wholist tendencies have been seen to manifest themselves in a number of ways. Wholist teachers are regarded as favouring spontaneity of responding, frequent interaction with learners, enthusiasm, individuality of contribution, no timetable limitations and informal seating and discovery learning (Leith, 1974). In addition, wholist teachers tend to involve learners more in organising the content and sequences of the teaching and learning process, and encourage learners to formulate principles themselves. Teaching tends to be more informal. Wholist teachers exhibit a readiness to switch attention and divert to something of immediate interest, have concern for global effects rather than precise detail and dislike tight organisation schedules. Such teachers preferred " plunging into the deep end" compared to the analytic strategy of " stepping into the shallow end of the pool" (Entwistle, 1981:238). Wholist teachers are also seen to provide students with facts rather than principles in contrast to analytics who are also more likely to correct the learner (Witkin et al., 1977).

Analytic teachers are characteristically seen as favouring formal teaching, being conscientious, attentive to detail, impersonal, more directive, giving greater responsibility for organising the learning situation to the teacher and well organised (Witkin, 1962; Witkin, Moore, Goodenough and Cox, 1977). Field independent

(analytic) teachers are also more direct in their attempt to influence students (Onnmacht, 1967a). Analytic teachers value orderliness, obedience to rules, attentiveness, timetable regularity, ordered seating arrangements (Leith, 1974). In contrast to the wholistic approach, analytic teachers are more likely to emphasize their own standards and formulate principles themselves when explaining subject matter to learners. Such teachers prefer more formal approaches using questions as instructional tools (Witkin 1983 cited in Entwistle and Ramsden, 1983:65). Field Independent teachers are seen as preferring lecturing or discovery methods (Wu, 1968; Witkin, Moore, Goodenough and Cox, 1977). In contrast, despite their preference for more informal and tangential approaches to teaching, field dependent teachers (wholists) are seen as likely to be less imaginative and stimulating in the classroom than field independent (analytic) teachers (Onnmacht, 1967), who were also found by Messick (1976) to be more creative and to have more facility with tasks requiring differentiation and analysis compared to wholists.

With regard to the choice and nature of materials used and structuring of such materials, several studies have demonstrated that students/teachers tend to apply instructional measures in keeping with their own learning preferences. In particular, mode of presentation is highlighted by Riding (1997:36):

> "It is also likely that lecturers and teachers will reflect their own style in the ways in which they present information, such as that … Verbalisers will use a highly verbal content, while Imagers will use pictures and diagrams to illustrate their words. This is worthy of further study."

Whilst it has been acknowledged that cognitive style may influence pedagogy in terms of what is considered to be the best form of delivery, it may also influence preferred methods of assessment and planning. With regards to detail, Sternberg and Grigorenko (1997:24) found that wholists preferred less detail compared to analytics, with the former favouring large and abstract issues and the latter preferring tasks requiring engagement with specific concrete detail requiring precision in execution.

With regard to decisions taken in the lesson, the 'impact phase,' wholists are typically viewed as being more likely to deviate from an established plan, have a less structured approach, interact more with the students and be more flexible than analytics.

Riding (2002:61) acknowledges that the cognitive style of a teacher may affect the type of relationship with pupils and expectations about behaviour. He specifically argues that: if the teacher is analytic-bimodal, analytic-imager, intermediate-bimodal or intermediate-imager, then the natural relationships with pupils may be more distant. The bank of evidence on which this premise is made is unknown. Whilst there is less evidence regarding the verbaliser-imager dimension of cognitive style and impact on teaching, the work of Leith (1974), Messick (1976), Witkin (1981), Packer and Bain (1978), Saracho (1991) and Riding and Rayner (1998) suggests links between wholist-analytic qualities and delivery in the classroom. In relation to teaching, a number of implications are suggested.

Firstly, in terms of relationship within the classroom, wholists are viewed as being more effective in developing interpersonal relationships (Witkin & Goodenough, 1971; Saracho, 1991); they enjoy and are more satisfied with their students (Packer and Bain, 1987; Saracho, 1991). Wholists are also viewed as more gregarious and less self-sufficient whilst analytics are viewed as more self contained and able to work on their own. Mahlios (1981) and Saracho (1987) found that field dependent teachers (wholist) interacted significantly more with their students in small groups and individually whereas analytic teachers initiated more whole class interactions with students. In addition, wholist teachers were found to be more perceptive to social characteristics such as names and faces (Messick, 1976) and more flexible (Riding and Rayner, 1998) than their analytic counterparts. Thus wholists are viewed as better equipped to deal with situations requiring social perceptiveness and interpersonal skills and highly adept in problems requiring the generation of several equally acceptable answers, being more accepting of variety and originality in questions (Guilford, 1959). Analytics are also perceived to be more shy and inflexible (Riding and Rayner, 1998) yet more compliant. Saracho (1991:324) suggests that cognitive style influences the teachers' classroom

behaviours, which require either a more social or more personal orientation. Thus, teachers' cognitive styles affect how they interact with others and select a more social or a more abstract curriculum content (Saracho, 1989). Witkin et al. (1977: 2) also refer to the importance of cognitive style in affecting interaction in the classroom:

> "cognitive styles interact with several classroom factors and influence educational practice, such as how students learn, how teachers teach, how teachers and students interact, and how students make their educational choices."

Secondly, analytics are seen as more goal seeking, directing in their style of managing other people and requiring increasing control of people and situations, even to the point of becoming authoritarian. Analytic teachers, therefore, are more likely to find aspects of indiscipline, little motivated pupils and class management more threatening, more potentially sources of stress than wholist teachers would (Riding & Rayner, 1998). Sadler-Smith and Riding (1997) also found that whereas analytics preferred to have control over their own learning, wholists exhibited no particular preference.

Thirdly, with regards to management and organisational skills, Riding and Rayner (1998) found analytics to be more organised and precise compared to wholists who were deemed to find working to deadlines more difficult. Saracho and Dayton (1980) found that wholists need to understand the overall concept before moving to an analytic process but need information that is organised and structured, whereas analytics like information to be presented in a structured, logical and sequential fashion but can cope well with unstructured information unlike the wholists (Allinson and Hayes, 1996:122). Translated into teaching behaviours, Witkin, (cited in Entwistle and Ramsden, 1983:65), found that field independent (analytic) teachers were more likely to impose a tighter and more logical structure on teaching material.

Fourthly, with regards to the process of learning, a number of differences between the two styles have been noted. Characteristically, wholists are deemed to be good at 'seeing the whole picture' and less good with detail (Kirby, 1988; Schmeck, 1988;

Hayes and Allinson, 1998; Riding, 2000). Wholists prefer an open-ended approach to problem-solving, rely on random methods of exploration, remember spatial images most easily, and work best with ideas requiring overall assessment. They are typified by 'undisciplined' thinking and tangential approaches to tasks and problem-solving which cut across accepted paradigms and can also be characterised as adopting a global or overall perspective. As a consequence of the latter they may blur the distinctions between the parts of a problem, situation, issue or topic (Allinson and Hayes, 1996; Riding, 1991; Kirton, 1994 and Entwistle, 1981). Alternatively, analytic individuals focus on detail and make decisions or solve problems largely on the basis of mental reasoning and by focusing on detail. They are characterised by precision, reliability, efficiency, discipline and conformity and prefer to break down a problem, situation, issue or topic into its constituent parts in order to deal with it, sometimes to the extent that they may become focused on one particular aspect at the expense of the rest (Allinson and Hayes, 1996; Riding, 1991; Kirton, 1994 and Spicer and Sadler-Smith, 2000: 305). Field independent learners (analytics) have been identified as responding better to more independent and more individualised approaches compared to field dependent. They are also deemed to be more likely to have self-defined goals and to respond to intrinsic reinforcement with a preference to structure their own learning and develop their own learning strategies whereas field dependent learners may require more extrinsic reinforcement and need more assistance in problem-solving strategies (Kogan and Wallach, 1964).

Fifthly, Watts and Pedrosa de Jesus (2001: 76) have also raised the question as to whether different cognitive styles use different forms of questioning. Are analytics more likely to ask questions seeking specific details, 'confirmation questions,' and are wholists more likely to ask 'transformation questions' which question ideas and require some restructuring or reorganisation of the student's understanding? Schmeck (1988) also suggests that some of the methods teachers use to assess pupil work may encourage the development of one type of processing at the expense of another. Whether a student is unable to work in a certain way due to years of a certain method of instruction or whether this is due to stylistic inflexibility is worthy of research. Does cognitive style

affect risk-taking and the willingness to try out new ideas in the classroom? Does cognitive style manifest itself in the ways that teachers organise their classrooms?

Sixthly, wholists are regarded to be spontaneous decision-makers tackling issues on the basis of feeling. They are typified by 'undisciplined' thinking and tangential approaches to tasks and problem-solving whereas analytics are seen as more rational decision-makers solving problems on the basis of mental reasoning (Spicer and Sadler Smith, 2000).

In terms of classroom behaviours, analytics have been identified as asking and answering more questions, to be more content orientated, and more likely to provide self-explanatory and self correcting activities (Saracho, 1987, 1991). Saracho also found that analytics were likely to make more self references in their speech than wholists, who were also more likely to provide simple, short and concrete activities compared to analytics.

Finally, with regards to subject orientation, it has been argued that those who are field dependent (wholist) are more likely to prefer occupations with high involvement with people such as social sciences, rehabilitation, teaching and persuasive activities such as selling (Witkin in Messick, 1976 and Chung 1967). In contrast, field independent (analytic) are seen as favouring physical and biological sciences, maths, engineering and technical and mechanical activities. Kogan and Wallach (1964), in addition, comment on the higher mathematical than verbal ability of field independent subjects.

Considering post-impact behaviours, analytic teachers are perceived as giving more specific, critical feedback to students, to be more conscientious with marking than wholists. Wholists are typically seen as more gregarious, better team players and more willing to take advice than analytics. With regards to the learning process and development as a teacher, cognitive style may affect the willingness of an individual to take on board new ways of learning. According to Oosterheert and Vermunt (2001b) in additional to external sources, two internal sources of self-regulation are involved in

learning to teach: active and dynamic self-regulation; the former referring to a "deliberate and intentional focus on specific details of new (experiential) information and one's (emerging) understandings" (Oosterheert et al., 2002:43) and the latter to "the spontaneous delegation of attention to multiple independently and simultaneously functioning mind sources, which may reframe existing understandings" (Iran-Nejad et al., 1992). Kubler-La Boskey (1993) in her consideration of multiple aspects of student teachers' learning used the following terminology: 'common sense thinkers', via 'alert novices' to 'pedagogical thinkers', to characterise individual student teachers. Oosterheert et al. (2002:59) identified 'common sense thinkers as being 'survival oriented and demonstrating characteristics such as learning-by-doing, not being engaged in learning, contrasting with 'pedagogical thinkers' who demonstrated broad open interest, showed initiative, were pupil oriented and tried to understand. The third category included 'alert novices' who were seen as depending more on external motivations for their learning but to also have an inquiry motivation. The authors conclude that the frames of reference of these three types of student teacher were different reflecting how they had learned differently. Sugre (1997) argues that given their own experiences as a pupil, many student teachers may have to change their current understandings of teaching, learning and their own teaching practice if they are to move towards better models of delivery. Whether students are able to develop and change their own existing frame of reference could also be related to their own cognitive style flexibility or rigidity.

Characteristics of wholists and analytics and how they may present in the classroom have been outlined above. A few words of caution are necessary. Much of the research looking at teacher behaviours and cognitive style are presented in relation to field independence / dependence (Witken & Goodenough, 1981), which is often seen to be broadly equivalent to analytic / wholist, but this contention is challenged by Riding and Rayner (1998).

Reviewing the various opinions regarding the characteristics of wholist and analytic teachers, it is evident that there are contradictions in the literature. On the one hand,

wholists are described as being more involved in delivering facts rather than principles and then, on the other hand, they are perceived to be involving the learner in the process and formulation of principles. In similar vein, on the one hand, analytics are seen as more controlling, rigid and less accepting of alternative answers than their wholist counterparts but at the same time more imaginative and stimulating. It is also interesting to note the lack of recent studies on teaching styles and especially those linking teaching style to cognitive style. With the exception of the work of Riding et al many of the studies date from the 1960s to 80s. In addition, how style has been measured in the classroom is not immediately obvious from the literature. This does call into question the premise on which such assertions about teaching style have been made; how accurate are they and can such findings be replicated? It could also be argued that it may only be at the extremes of cognitive style that such behaviours may be apparent.

Riding, (1997:44) also suggests that:

> "[cognitive style] will not show an effect if there is a lot of noise in the system, occurring because other relevant variable are not measured and included in the analysis. Further, style is not likely to be critical when the task is simple. It is likely to be important, however, where the learner is under pressure because, relative to their ability etc., the task is difficult."

Furnham (2000) is in agreement suggesting that because people choose / select environments in which they will study you instantly wash out the variability; people need to be forced to work in environments / situations they don't want to in order to observe the effects of learning styles. The swamp (Schön, 1989) is indeed a muddy one. One of the main problems with the concept of teaching style is that it implies some consistency in preferences for particular ways of teaching; to what extent are teachers consistent in their delivery? And are teachers actually able to teach in the way that they would like with so many contextual factors mediating practice in the classroom. The degree of control exercised by schools, mentors, attaining the standards for Initial Teacher Training (TTA: 2002), may also wash out such variability for the teacher training cohort involved in this study. Consideration of whether cognitive style is stable

over time and whether some cognitive styles are more amenable to taking on new ideas than others is needed as stated by Mc Intyre (1997:9):

> ... more extended qualitative longitudinal investigations, examining those elements of beginning teachers' thinking and practice which remain stable and those which change over the months and years as they learn to teach and become established members of the teaching profession."

Chapter 5: Teaching Styles

5.1: Identifying Teaching Styles

The absence of research on effective teaching and teaching methods (McIntyre, 1997; Mortimer, 1999:5) has lead Mortimore to suggest that: " a convincing categorisation [of how teachers teach] has yet to be created". If the term teaching style is used to describe the way a learning experience is conducted, then there are many permutations as to how one could attempt to classify such actions although most attempts differentiate on the grounds of low to high structure with varying degrees of sophistication. Early studies of teacher style found that distinct teaching style clusters could not be easily identified and resultant classifications tended to construct 'polarized typifications' of teachers (Mortimore, 1999:2). Bennett whilst arguing strongly against 'ill-defined dichotomies' (Bennett and Jordan, 1975) himself used formal (traditional) v informal (progressive) to describe practice in classrooms. Both Bennett's (1976) UK and Solomon and Kendall's (1979) USA studies highlighted the difficulties in observing and classifying teacher style. With the 7 types, (reduced from an initial 12), identified by Bennett and the 6 types found by Solomon and Kendall, it was actually very difficult to find examples of truly formal and informal classrooms, in that elements of both were usually present in all classrooms but to differing degrees. Mortimore (1999:9) argues that such simplified bipolar descriptions, 'thinking in twos,' (Jackson, 1977) of teaching predominate because of the lack of an agreed framework in which teaching can be discussed; thus teachers may simply describe their approach in terms of a contrast with the style which they attribute to others. Morgan and Morris (1999) in their study of teachers across 10 schools, (n= 133), found that teachers found it very difficult to describe their teaching styles. From analysis of teacher responses they were able to identify 5 groups: traditional, mixed tending towards traditional, mixed, mixed tending towards progressive and progressive. In similar vein to Bennett and Solomon and Kendall, they found that these were not discrete categories. With 15% of the

responses received they were unable to allocate a style with confidence to any of the 5 types. The majority of teachers were very hesitant and found it difficult to articulate their teaching style. A wide range and diversity of comments were received. To describe traditional teaching words such as formal, didactic, transmissive, teacher-directed, traditional, chalk and talk, whole class teaching and running a tight ship were used. To describe progressive teaching, a similar range of terms were used: child-centred, individual, process-based, experiential and non-traditional aspects of classroom practice. Most teachers wanted to describe themselves in a mixed position. When asked about aspects of classroom practice and concerns, only 6% of respondents talked about teacher-pupil relationships; when discussing successful lessons, teachers focused on planning, delivery and control to the neglect of affective aspects. What Morgan and Morris (1999:94) concluded from their research was:

> "the substantial lack of homogeneity in the vocabulary and concepts available to teachers with which they are able to describe their teaching activities and the factors that drive them...it seemed that teaching methods were something they enacted rather than thought about a great deal, or analysed in any systematic way."

The researchers concluded that the restricted range of teachers' views on teaching style and methods reflected a general lack of discourse and discussion on pedagogy. A more detailed attempt to classify teaching styles was that undertaken by Mosston and Ashworth (1994). The styles they identify are similarly seen as a continuum moving from teacher-controlled and directed learning experiences through to more independent learning as represented in Table 7. Styles A – E involve more direct teacher control, reproduction, a one correct solution and a classroom climate involving repetition and reduction of errors. Styles F - J assume more student control, more variable subject matter, no one single model to emulate, discovery learning, greater consideration of individual differences and a classroom climate fostering a searching for new meanings. Mosston and Ashworth describe a 'TLO approach': the links between 'teaching and learning behaviours and the objectives of each style'.

Table 7: Mosston's continuum of Teaching Styles

A: Command Style: Autocratic/teacher centred.
B: Practice Style: More scope for teacher to work with individuals whilst group are occupied with practice tasks.
C: Reciprocal style: Pupils work in pairs evaluating each other's performance, providing more opportunities for interaction and communication among students.
D: Self-Check style: Designed to develop the learner's ability to evaluate own performance. Pupils evaluate their own performance against criteria and set new goals in collaboration with teacher.
E: Inclusion style: Differentiated tasks are included to ensure all pupils gain some feeling of success.
F: Guided discovery: The teacher plans the pupil's learning programme on the basis of the cognitive development of the learner. The teacher then guides the pupil to find the answer.
G: Divergent style: Learners are encouraged to find alternative solutions to a problem.
H: The individual programme: Learner's design: A pupil designs and carries out a programme of work within a framework agreed and monitored by the teacher.
I: Learner's initiated style: The pupil actively initiates the learning experience. Choosing own homework format. The teacher acts in a supportive role.
J: Self-teaching style: Independent learning without external support.

Teacher focused **Student focused**

Conceptions of Teaching

Content oriented **Learning oriented**

In similar vein, Barnes et al. (1987:25) considered the level of participation of students in their classification of teaching styles and demonstrate an analogous continuum: teacher control to independent student learning as demonstrated in Table 8. Teachers are perceived to vary their style depending on context but there are few studies which actually look at teacher style flexibility. In contrast to looking at student / teacher autonomy, an alternative approach is that of Entwistle and Walker (in press) who from school-based research, have looked at the three main forms of knowledge teachers use:

knowledge of subject matter, knowledge of teaching techniques and strategies and knowledge of how their students learn.

Table 8: Pupil participation and Teaching Styles

Teacher Dominated – closed	Framed	Independent learning - negotiated
Content: Tightly controlled by teacher. Not negotiable.	Teacher controls topic. Explicit criteria.	Discussed - joint decisions.
Focus: authoritative knowledge and skills.	Focus on empirical testing. Processes chosen by teacher.	Search for justifications and principles; strong legitimation of pupil ideas.
Pupil's role: acceptance - routine.	Making hypotheses. Join in teacher's thinking.	Discussion of goals; shared responsibility for frame and criteria.
Key Concepts: authority; proper procedures and right answers.	Access to skills, processes.	Relevance: critical discussion of pupils' priorities.
Methods: Exposition; worksheets; note giving; individual exercises, routine practical work, Teacher evaluates.	Exposition, with discussion eliciting suggestions; individual/group problem solving. Discussion of outcomes.	Group and class decision-making. Pupils plan and carry out work, make presentations, evaluate success.

(adapted from Barnes et al. (1987:25)

Another theory of teaching styles is that of Henson and Borthwick (1984) which suggests 6 different styles of teaching, (not mutually exclusive), including the following: in a task-oriented approach, planned tasks associated with appropriate materials are prescribed; in a subject-centred approach, the content is planned and structured to the extent that students are nearly excluded from the process; in a co-operative-planner approach, an instructional venture is planned by teachers and students

collaboratively, though the teacher is basically in charge; in a child-centred approach, the task structure is provided by the teacher, with the students choosing from options according to their interests; in a learning-centred approach, equal concern is shown by the teacher both for the student and for subject content and finally, in an emotionally exciting approach, the teacher tries to make his/her teaching as emotionally stimulating as possible.

Yet another attempt by Brown and Bahkar (1983) identified five teaching styles based on how lecturers organised and presented information. **Amorphous** and **self-doubters** produced ineffective, disorganised presentations; **oral lecturers** wove intricate verbal webs, but lacked clear structure or audio visual support (holists?); **information providers** followed their notes closely in providing a lot of detail (serialists?) and **exemplary lecturers** had a clear set of objectives, planned and presented clear and well structured material avoiding too much detail and used audio-visual aids to enliven presentations.

Another approach to consider is Sternberg's (1988, 1990) 'Thinking Styles' and their relevance to teaching styles. In his theory of mental self–government, he sees these as an alternative way to look at people's behaviour. In the model people can have combinations of functions, forms, levels, scope and leanings of mental self-government as demonstrated in Table 9.

Table 9: Styles of Thinking (Sternberg, 1999:26)

Functions	Forms	Levels	Scope	Leanings
Legislative	Monarchic	Global	Internal	Liberal
Executive	Hierarchic	Local	External	Conservative
Judicial	Oligarchic			
	Anarchic			

Whether teachers demonstrate Sternberg's thinking styles in the classroom, is a debateable issue and one that would benefit from more research. From the suggested 13 categories each individual can build up a profile of their 'styles' which Sternberg sees as variable across tasks, situations and time. The strength of each preference is seen as varying from one person to another. In his theory of mental self government, the characteristics of the 13 'types' are summarised in Table 10. Using the Thinking Styles Questionnaire for Teachers (Grigorenko and Sternberg, 1993), it should be possible to observe these behaviours in a classroom. Sternberg maintains that such styles are teachable. It is interesting to note that many characteristics of wholists and verbalisers are found in Sternberg's 'legislative, global and external' categories whilst the 'executive, local and internal' types have much in common with analytic and imager characteristics. Sternberg argues that whilst many schools most reward executive types, different schools appeared to reward different types and to promote certain 'types' of teachers. He identified teacher's age and the type of school as significant factors affecting teaching style, finding older teachers to be more 'executive', 'local' and 'conservative' than younger ones. With regards to the impact of the school, Sternberg (1999:8, 129) also comments on the role of socialisation in affecting teaching styles: "Schools..., value certain ways of thinking more than others..." and from a study of 85 teachers he found that schools differed in their profiles of styles of teachers:

> " ...teachers tend to match the stylistic ideology of their schools. Either teachers tend to gravitate towards schools that fit them ideologically or else they tend to become like the place they are in."

Table 10: Sternberg's Thinking Styles

Functions	
Legislative:	Creative. Prefer own way of doing things – like to create their own rules – prefer problems that are not pre-structured.
Executive:	Implementers. Like to follow rules – like pre-structured problems.
Judicial:	Like to evaluate rules and procedures. Like giving opinions and likes analysing.
Forms	
Monarchic:	Single-minded and driven. Like to focus on one task at a time.
Hierarchic:	Sets priorities – deals with multiple goals - more accepting of complexity than monarchic person.
Oligarchic:	Motivated. Confused as to what to do first by several competing goals of perceived equal importance .
Anarchic:	Motivated by many needs that he/she finds difficult to sort out. Takes a random approach to problems; reject systems especially rigid ones.
Levels	
Global:	Individuals prefer to deal with large and abstract issues. They don't like details.
Local:	Individuals like concrete problems requiring working with details. Pragmatic and down to earth.
Scope	
Internal:	Individuals are concerned with internal affairs – tend to be introverted, task oriented, aloof, and socially less aware. They like to work alone.
External:	Individuals tend to be extroverted, outgoing, and people oriented. Socially sensitive and aware of what is going on with others. They like working with people.
Leanings	
Liberal:	Individual likes to go beyond existing rules and procedures to maximise change and to seek situations that are somewhat ambiguous.
Conservative:	Individual likes to adhere to existing rules and procedures, minimise change, avoid ambiguous situations and stick with familiar situations.

5.2: The impact of Subject on Teaching Style

In the previous section the lack of current classroom based research on teaching styles was identified as a major issue; this criticism could also be levied with respect to work on subject and teaching style. There is relatively little research on the ways in which effective teaching varies in relation to different subject domains or topics within subjects (Hallam and Ireson, 1999:83). Stodolsky and Grossman (1995a, 1995b) have explored teachers' perceptions of different subject domains and the evidence from research suggests that teachers perceive their subjects as depending on differing levels of prior or sequential learning (Hallam and Toutounji, 1996), with maths and modern foreign languages tending to be perceived as requiring considerable sequencing, while English and humanities are much less so. Within subject domains, wide differences in the teaching and learning requirements of different topics have been identified (Paechter, 2000; Entwistle, 2002).

Some authors see learning style and subject choice as mutually reinforcing (Phenix, 1964). Kolb (1984) and Nulty and Barret (1996) suggest that different disciplines will favour distinct learning styles; the line of argument suggests that students whose learning styles are congruent with particular disciplines will first be attracted to them and then refine and develop those learning styles as they find the subject to their liking and do well at it. Bearing this in mind, Boulton-Lewis, Marton and Wilss (2001:138) also comment:

> "Most learners are attracted to materials that suit their style, underestimate their performance on subjects that do not suit their style, and overestimate their performance on those that do."

Therefore, do students choose subjects because they suit their own cognitive styles or do subject bases develop certain learning traits? As commented on by Jarvis (2000: 149):

> " What one cannot conclude is what proportion of the learning preferences are attributable to predisposition, students selecting the subject that fits in with their preferences, or enculturation, their learning preferences being shaped by the subject they choose."

And in relation to teaching, the answer to such questions also remains unclear:

> "Whether it is the teacher's own learning style preference which influences the way they teach or the nature of the subject itself which influences decisions over the curriculum remains an important and unresolved question" (Lawrence 1997:165).

There have been a number of studies suggesting a link between subject and, indirectly, cognitive style, particularly differences between arts and sciences although the numbers involved in such studies have been quite small. Biglan (1973) distinguished between 'hard' and 'soft ' subjects. Thus subjects that have a single paradigm (hard) would be more fixed in content as areas of interest and research methodologies are usually agreed. Subjects without a paradigmatic basis (soft) have idiosyncratic contents and methods with no consensual area of study or research. Under this classification, maths and science are hard subjects and humanities and social sciences soft.

Kolb (1984) and Nulty and Barret (1996) in more detailed analysis, both argue that different disciplines have their own distinctive ways of working and that it is possible to cluster academic subjects based on the predominant learning styles of their students.

The two axes of Kolb's and Nulty and Barret's learning styles: 'abstract-concrete' and the 'active reflective' dimensions are shown in Table 11. The former refers to the way new information or experience is grasped by individuals immersing themselves in the experience or thinking abstractly using logic and reason and the latter refers to how what is perceived by the learner is processed or transformed by actively experimenting or by watching and reflecting. Thus in Kolbs' classification, linguists and physical education students are 'divergers'; mathematicians, geographers and scientists are 'assimilators' and those studying education are 'accomodators.'

Table 11: Principle characteristics of Kolb's Learning Styles (Kolb, 1984 & Gibbs,1988).

Concrete Experience

Active Experimentation		**Reflective Observation**
	Accomodative Can carry out plans Interested in action and results Adapts to immediate circumstances Trial and error style Sets objectives Sets schedules	Divergent Imaginative, good at generating ideas Can view situation from different angles Open to experience Recognises problems Investigates Senses opportunities
	Convergent Good at practical applications Makes decisions Focuses efforts Does well when there is one answer Evaluates plans Selects from alternatives	Assimilator Ability to create theoretical models Compares alternatives Defines problems Established criteria Formulates hypotheses

Abstract Conceptualisation

Nulty and Barret come up with similar groupings with the exception of geography which they move from Kolb's 'reflective and abstract' positions to 'concrete and active', under their classification. Renzulli (2001:35) also argues that certain curricular materials favour the applicability of some styles over others. Using this classification, Booth and James (2001) suggest that teachers with different styles will ask different kinds of questions in that 'assimilators' will ask more 'what' questions; 'accommodators' – 'what if' questions; 'convergers' – 'how' questions and 'divergers' – 'why' questions.

In agreement with Kolb, Nulty and Barret, Renzulli (2001:35) sees mathematics concepts favouring 'abstract, sequential and analytic styles' compared to the more

concrete affectively rich materials favoured in English. There is also widespread belief that maths, modern foreign languages and sciences are characterised by more teacher-led methods than arts, humanities and social sciences. Sternberg (1999) from a study of 85 teachers found that science teachers tended to be more local (analytic) than humanities teachers who, themselves, were identified as more liberal (wholist). This is supported by earlier work done by Witkin et al. (1977) suggesting that teachers who taught maths or science were likely to be relatively field independent (analytic); whilst those who selected social sciences were more likely to be more field-dependent (wholist). However, the affinity that analytics have for science is challenged to some extent by the work of Riding and Rayner (1998) and Riding and Agrell (1997) who, in relation to performance, found analytics did badly in science compared to intermediates.

With regards to subject differences, it is often argued that the criteria for success in the hard subjects are often more straightforward with an emphasis on right and wrong answers. Wade (2002) also found significant differences between subject delivery from a study of 178 pupils in a middle school, where the surface learning environment or transmission of data approach in teaching maths and science was significantly associated with successful student learning outcomes whereas the reflective learning environment or construction of knowledge approach in teaching social studies and language and arts was significantly associated with successful learning outcomes. Following this argument, Entwistle (1981:239) argues that sciences tend to use mathematical or mechanical analogies, whereas humanities depend on analogies drawn from personal experience. Science is also seen as depending more on previous knowledge in building up new ideas. He argues that the emphasis on fact and detail may expose scientists to an 'excessively serialist [analytic] style of teaching'. He also cites research undertaken at Lancaster University by Entwistle & Wilson (1977), where it was found that the personality characteristics of science and arts students were substantially different from one another. Scientists were described as toughminded, conservative, hardworking, unsociable and unimaginative; in contrast, arts students were described as tenderminded, liberal-minded, sociable and imaginative. In similar vein, earlier work by Saville and Blinkhorn (1976) found arts students to be more

outgoing, suspicious, imaginative, and radical whilst scientists were found to be more socially precise and controlled.

In addition to the suggested disparate characteristics of those pursuing different subject specialisms, researchers have also suggested that those pursuing different disciplines will have discrepant learning needs and preferences. Entwistle (1981:241) in the following quote suggests with some caution, due to the lack of classroom research, that teacher cognitive style will influence their choice of specialist subject and along with this comes the teaching methods employed:

> "Different subject areas are also likely to differ in the relative incidence of highly structured teaching methods, partly because of the nature of the subject and partly because of the cognitive styles of the teachers who are attracted to that subject."

In an attempt to discover whether teacher training students had divergent learning predilections, Jarvis (2000) looked at the learning preferences of 867 students, over half of whom were working towards their Postgraduate Certificate in Education in a number of different subject areas. Students were asked to rank in order of preference which method of learning they felt was best for them. The methods were talking and discussing, learning from mistakes, doing problems, hearing an explanation, memorising and practising, reading books and doing own research. The relative scores of English and maths PGCE students appear in every case, with the exception of learning from mistakes, at almost opposite ends of the scale indicating that students of these subjects preferred to learn in different ways. Students of geography, religious education and English, surprisingly, disliked doing their own research and reading books, preferring memorising and practising which would indicate that in this survey, students of these subjects preferred to learn in a similar way. Maths, science and religious studies PGCE students preferred lectures whilst the majority of students favoured seminars. Maths students were the least likely to prefer to do independent research. Jarvis concluded that students of English, art and humanities were more likely to use a deep approach, believe in the uncertainty of knowledge, be intrinsically motivated and interact more in the classroom than students of other subjects, particularly maths students. This corroborates some of the earlier findings of Entwistle.

With regards to learning styles, Entwistle (1983) and Lawrence (1997) have identified subject specific differences. In terms of approaches to studying, Entwistle & Ramsden (1983) found academic progress in arts to be more closely related to a deep approach and comprehension learning, and negatively to reproducing approaches. In social science, higher positive correlations were found with relating ideas, intrinsic motivation and higher negative correlations with disorganised study methods and negative attitudes. Social scientists appear to be less heavily penalised for the pathologies of learning or adopting a surface approach. In science, strategic approach and disorganised study methods, incredulously, showed closer relationships with progress; of course, the intention to be strategic does not equate with success to do so. Why disorganised study methods were related to progress warrants further study.

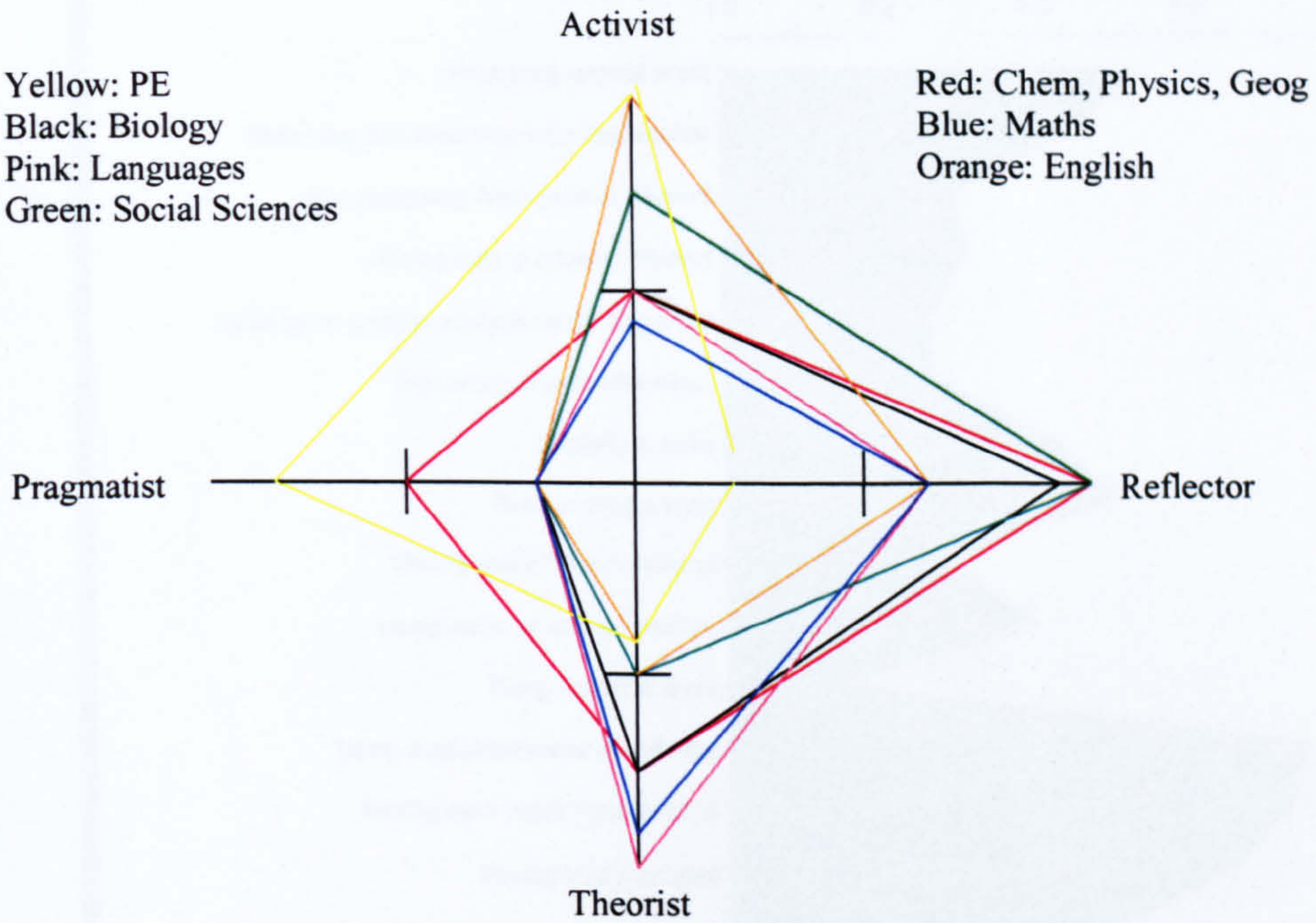
In consideration of teacher learning styles, Lawrence (1997) when considering the learning styles of 353 secondary school teachers using the Honey and Mumford Learning Styles Questionnaire (1986), found that most teachers taught in a reflector style or 'reflector/theorist style with the least favoured style being 'pragmatist' as demonstrated in Figure 13. Significant variations in teaching style were found between subjects. Physical education teachers had a dominant style preference of 'activist'. Geography, chemistry and physics teachers had identical learning style preferences. Of most concern to Lawrence, was the negligible numbers of teachers with a pragmatist learning style preference. Senior managers were also found to have different learning preferences to main scale teachers suggesting additional factors affecting style.

This leads to a further questioning of whether the approach taken in different subjects in UK secondary classrooms is actually disparate. In support of this argument, Jarvis and Woodrow (2001:447) argue that the approach taken will reflect the influence of subject and that students will be accepting of these differences:

> " it is well reported that teachers' strategies for managing their classrooms are inevitably subject-specific but there is little research

concerning the learning preferences of students within different subject areas. It seems likely that those studying soft subjects will incline towards the more interactive techniques while an acceptance of the teacher as authority is more likely to occur in the hard subjects."

Figure 13: Learning Styles (Lawrence, 1997:165)



One established piece of research to answer the questions raised by Jarvis and Woodrow, is the work of Fitz Gibbon et al. (1996) via the ALIS project which investigates the teaching experience received by students in different subject disciplines. This project considers student perceptions of their learning experience as documented by the ALIS project (the A-Level information System), run by the CEM centre (Curriculum, Evaluation and Monitoring Centre) based at the University of Durham. Pupils are asked to comment on the frequency with which 22 teaching activities are undertaken and the average scores are recorded and classified on a 6 point scale from 1 = never or almost never to 6 = about every lesson. An example of a Geography profile (2001) from 2872 students with the 22 teaching activities demonstrated is shown in Figure 14.

Figure 14: Approaches to teaching and learning in A Level Geography, 2001
(ALIS DATA, CEM CENTRE, DURHAM).

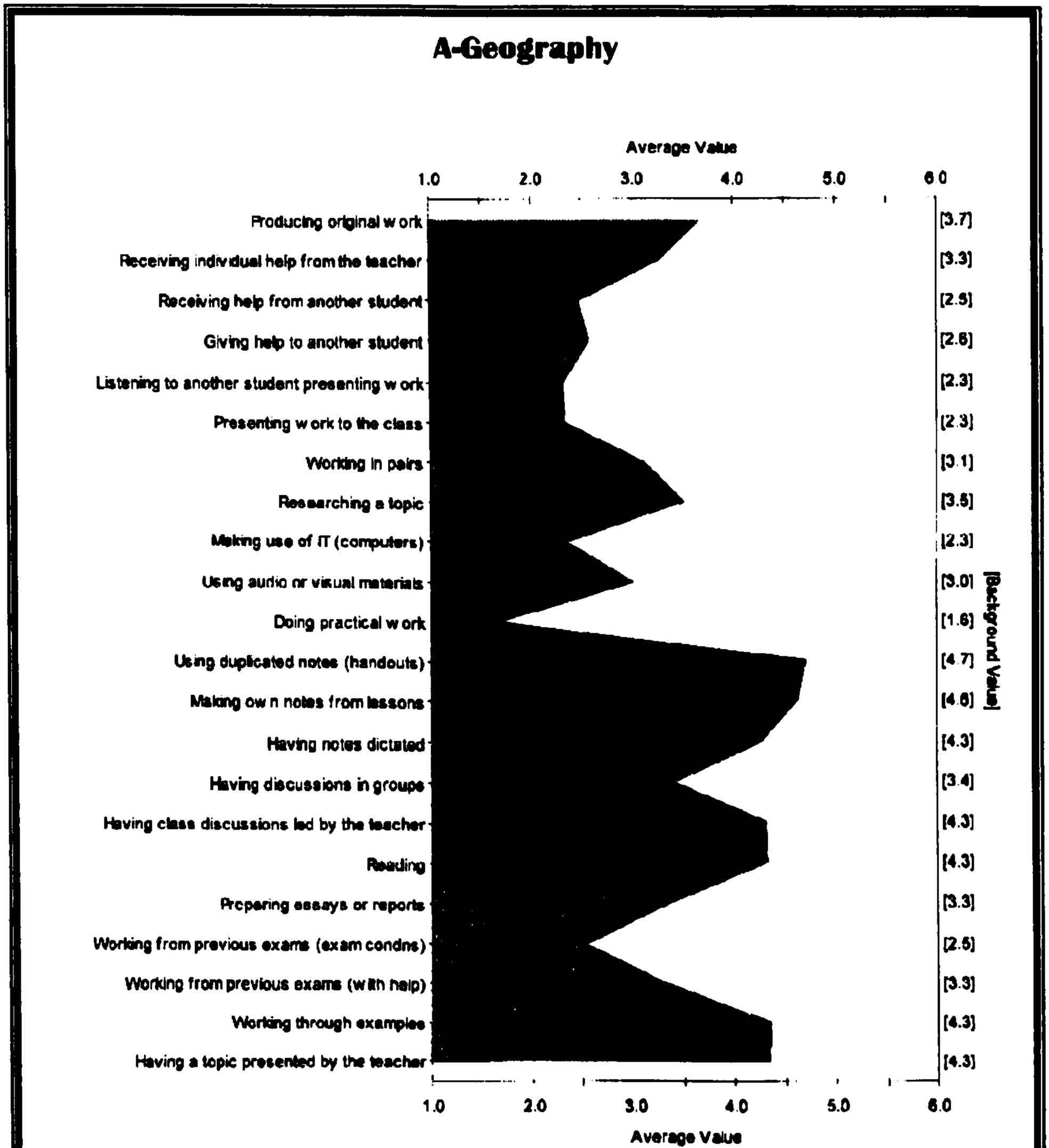
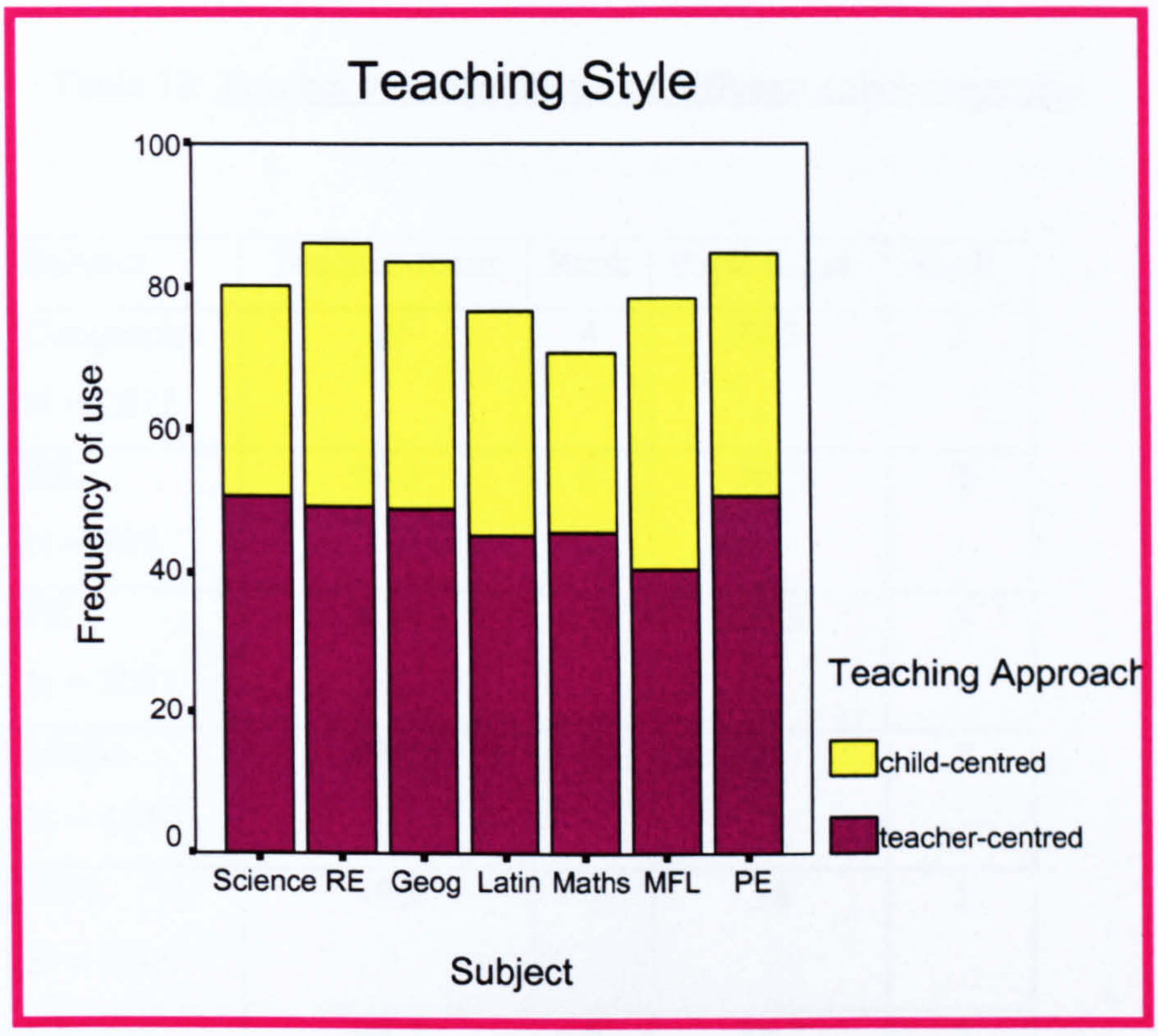


Figure 15: Predominant teaching approaches used in different subject domains



Using this information and comparable data from other subjects, it was possible to look at the responses from students for the 7 subject areas that are represented by the PGCE students in this research: geography, religious studies, physical education, classics, modern foreign languages, science and maths. Using the 22 statements as shown in Figure 14, it was possible to categorise these into those with a 'strong teacher focus' and those with a 'strong pupil focus' as shown in Figure 15. Thus items such as 'help from a student' and 'having discussion in groups' were classified as having a strong student focus whereas items such as 'class discussions led by the teacher' and 'having a topic presented by the teacher' were classified as having a strong teacher focus. Using individual statement scores for each of the 22 statements of teaching/learning activities,

it was possible to rank individual subjects according to how teacher centred v student centred the learning appeared to be; this is summarised in Table 12 and Figure 16.

Table 12: Teacher v student focus for different subject domains

Subject	Teacher-focus	Rank	Pupil focus	Rank
Geography N = 2872	49	4	34.3	3
RE N = 989	49.3	3	36.9	2
PE N = 2011	50.9	1	33.5	4
Maths N = 4040	45.6	5	25	7
MFL N = 3409	40.3	7	38	1
Classics N = 109	45.2	6	31.2	5
Science N = 4993	50.8	2	29.45	6

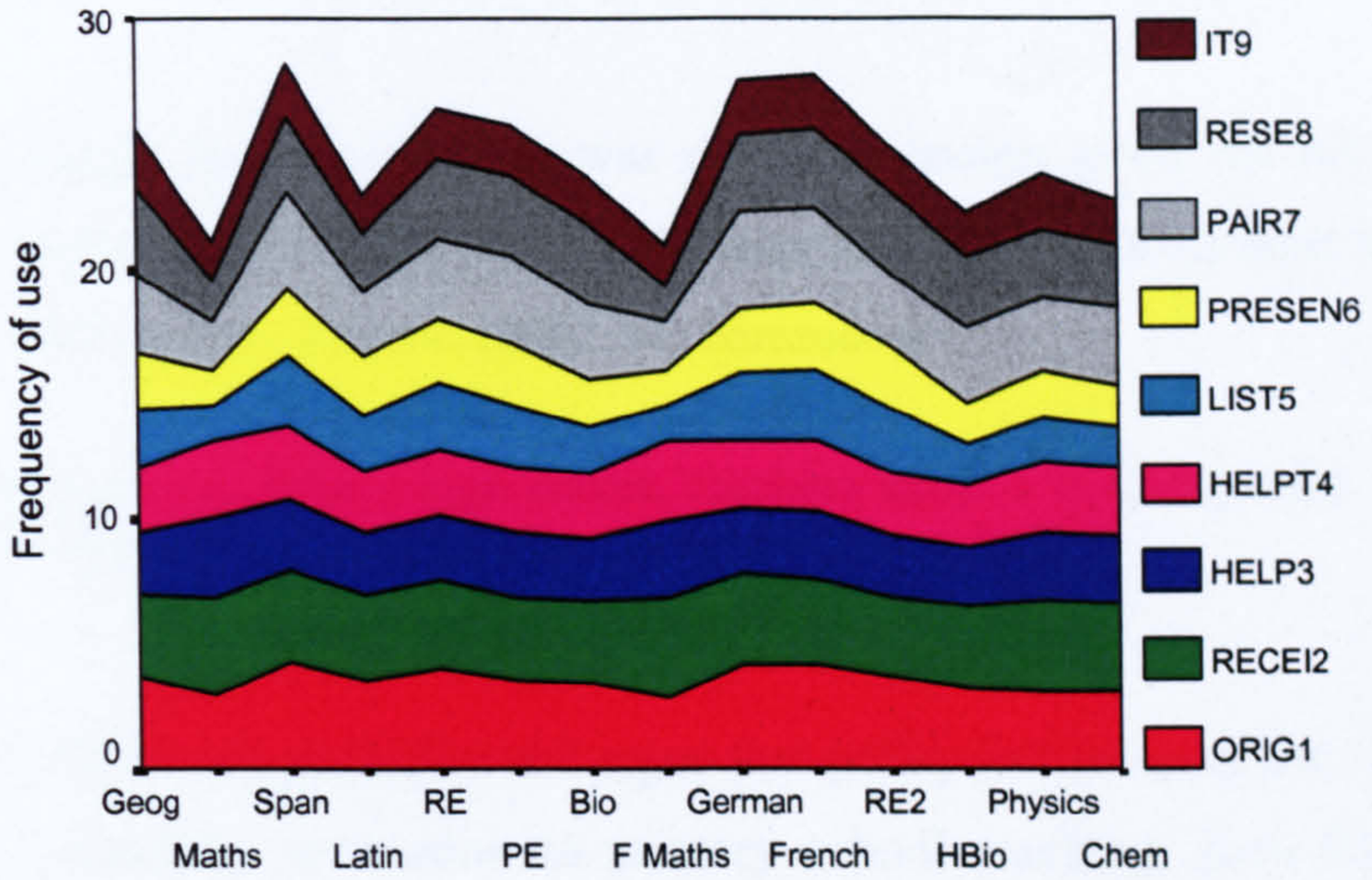
From consideration of Table 12 and Figures 15 and 16, and a study of individual scores for each of the 22 statements, it was clear that teacher–centred (formal) learning dominated the teaching the students felt they were receiving and clear patterns were present in the data. Ten of the statements describing classroom activities had a teacher directed focus and thus the maximum score for these items was 60 and minimum was 10, similarly eleven of the classroom activities had a stronger pupil focus giving a maximum score for these items of 66 and minimum score of 11. In Figure 16, the

profiles for A Level subjects represented in this study are demonstrated in relation to use of the 22 approaches to teaching and learning as measured by ALIS (Clarke: CEM, 2001). Thus in 16A, German involves a greater frequency of 'pair work' compared to further mathematics. In 16B, further mathematics involves less essay writing, as would be expected, than religious education and in 16C, 'working through examples,' is less prevalent in geography and religious studies than in mathematics.The full key to Figure 16 is given below.

Key to Figure 16: Teaching activity profile using ALIS data.

16A	ORIG1	Producing original work
	RECEI2	Receiving individual help from the teacher
	HELP3	Receiving help from another student
	HELPT4	Giving help to another student
	LIST5	Listening to another student presenting work
	PRESEN6	presenting work top the class
	PAIR7	Working in pairs
	RESE8	Researching a topic
	IT9	making use of IT (computers)
16B	AV10	Using audio visual materials
	PRAC11	Doing practical work
	DUPL12	Using duplicated notes
	NOTE13	making own notes from lessons
	DICT14	Having notes dictated
	DICS15	Having discussions in groups
	CLDIS16	Having class discussions led by the teacher
	READ17	Reading
	ESSAY18	Preparing essays or reports
16C	EXAM19	Working from previos exams (exam conditions)
	PEXAM20	Working from previous exams with help
	EG21	Working through examples
	TEACH22	Having a topic presented by a teacher

16A



16B

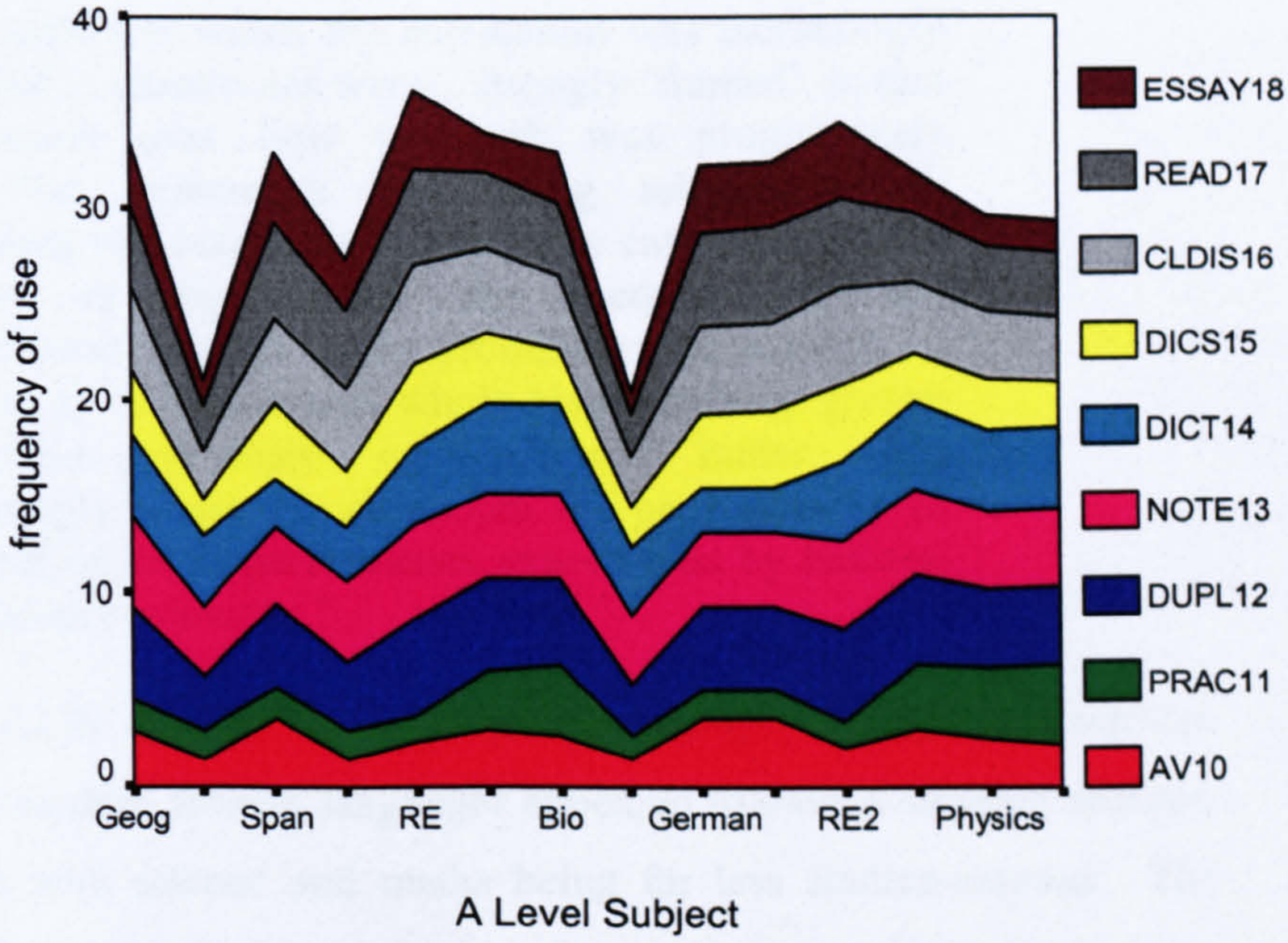
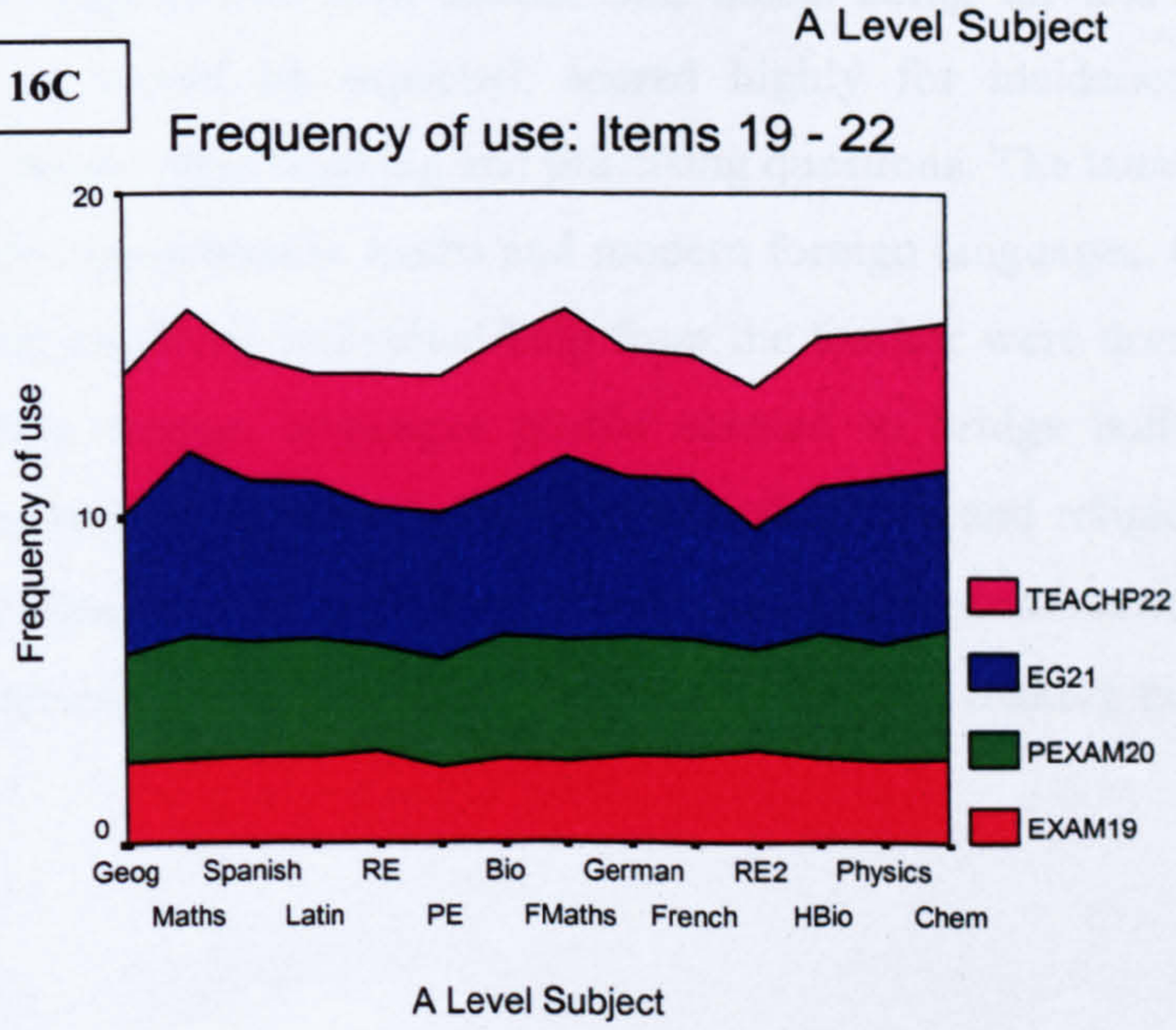


Figure 16: Teaching activity profile using ALIS data, 2001.

16C



The strong teacher focus of lessons was not unsurprising given the high amount of testing UK students experience, up to 105 tests and exams during their school career (Williams, 2003), and as Radnor, (2002:14) comments:

> "When passing tests is high stakes, teachers adopt a teaching style which emphasises transmission teaching of knowledge."

Pollard et al. (2001:18) go further and argue that policy initiatives of the 1980s and 90s in the UK, especially in relation to primary school teaching, gave little room for individual teachers or schools to redefine what was to be learned, denying teachers discretion concerning the control of learning:

> "We found a situation in which the curriculum was increasingly strongly 'classified'...classrooms were...strongly 'framed', in that teachers's discretion over how to teach was progressively reducing and this structuring was being relayed on to pupils....assessment was becoming increasingly categoric, regular and high-stakes as requirements for accountability and performance measures became more prominent and explicit ... overall [we found a] trend towards whole class teaching, greater teacher instruction...emphasis on product rather than process...increasingly pressured classroom life permeated by an instrumental focus on pupil performance exacerbated by national literacy and numeracy strategies."

Looking at the 2001 ALIS data for the 7 subjects: geography, religious education, physical education and modern foreign languages appeared to have a stronger student-centred activity profile with science and maths being far less student-centred. The sciences, as would be expected, scored highly for incidences of practical work, dictation, whole class teaching and practising questions. The latter two approaches were also highly represented in maths and modern foreign languages. Giving help to another student and receiving individual help from the teacher were dominant in mathematics. The modern foreign languages profile seemed to bridge both the science / maths profiles as well as the geography, physical education and religious studies profiles. In the latter three subjects mentioned, there was a higher dominance of producing original work, receiving duplicated notes, discussion, reading, making notes and essay writing.

In modern foreign languages there was also a high emphasis on discussion, reading and essay writing. These patterns are consistent with those found by Fitz Gibbon (1996:108) when looking at the profile of activities reported for English and mathematics ALIS data for 1993, leading her to conclude:

> " It is a fairly reasonable hypothesis that how you teach depends on what subject you teach."

Whilst there were differences in the experiences received by students studying maths and science compared to linguists, geographers, physical education and religious studies students, there were also areas of overlap. The 'hard' versus 'soft' description, it could be argued, is too simplistic and with new modular courses and especially 'Salters Science' (Salters Group/OCR, 2000), a discovery learning approach, requiring a different approach than traditional science courses, the boundaries may become more blurred.

The overall picture painted by looking at mean scores for each teaching method was that the diet received by all the students in this ALIS (2001) sample, a total of 18,423, was predominantly traditional and formal with a high emphasis on working from examples, whole class teacher instruction, receiving duplicated notes and making own notes and whole class discussion; this may reflect the pressures of preparing classes for examinations. Scores of below 2 (once a term – never) were recorded for use of ICT, practical work, student presentation, use of audiovisual and research.

Of further interest would be how teachers vary their classroom instruction over time and whether their ability to do this is related to cognitive style. Whilst certain subject variations were found in the ALIS study, it would also be useful to look at the variation within as well as between subjects. This present study focused on the cognitive and teaching styles of teacher trainees with little to no experience of teaching; there are many studies documenting the different teaching concerns of experienced and less experienced teachers, (Kennedy, 1991; Brophy, 1992; Mortimore, 1999 and Sabers et. al., 1991), which also, obviously, play a significant part in classroom delivery.

Chapter 6: Research Design

6.1: Selection of a Paradigm

The main aim of the research was to investigate the links between cognitive styles and teaching styles. From a detailed analysis of the literature, this appears to be a very neglected area, as confirmed by Richard Riding, who in an email communication (14.03.2002) with the researcher commented: " I am not aware of any work done on the CSA and Teaching Style".

With regards to selecting a positivistic (rationalistic, normative, quantitative) or interpretive (naturalistic, individual focus, qualitative) paradigm, the concern in the words of Desforges (2000:26) was essentially in ensuring that:

> "the question [was] right, clear, researchable and relevant to the practice of education... we will, as a field, make best progress by cooperating in multi-methods research designed at the strategic level and with subsequent synthesis in mind."

Thus the aim was to choose an appropriate research tool for each individual question posed thus allowing both quantitative (positivist) and qualitative (interpretive) approaches and in so doing, try to marry the positivist approach taken by cognitive researchers with the phenomenological perspective taken by learning styles researchers as noted by Sternberg & Zhang (2001: 74):

> " a dialogue between these two traditions...is not only possible but also beneficial to the understanding of origins of cognitive and learning styles. Styles can have both objective and subjective bases. The objective basis resides in the structural properties of cognitive systems or characteristic modes of cognition that are highly stable and typically operate without conscious awareness. The subjective basis

> lies in one's direct learning experiences and metacognitive knowledge of what works best. Affective experiences form the second basis."

The over-arching approach was positivist in that the design of the research was pre-determined and not emergent. The collection of evidence on teaching behaviour could be observed and measured. The quantitative design involved descriptive and inferential statistics. The intention was to collect associational data, and then to infer from them, patterns and causal relationships.

In addition, being mindful of the difficulty in assessing cognitive style, the research involved the use of several tools to measure cognitive style embracing the views of Curry (2000: 250):

> " all further research should use multiple indicators of the concept studied – this triangulation in measurement is the best solution to the theoretical and practical fragmentation so evident in the field, particularly in learning styles."

Within this established positivist framework it was also intended that qualitative data acquired through open-ended questions and interviews with the interviewee as the central focus, would give an essential added richness to the research and tackle some of the arguments often levied at positivist approaches:

> " It has been our view for some time that the processes of education, teaching and learning are so complex and multifaceted that to focus only upon cause and effect, products, outcomes or correlations in research on schools is of limited value" (Hitchcock & Hughes, 1995:25).

The literature review raises many questions and issues, primarily the lack of research on cognitive styles in the classroom. Another contentious issue is the allegedly fixed nature of cognitive style; this also raises important pedagogical issues when considering teaching and learning in the classroom.

6.2: Research Questions

In order to explore the relationship between a teacher training student's own cognitive style and teaching style(s) the following questions were considered:

(1) Is it possible to identify cognitive style and to what extent do PGCE students studying different disciplines have different cognitive styles? To explore this question two measures of cognitive style were used: Cognitive Styles Analysis (CSA) (Riding, 1991) and Cognitive Styles Index (CSI) (Allinson and Hayes, 1988).

(2) Is there a link between cognitive style and learning style? To explore this, the correlation between the two cognitive style instruments and the learning styles instrument: Approaches to Studying Inventory (ASI) (Entwistle and Ramsden, 1983) was used.

(3) To what extent does cognitive style affect learning preferences? To explore this each PGCE student completed a Learning Preferences Questionnaire (LPQ) based on work by Riding and Read (1996).

(4) Does cognitive style affect teaching style? Following the completion of aforementioned tests on cognitive style, mentors in schools were asked to complete a Likert style questionnaire – the Teaching Styles Questionnaire (TSQ) on their PGCE student to assess cognitive style in relation to teaching.

(5) Does age affect cognitive style? In order to consider these questions. Age was correlated with the learning style instruments. Two-way between-groups analysis of variance tests considered the interaction of sex and age with cognitive style.

(6) To what extent do age and gender interact with cognitive style in affecting learning/teaching preferences? In order to examine this, t-tests and two-way between-groups analysis of variance tests were carried out.

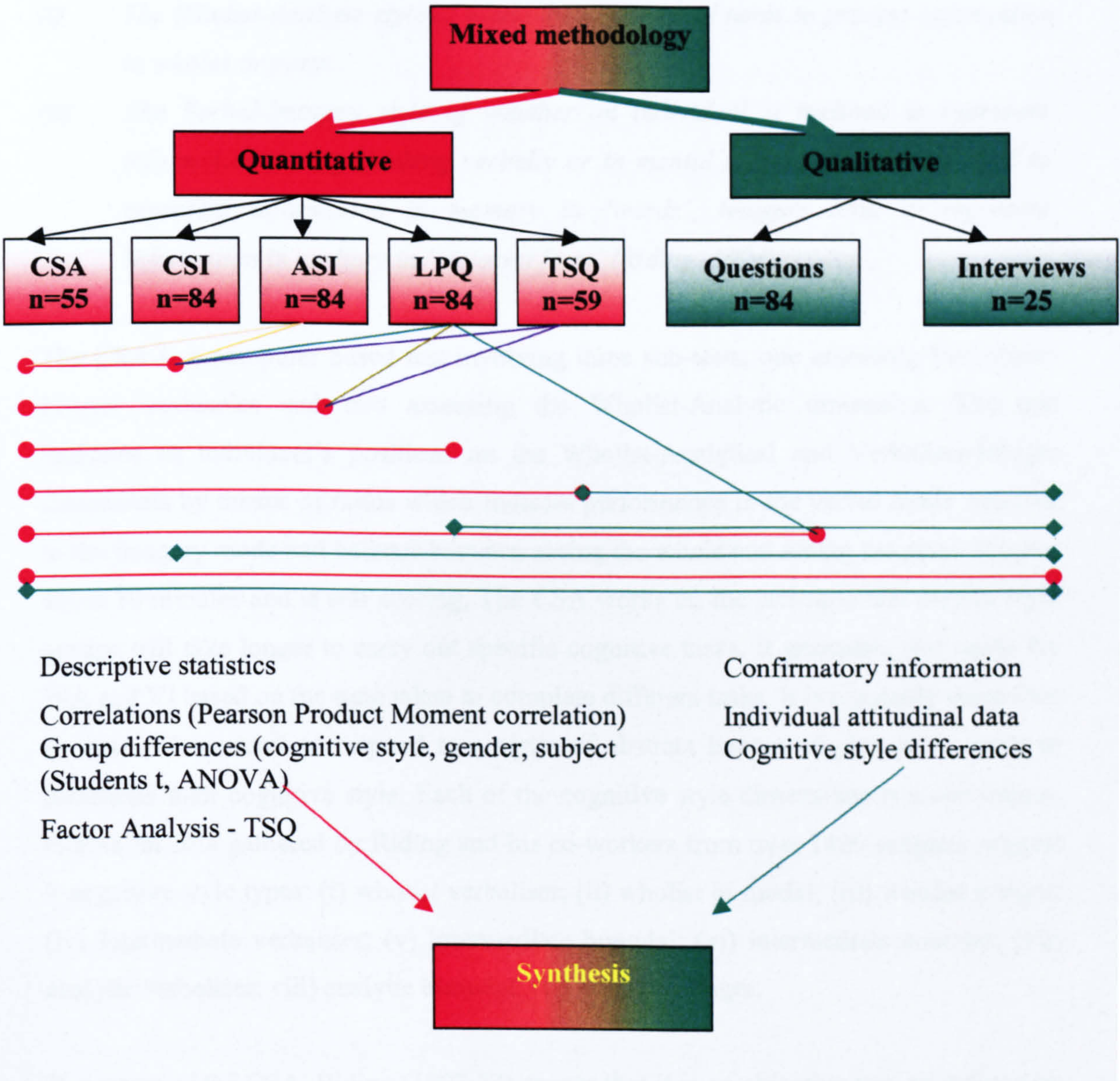
(7) Should statistically significant differences be found between the four cognitive styles and/or between males and females, verbalisers and imagers etc, the size of the difference between the groups being studies was identified by calculating effect sizes; the value of which is expounded by Coe (2002:6): "...the size of the effect rather than its statistical significance...promotes a more scientific approach to the accumulation of knowledge...". In order to calculate effect size, 'eta squared,' the most commonly used effect size statistic (Pollard, 2001) was used. The actual statistic calculated by SPSS is a more refined measure: 'partial eta squared,' Pollard (2001).

(8) To what extent does cognitive style affect attitudes towards learning and teaching? The author interviewed 25 PGCE students and mentors completed a Likert style questionnaire assessing the teaching of PGCE students (N = 59). In addition, all 84 students were asked to give their own views on what constituted good teaching and learning and what their main concerns about teaching were.

6.3: Research Tools

The research design is illustrated in Figure 17. Correlations / links between data sets were undertaken as demonstrated by arrows and lines drawn beneath the diagram; thus the CSA was correlated with the CSI, ASI, LPQ, TSQ and was used to inform the selection of interview candidates, whose responses were checked against other data already assembled regarding attitudes to teaching and learning. Figure 17 outlines the research design involving both quantitative and qualitative methods. An overview and critical analysis of all methods used is described in the following section, beginning with an analysis of the quantitative instruments chosen.

Figure 17: Research Design



6.3a: The Cognitive Styles Analysis

Riding's (1991) CSA purports to assess two basic but independent dimensions of cognitive style:

(i) The Wholist-Analytic style of whether an individual tends to process information in wholes or parts.

(ii) The Verbal-Imagery style of whether an individual is inclined to represent information during thinking verbally or in mental images. Verbalisers tend to represent information in memory in 'words', imagers tend to represent information in memory in 'pictorial form' (Riding, 1994).

The CSA is a computer based test involving three sub-tests; one assessing Verbaliser-Imager tendencies and two assessing the Wholist-Analytic dimension. The test indicates an individual's positions on the Wholist-Analytical and Verbaliser-Imager dimensions by means of ratios which indicate performance in the verbal mode relative to the imagery mode and balance between seeing the whole and seeing the parts. It takes about 10 minutes and is self scoring. The CSA works on the principle that certain style groups will take longer to carry out specific cognitive tasks. It generates two ratios for WA and VI based on the time taken to complete different tasks. It is reputedly value free in that students have to respond to a series of abstract images of phrases in order to determine their cognitive style. Each of the cognitive style dimensions is a continuum. Norms for data gathered by Riding and his co-workers from over 1400 subjects suggest 9 cognitive style types: (i) wholist verbaliser; (ii) wholist bi-modal; (iii) wholist imager; (iv) Intermediate verbaliser; (v) intermediate bimodal; (vi) intermediate analytic; (vii) analytic verbaliser; viii) analytic bimodal; (ix) analytic imager.

In support of the CSA, Riding (1997:32) argues that it is an objective test, as defined by Cattell and Warburton (1967), as it is objectively scored and its method of assessment is not obviously apparent to those being assessed. It is consequently difficult for assessees to contrive their results. It positively assesses both ends of the style dimension; this is

important, as otherwise it could be argued that the assessment is simply of ability. As it does not contain questionnaire-type items, or difficult language, it can be used in a wide range of situations and across cultures.

The validity of the construct of cognitive style is supported by evidence from Riding and Rayner (1998: 98, 181) who make references to the numerous studies, which support the construct validity. These studies provide the supporting evidence which suggest that the two cognitive styles (WA and VI) are independent of one another, separate from intelligence and gender, but interacting with, personality; and related to observed behaviours, such as learning performance, learning preferences, subject preferences and social behaviour. There is also an indication of a relationship between style and physiological measures.

In this study, 55 of the 84 PGCE students were able to complete the CSA. Students were grouped into the four main style groupings: wholist-imager, wholist-verbaliser, analytic-imager and analytic-verbaliser using median values on each of the two continuums: WA and VI. Median values were used rather than the norms suggested by Riding, (1991) because of the atypical nature of the sample population. Thus a score of < 1.32 indicated a wholist (N =27) and 1.32+ an analytic (N=28). On the VI scale, a score of <1.04 indicated a verbaliser (N= 25) and 1.04 + an imager (N=30).

Whilst the CSA claims to measure two dimensions of cognitive style, the CSI claims only to measure the wholist-analytic dimension; this accepted, if both tests are measuring the same aspect of wholist-analytic style there should be an observed statistically significant correlation between them. In addition, the work of Riding and Rayner (1998) suggests that different cognitive styles have differing learning requirements and thus a relationship would be expected between the learning preferences questionnaire (LPQ). If indeed, cognitive style affects teaching style, a relationship would be expected between the CSA and the teaching styles questionnaire (TSQ).

6.3b: The Cognitive Styles Index

The Cognitive Style Index (Allinson and Hayes, 1996) is a fairly recent instrument which assesses a dimension related to the wholist-analytic dimension of cognitive style. Details of the questionnaire can be found in Appendix A. The CSI does not purport to produce a full measure of cognitive style, it is focused on a single universal dimension, which Allinson and Hayes (1996) argue, reflects the duality of 'human consciousness' and problem-solving responses which are either analytic or intuitive. The CSI is a 38 item self-report questionnaire with items placed in random order, scored on a trichotomous scale which can be completed within 5 to 10 minutes. In the item analysis, a score of 2 is assigned for a response of true, 1 for uncertain and 0 for false. Twenty one of the items are worded in such a way that a response of 'true', indicates an analysis orientation. The scoring of the remaining 17 (intuitive statements) is reversed, therefore, so that the nearer the total CSI score to the theoretical maximum of 76, the more analytical the respondent, and the nearer the total score to the theoretical minimum of zero, the more intuitive the respondent.

Allinson and Hayes (1996:130) from a study of over 1000 adults concluded that the measure possessed robust psychometric properties, including good reliability, in terms of internal consistency and temporal stability, as well as good initial evidence of construct and concurrent validity. In terms of internal validity, according to Allinson and Hayes, it is highly reliable with internal consistency coefficients of .75 to .92. The CSI has demonstrated consistent and acceptable results in terms of test-retest reliability. Results are typically in the range of 0.78 to 0.9 (Allinson and Hayes 1996; Armstrong et al 1997, 1999; Sadler-Smith, 2000). Internal consistency is also seen as acceptable (α in the range 0.79 – 0.92, Allinson and Hayes, 1996). According to the authors, the CS1 has face validity in so far as if you know the subject you should be able to predict the score and it is not easy to fabricate responses to get a 'design score.' Allinson and Hayes (2000) also observed that the properties of the CSI remained broadly consistent across eastern and western cultures.

In terms of convergent external validity, results are mixed. As the CSI purports to measure an intuitive – analysis dimension it might be expected that this is similar to models in the wholist – analytic family of styles. But whilst the CSI has been found to correlate with Kirton's Adaption-Innovation Questionnaire (1976, 1994), a study by Sadler-Smith using 99 business studies university students who completed the CSI and CSA suggested that the CSI does not assess the wholist-analytic dimension of style as reported in Riding and Rayner (1998:36).

Whilst over a 100 people are using the CSI, at the present time, around the world, Rayner and Riding (1998) argue that, as of yet, there is little empirical evidence to support the CSI. The authors, Allinson and Hayes, do stress the need for more rigorous test-retest studies of larger samples over extended time periods. Studies undertaken by Spicer and Sadler-Smith (2001) have argued that the instrument does demonstrate strong reliability, internal consistency and temporal stability with over a 1000 subjects.

Whilst the CSI was originally constructed by Allinson and Hayes (1996) to represent intuition and analysis as opposite poles of a unidimensional construct, recent research by Spicer (2001:315), Sadler-Smith et al. (2001) and Hodgkinson and Sadler-Smith (2000) suggests that intuition and analysis might be better conceived as separate dimensions with intuition and analysis treated as separate scales. They present evidence for such a model drawing on data from almost 1000 respondents. A revised scoring procedure is proposed with both sets of items being scored positively (true =2; uncertain = 1; false = 0 and responses are summed and then divided by the number of items on each dimension (i.e. 21 for analysis and 17 for intuition) to give directly comparable scores for each dimension, with a theoretical minimum and maximum of zero and two, with higher scores indicating more positive response for each scale.

In the present study all PGCE students completed the CSI questionnaire and results were calculated using both the original scoring system advocated by Allinson and Hayes, (1996) and the revised scoring suggested by Sadler-Smith et al. (2001). Within this study, the correlation between the CSI and other cognitive style and learning style

instruments will be explored such as the CSA and ASI. Gender differences with regards to CSI scores will also be explored although the small number of males within the sample makes it difficult to corroborate or contest Allinson and Hayes' (1996) findings suggesting females to be more analytical than men.

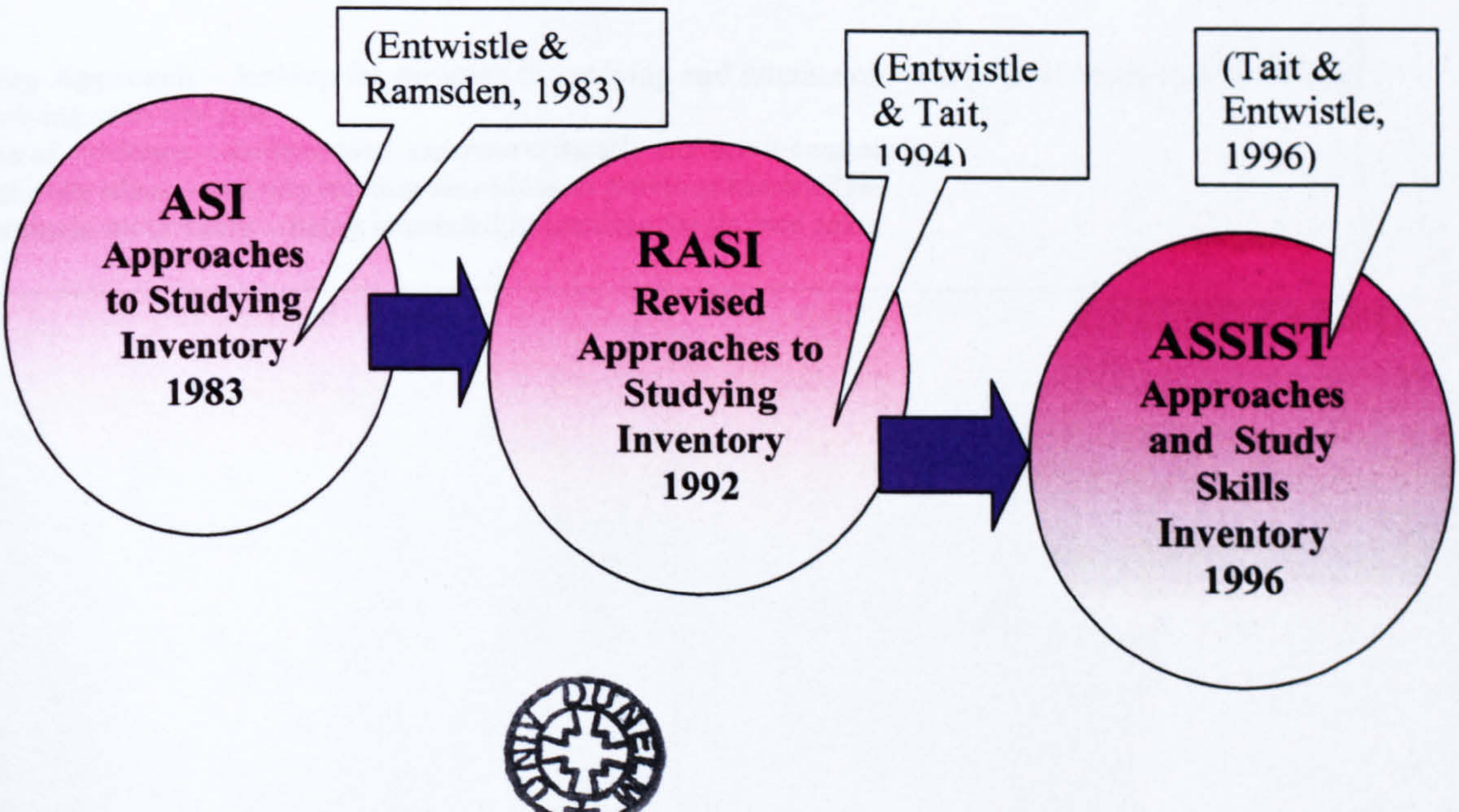
6.3c: The Approaches to Studying Inventory.

Since its development in the UK, the ASI has become one of the most widely used questionnaires on student learning in higher education and Entwistle's work is seen by Rayner (2000) as an attempt to link instructional preference to information processing. The ASI has involved a depth of empirical support not so obvious from many models of learning style. Developed by Ramsden and Entwistle (1981) the original version of the ASI contained 64 items that purported to measure four orientations to studying: meaning, reproducing, achieving and a non-academic approach.

A considerable amount of work has been done on the ASI since its conception. It has since undergone a number of revisions and changes of nomenclature as demonstrated in Figure 18.

The original questionnaire by Ramsden and Entwistle (1981, 1983) sought to identify amongst students their motivation, learning style, and the extent to which they were

Figure 18: The development of the Approaches to Studying Inventory



taking a surface or deep approach towards learning. In the latest version of ASSIST by Tait, Entwistle and Mc Cune (1998) additional scales are included to extend the description of studying and reactions to teaching.

In the present study, a shortened version, advocated by Gibbs (1990a) and Gibbs et al. (1988) of the ASI was used. This test uses only 18 items from the original 64 item scale and measures three orientations towards study; these were concerned with three orientations as outlined in Table 13.

Table 13: Orientations towards study (Entwistle)

A **Strategic Orientation,** made up of:
Extrinsic Motivation – seeing qualifications as the main source of motivation for learning. **The Strategic Approach** – actively seeking information about assessment requirements. **Achievement Orientation** – being competitive and self-confident, driven by a hope for success.
B Reproducing Orientation, made up of:
Surface Approach – relying on rote learning. **Syllabus-boundness** – restricting learning to the defined syllabus and specified tasks. **Fear of Failure** – lacking self confidence and being anxiously aware of assessment requirements. **Improvidence** – not looking for relationships between ideas, and being fact bound. Emphasis on facts and details, difficulty in building up overall picture.
C **Meaning Orientation,** made up of:
Deep Approach – looking for meaning in studying and interaction with what is being learnt, linking studying with real life. **Use of evidence** – students who examine critically and use it cautiously. **Relating ideas** – actively relating new ideas to previous knowledge. **Intrinsic motivation** – being interested in learning for its own sake.

As demonstrated in Appendix D, there are six questions measuring each of the three orientations towards learning:

a. questions: 1,3,6,9,12,15, = measure the achieving orientation
b. questions: 2,5,8,11,14,18, = measure the reproducing orientation.
c. questions: 4,7,10,13,16,17, = measure the meaning orientation.

PGCE students were offered 5 responses to each question from definitely agree (4), agree with reservations (3), disagree with reservations (1), definitely disagree (0), and one other category (2), if the item did not apply or it was impossible to give a definite answer. The maximum score for each of the three orientations was 24 and the minimum 0.

A high score on the 'Achieving Orientation' would indicate that the student is competitive, self confident, has well organised study methods and hopes for success. Such students look for clues from the lecturer which will show where and how to get the marks. The qualification at the end of the course is probably their main reason for studying.

A high score on the ' Reproducing Orientation' would indicate that the student often attempts to memorise subject matter and is not so interested in studying the subject for its own sake. They tend not to see underlying connections between ideas. They are concerned to do well, and want to gain the qualification, but sometimes do not pick up clues from lecturers on what leads to success in assignments.

A high score on the 'Meaning Orientation' would indicate that the student is very interested in the subject itself; such students characteristically want to go deep into the subject matter, making sense out of it and relating it to real-life situations. Sometimes they may spend too much time following up their own interests rather than doing what is required by the course, but they are usually successful.

The shortened version was chosen as it was quick to adminster. There was an evidence base to suggest that this version was a potentially useful measure with moderate reliability and validity (Newstead, 1992: 299). Newstead (1992) had found the scale to be fairly reliable with reliabilities over 0.5 – 0.69 (Clarke, 1986; Richardson, 1990, 1992) and to be applicable to students from a wide range of cultures and educational institutions (Watkins et al., 1986). Newstead (1992) comments that whilst it is a measure of only moderate reliability, the factor structure is reasonably robust (Harper and Kember, 1989; Sadler-Smith, 1996). However, whilst the reliability of the achieving and meaning orientations were found to be acceptable, Newstead (1992) did not find this to be the case with the reproducing orientation.

Given that learning styles are malleable and affected by the environment, one might expect to find a difference in scores for students studying different disciplines depending on subject delivery. It would also be interesting to hypothesise that students scoring high on 'meaning' (a deep approach) might also score highly on intuition and / or analysis dimensions of cognitive style. It would also be useful to consider to what extent age and gender affected approaches to studying. A consistent finding is that age is positively related to the adoption of a deep approach and negatively to a surface approach (Duff, 1999; Richardson, 1995, 1999; Sadler-Smith, 1996, 1998).

6.3d: The Learning Preferences Questionnaire

This questionnaire outlined in Appendix B, mainly based on questions previously used by Riding and Read (1996) to ascertain learning preferences for students, contained 9 closed questions on learning preferences, where PGCE students were asked to select from two or three alternatives in relation to their own subject; additional questions included one where students were asked to rank their preferred method of teaching out of a choice of 7 options and two open questions where PGCE students were invited to give their views on what constituted good teaching and their main concerns about teaching practice. These views were then coded along with interview data.

6.3e: The Teaching Styles Questionnaire

The (TSQ) was designed for the present study with the intention of being able to measure wholist-analytic teaching characteristics in the classroom and was based on the work of Messick (1976); Witkin (1976) and Riding (1991, 2002). The instrument was originally piloted in one school and amended as a result of discussion with teachers. A detailed analysis explaining and justifying the instrument can be found later in Chapter 8.

The 84 mentors in the secondary schools were asked to complete the 60 item Likert Scale questionnaire using their perceptions of the teaching style of their own PGCE student. The instruments consisted of partial agreement oppositional constructs whereby respondents were asked to state their own degree of agreement between them. 52 of the statements related to wholist-analytic characteristics, 7 to verbaliser-imager characteristics and one question related to ability. Mentors were asked to allocate a mark of 1 (strongly agree) to 5 (strongly disagree) to each of the statements. Some statements were positively worded and others negatively worded to try to reduce response bias. With reference to the questions on wholist-analytic tendencies, a total score was produced for each student with a lower score indicating more wholistic tendencies and a higher score indicating a more analytic approach. Mentors were asked to complete the form and return to the researcher. It was stressed at the time that the questionnaire was not intended as a measure of ability or related to the student's qualified teacher status profile.

An analysis of the questionnaire's internal consistency produced an initial Cronbach's alpha coefficient of .642. On the basis of this, 32 items were retained. The following item numbers were dropped: (7, 9, 10, 16, 17, 20, 21, 22, 23, 24, 26, 27, 30, 35, 36, 38, 40, 41, 42, 45, 47, 48, 57) to improve the internal consistency of the measure to an acceptable 0.88; the scale could now be considered reliable with the sample. Analysis focused specifically on wholist-analytic tendencies given the fact that only 7 items

reflected verbaliser-imager characteristics and taking these 7 items alone, the internal reliability of these few items was not sufficient to warrant further analysis (Cronbach's alpha of 0.30).

Using the scores for the selected 32 items, a wholist-analytic score was produced and this was then correlated with other instruments measuring cognitive and learning styles; age and gender effects were also considered. Comparative analyses were undertaken by looking at group comparisons (cognitive style and subject) in relation to the scores on the TSQ.

6.4: Structured Interviews

All of the PGCE students were asked at an introductory lecture (September, 2000) whether they would be willing to participate in interviews; all but one agreed in principle to be involved. Using data collected from the Cognitive Styles Analysis (Riding, 1991), a stratified sample was selected to involve students from each of the 7 subject areas and students with more extreme scores on the CSA were selected. Initially 35 students were selected from the 55 that had completed the CSA, however due to subject demands only 25 (approximately 30% of the PGCE cohort) were able to participate in the interviews. Of these 25, 5 were religious studies students, 5 geographers, 5 mathematicians, 2 classicists, 6 scientists and 2 modern foreign languages and no physical education students because of the nature of their course and associated time constraints.

It was felt that by interviewing students with more extreme cognitive styles it might be possible to observe differences in their thinking and approaches to learning and teaching and thus allow more in-depth information to be collected. The aim was to seek out the individual teacher's perception of their learning and teaching experience. It would also allow cross-checking against other quantitative data that had already been and was in the process of being collected. This method was also used to collect data about the

belief systems and knowledgeability of the individuals and to see if any patterns in thinking emerged and the reasons behind them.

The interviews took place in the middle of January 2001. It was felt that by this time the PGCE students would be less preoccupied with establishing a balance in their teaching and would also have greater insight into the process of teaching after their first term of teaching practice.

The 25 students were given a copy of the research questions in the form of a questionnaire before attending interview; they were also invited to ask any questions that they themselves had. The format adopted was that of semi-structured interview allowing depth by asking specific questions but allowing flexibility in terms of question order and questions raised by the interviewees. The questions asked of the students were predominantly open-ended, asking for background information, opinions, feelings and knowledge. Such questions, it was hoped, would encourage co-operation and help establish a rapport and allow the interviewer to make a truer assessment of what the respondent really believed.

The questionnaire ensured a strong focus, (agenda adhered to), with all interviewees being asked the same questions but at the same time allowing the students to ask additional questions or focus more specifically on issues that they felt most strongly about. Thus the questionnaire provided a structure but at the same time did not limit flexibility in the discussions that took place to limit concerns such as those raised by Mc Cracken (1988:24):

> " for the purpose of the long qualitative interview, it [the questionnaire] is indispensable...It...establishes channels for the direction and scope of discourse – it allows the investigator to give all his or her attention to the informant's testimony... In sum, the questionnaire that is used to order data and free the interviewer must not be allowed to destroy the elements of freedom and variability within the interview."

In discussing the 'framing' (Scott and Usher, 1999) of the interview process in terms of timing, seating, voice, interaction of interviewees with each other and with the interviewer, it could be argued that on this occasion the interviewer chose a weak frame. Notes were taken during interview rather than using a tape recorder, about which some students had previously expressed concern. Although such a method of noting information is less intrusive than a tape recorder, this does act as a framing device, (Scott and Usher, 1999). The setting was relatively informal and the students were interviewed predominantly in groups of 2 or 3 with colleagues that they had been working with for a term. The room was small and therefore there was a high degree of physical intimacy and the atmosphere was relaxed with the aim of enabling an honest and open dialogue.

It was felt that the group interview would enable a wider range of responses than individual ones and that the students would feel more comfortable with this format. It did enable students to discuss their differing experiences and to share these with their colleagues. It was also felt that this might minimise the potential impact of the researcher on the process by allowing the group to discuss the questions and enabling the researcher to take more of an observer role at key points in the interviews. The composition of the groups did prove to be a key issue with some students taking a more leading role; at such points the researcher would intervene to ensure that all of the interviewees had an opportunity to voice an opinion. The PGCE students were also invited to write down any further comments that they wanted to make after the interview and return these confidentially to the researcher by the end of the day; it was felt that this would enable individuals to raise more personal thoughts that they might not want to share with the group and thus seek to reduce the point made by Watts and Ebbutt (1987) that group interviews are of little use in allowing personal matters to emerge: "the dynamic of a group denies access to this sort of data."

The researcher was very explicit at the beginning of each interview in explaining the purpose of the research, the researcher's own interests and experience, the protocol and ethical issues regarding non-traceability and anonymity for the PGCE students. This

is an approach recommended by Oakley (1981) although Babbie (1990) and Fowler (1993) both argue the case for the neutral and standardised interviewer. Both suggest that one should try to neutralize the effect of the interviewer so that differences in answer can be attributed to differences in the respondents themselves.

All of the interviewees asked the researcher to interpret the scores they had received on the instruments they had completed. The interviewees were encouraged to share their thoughts about the results and whether they felt that the cognitive style labels were an accurate reflection of their approaches to learning. All interviewees were also shown a list of factors (Appendix G) contributing to teaching style and asked which ones they felt had been most important to themselves.

The data collected through note-taking and returns from individual PGCE students were coded following interview using content analysis procedures. The responses to the open–ended interview questions and questionnaires were content analysed for their content characteristics. Views on teaching and learning, approaches to teaching, concerns about teaching, subject bias were distinguished in the responses and grouped under these categories and related to cognitive style.

6.5: Procedure

For the purposes of this research it was necessary to focus on the four main style groupings as suggested by Riding, especially given the sample size, and thus the concept of the cognitive style continuum needs to be borne in mind as suggested by Messick (1984:61): 'cognitive styles are not categories or types but dimensions of continuous variation; not pigeon holes but sign-posts for characterising individual propensities'. The Likert Scale questionnaire on teaching style was principally looking at the Wholist-Analytic Dimension in order to discern 'typical' characteristics; a cautionary note in this respect is also raised by Springer and Deutsch (1998:293) in that the ' formulation of dichotomies is just a convenient way of viewing complex

situations'. In order to take on board the views of Messick and Springer and Deutsch, raw scores of wholist-analytic tendency were also used for correlation purposes and interview analysis enabled in depth study of patterns that had been identified using statistical techniques.

6.6: The nature of the sample

The sample comprised an opportunist sample of 84 students studying for their PGCE qualification in a number of subject areas at one university for the duration of one year; these subjects areas included: geography, classics, science, physical education, modern foreign languages, mathematics and religious studies. The students were aged between 20 to 48 (males, n = 23; females, n = 61). The distribution of the 84 PGCE students by gender and subject is shown in Table 14.

Table 14: Distribution of students by subject and gender

Subject	No.of female students	No.of male students	Total Number
Geography	6	4	10
Maths	7 (1)	6 (1)	13
Languages	16 (2)	2	18
Classics	2	1	3
PE	5	2	7
RE	12 (2)	3	15
Science	13 (1)	5	18
Total	61	23	84
Final total	55	22	77

() numbers in brackets denote students that left the course during the course of the year.

6.7: The Process

Time Scale: Data collection took place over the period of one academic year from September 2000 to July 2001 as illustrated in Figure 19. The sequence of events involved an initial lecture to all PGCE students on the 14th of September 2000 to

explain the purpose of research and to give an introduction to learning styles research. At this initial meeting students completed three pen and paper inventories: the Cognitive Styles Index (CSI) (Allinson and Hayes, 1988), The Approaches to Studying Inventory (ASI) (Entwistle and Ramsden, 1983) and a Learning Preferences Questionnaire (LPQ) based on work by Riding and Read (1996).

During the Autumn term, 55 PGCE students completed Riding's (1991) Cognitive Styles Analysis; a separate disk containing the scores of additional students collected in the Spring term was corrupted and the data was irretrievable. In addition, in the Spring term, 25 students were involved in structured interviews.

During the course of the academic year, school mentors were asked to return a 60 item Likert scale questionnaire on their perceptions of their PGCE student's teaching style. Six letters were sent to mentors; the greatest success was achieved when the letters were personalised and a stamped addressed envelope enclosed in the mailing. By August 2001, 59 out of 79 mentors, (5 students had left the course) had returned the Likert scale questionnaires giving a final return rate of 75%. A response rate of around 70% has generally been recommended as acceptable (Berdie, 1990; Gay, 1992).

6.8: Limitations

Whilst a number of the issues relating to instruments, process, data collection etc will be discussed in the following data analysis, it is useful to provide a succinct overview of some of the inherent limitations of this research. Such limitations fall into a number of categories such as approach, time frame, testing and instrumentation issues. The appropriateness of the instruments selected will be considered using the criteria suggested by Sternberg and Grigorenko (1997:700), as demonstrated in Figure 20.

- **Approach**: The study was principally looking at the relationship between student teacher cognitive style and perceived teaching style. Traditionally, the study of

Figure 19: The data collection sequence

Making Contact: June -August 2000

- Contact made with University via letters explaining purpose of research
- Permission given to conduct research
- Initial meeting with PGCE co-ordinator and Geography mentor
- Agree nature of research
- Pilot TSQ

↓

Meeting Participants and clarifying research: September 2000

- Meeting with Subject tutors to explain purpose and method
- Meeting with ICT co-ordinator to put CSA on network
- Lecture to the PGCE cohort on Teaching and Learning Styles. Explanation of the nature and purpose of the research. Discussion about involvement in the research - consent issues: anonymity/confidentiality. Students signed consent forms if they wished to be involved

↓

Collecting research: September - November 2000

- Students completed CSI, ASI and LPQ at first meeting
- Letters sent out to all school mentors to explain the purpose of the research asking them to complete and return first Likert scale questionnaire on student teaching style
- Follow up letter to remind mentors
- PGCE students to complete CSA in college* (55 completed by December)
- Forms collected from mentors December 2000 *(only 26 returns)

↓

Interviews and entry of data: December 2000 – January 2001

- Initially 35 Students selected for interview based on subject and CSA returns
- Semi structured interviews took place in January with 25 students
- Disk collecting the CSA of the remainder of students corrupted

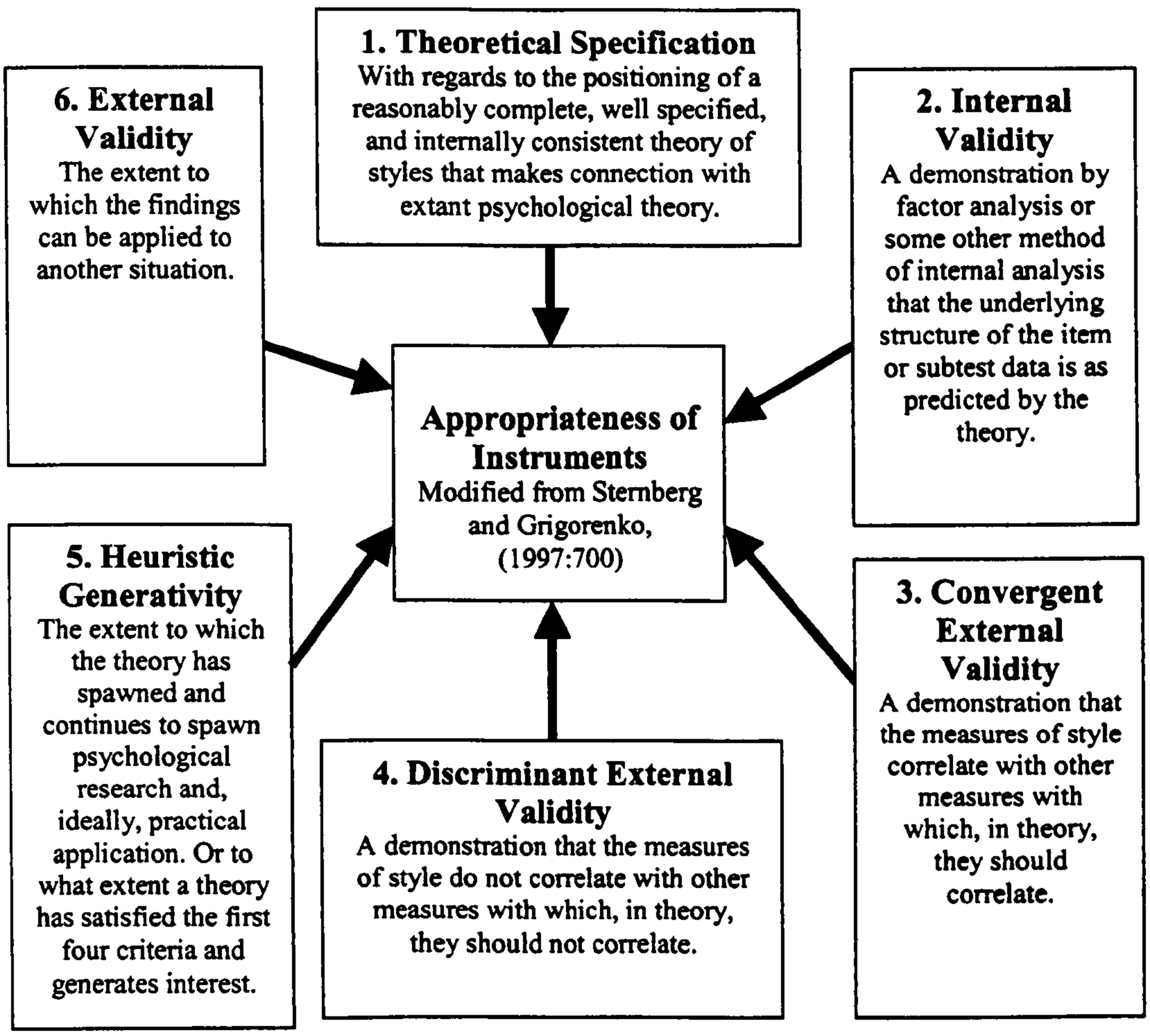
↓

Collecting research and entry of data: February – May 2001

- Letters sent out to mentors to collect second Likert scale questionnaire on student teaching style form in February – 3 further letters sent out in March and May* (only 18 returns by May)
- Individual letters with SAE sent out to all mentors in July (return rate by August 2001 – 59 mentors had returned the forms (75% of total sample)

cognitive styles has been rooted in a positivistic framework. Given the fact that the PGCE students were working in 84 different environments, trying to isolate the impact that cognitive style might have on teaching style was always going to be problematic and as mentioned by Salomon (1991) "Educational research deals not with linear causal sequence of independent and dependent variables, but with 'clouds of correlated events ….[that] mutually define each other". An assumption of the research was that individuals have a cognitive style which can be measured; in Schon's (1987:3) 'educational swamp' being able to isolate and measure cognitive style is no easy feat.

Figure 20: Issues relating to selection of instruments



Sternberg (1999:82) questions this notion of the stability of 'style,' seeing it as a learning style which is variable across tasks and situations and thus difficult to measure and compounded by the fact that people differ in the strength of their preferences and stylistic flexibility. As commented on by Sternberg (1997:142) and Hashway and Duke (1992) the classification of individuals into categories may appear arbitrary when cognitive styles scales are not clearly dichotomous. People are impulsive or reflective to degrees, rather than just showing one style or the other.

- **Time scale:** Data was collected during the course of the PGCE academic year (September 2000–July 2001); given that the students are predominantly school based and the very intensive nature of the course, access to the students was difficult. Pressures within schools also lead to difficulties in mentors completing the questionnaire (TSQ) sent to them. Principally, the research design involved a one shot survey (describing the characteristics at one point in time). Issues of maturation are raised concerning the time when instruments were completed and returned as not all instruments were completed at the same time. The students completed the CSI and ASI at the beginning of the PGCE year, the CSA was completed during the Autumn Term 2001 and the interviews took place in January 2001. It would have been advantageous to see how students' 'Approaches to Studying'(ASI) may have altered with the duration of the course. It would also have been interesting to have looked at whether cognitive style would have changed from the beginning to the end of the PGCE course and thus a longitudinal design allowing a longer period of time is suggested for future research.

- **Testing**: It could be argued that the introductory lecture given by the researcher to the students at the beginning of their course in September could have sensitised them and made them more aware of the impact of their own cognitive styles and thus they may have modified their behaviour as a consequence. During the interviews, analytic students reported that the lecture and completion of the instruments had little effect on their thinking whereas wholist PGCE students felt that it had made

them more aware of their own style and the need to modify their behaviour in the classroom as a result.

- **Treatment fidelity:** Whilst all students completed 3 of the instruments: (CSI, ASI and LPQ) at the same time and under the same conditions, with regards to the Cognitive Styles Analysis (CSA) completed by the students and the Teaching Styles Questionnaire (TSQ) completed by mentors, there are issues of treatment fidelity as it was impossible to ensure that all mentors followed the same procedures when assessing their students (Borg and Gall, 1989). Whilst all the PGCE tutors met with the researcher to discuss the issues concerning the protocol and research process, the ability of the mentors to take on board the process would have depended largely on their frequency of contact with the college tutors and varying levels of experience. Ideally training should have been provided for all mentors but there were substantial time and cost implications and it is also very doubtful whether schools would have released mentors for such training or indeed if mentors would have been willing to attend. Whilst some of the Teaching Styles Questionnaires were returned at the end of the first teaching practice, the majority were returned at the end of the second practice; whether these results are directly comparable given the different time frames is questionable. Students when on teaching practice were in far from uniform settings. In addition, the conditions under which the students completed the Cognitive Styles Analysis may have varied.

- **Size and nature of the sample**: The sample was an opportunist sample of PGCE students studying at one university and thus the generalisability of the findings is questionable. The relatively small size of the sample (n=84) makes it difficult to make assumptions about the results. In addition, the unequal numbers of students from each of the seven disciplines was not ideal nor the fact that the gender balance was predominantly female; these last two points made it difficult to use certain statistical procedures. The relatively small numbers present limitations when using specific statistical tests as outlined by Cohen (1992). When classified into the four cognitive

styles, significant in itself, there were few analytic-verbaliser males. Whilst the CSI and ASI were completed by 84 students, there were only 55 returns for the CSA due to the malfunctioning of a second disk at the college and subsequent loss of data. Those who had not attempted the CSA tended to be from certain subject areas suggesting course / and tutor effects. The return rate for the teaching styles questionnaire from mentors eventually produced a response rate of 75%. By December 1999 only 24 forms had been returned, the remaining 33 forms arrived in July 2000 after a number of follow up letters. The return rate was definitely influenced by the fact that the researcher was not a member of the college and thus unknown to the mentors which may have led to a lack of any accountability on their part and also a question of trust, as the contents of the questionnaire were relatively sensitive and they may have had concerns about the use of the data. Follow-up phone calls and personal letters from the researcher to the mentors enabled a better response than the initial standardised letter.

- Instruments: A computerised test, the Cognitive Styles Analysis (CSA) was completed by students along with a number of self report inventories: the Cognitive Styles Index (CSI), Approaches to Studying Inventory (ASI), Learning Preferences Questionnaire (LPQ), and in addition, mentors completed the Teaching Styles Questionnaire (TSQ). In relation to these quantitative measures a number of issues are worthy of note:

(i) When undertaking the research, the 2 cognitive style instruments: the Cognitive Styles Analysis (CSA) and the Cognitive Styles Index (CSI) were chosen to enable triangulation in that they would be both be able to measure analytic and wholist measures of style. It became evident in the early stages of analysis that these two measures were in fact measuring different aspects of cognitive style. An email communication with Chris Allinson regarding this gained the following response:

> "We should certainly have expected an association between CSI scores and those on the wholist-analytic dimension of the CSA, but, as you have indicated, this is not the case. This may call into question the validity of one or both of the measures, but we are

> quite satisfied with the validatory evidence for the CSI" (Chris Allinson, 18.04.2001).

(ii) In the ten or so years since the introduction of the computerised CSA, it was only in 2001 that a number of researchers outside the Birmingham school where the CSA was developed, began to question the stability of the measure over time, leading Peterson (in press) to comment that no research has been conducted on the stability and internal consistency of the measure. Roberts (2001:229) found that his architect students became more wholist and less analytic over time, leading him to conclude:

> " This is possibly related to the educational experience, where students are encouraged to think more holistically...it may be possible that students are developing all round skills in order to be able to switch between holistic and analytic thinking and between verbal and visual representation."

Further work by Peterson (2001, 2002) and Redmond, Mullally and Parkinson (2002) with 50 psychology students and 38 computers science and engineering students respectively, found test-retest reliabilities for the CSA to be low on both the wholist-analytic and verbaliser-imager dimensions. For the W-A dimension, Peterson reports re-test reliabilities of $r = 0.30$ and Redmond et al's. equivalent figure is 0.56, the respective figures for the verbaliser-imager dimensions are for Peterson: $r = 0.2$ and for Redmond et al. (2002): $r = -0.17$. In both of these reports, the test-re-test interval was only 7 and 12 days respectively whereas Riding feels the minimum test-retest interval should be at least one year. Work in progress by Waring and Evans (under review) looking at 18 physical education PGCE students, allowing a test-retest interval of 6 months did find an acceptable test-re-test figure for the wholist-analytic scale ($r = 0.71$, $p = 0.01$). Kline (2000) suggested that a reliability of about 0.7 is the minimum requirement for a good test. In agreement with the work of Peterson and Redmond et al., Waring and Evans found the test–retest reliability for the verbaliser-imager dimension was very low ($r = 0.16$, $p = 0.52$). Where there were changes in style there was no consistent movement in one direction on either of the two scales, thus some students became more analytic whilst others became more wholist and the same can be said for the verbaliser-imager dimension. The lack of stability of the V-I scale has also

given weight to the view that perhaps verbaliser-imager is not a separate cognitive style (Moore, 2000). Peterson (in press) argues that it may be possible that individual difference in verbal-imagery processing are not as prevalent as the individual differences in the wholist-analytic dimension and that there has been little empirical investigation into the possibility of there being a competing verbal-imagery dimension. Peterson has developed an alternative version of the CSA, including actual images which are not an integral part of Riding's V-I part of the CSA test. In assessing verbaliser-imager style, Redmond et al. (2002) also see the need for a greater variety of stimulus materials and argue that some questions in the CSA test are ambiguous and also culturally dependent e.g "postboxes are the same colour as strawberry" commenting that, in Ireland, postboxes are green as a case in point. Redmond et al (2002) also call into question the way in which style ratios are calculated in that with the CSA test it does not matter whether the answer is correct or incorrect; the ratio is based solely on the speed of response. In addition, they argue that the continual flashing up of right or wrong to each question will affect respondents' speed of response to further questions.

(iii) With reference to operating procedures, Roberts (2001) also suggests that the CSA software, used to take the style measurements, may have some limitations, especially when used with a high ability group of students. From analysis of the subsidiary data provided on accuracy of response to questions, and length of time to respond, it would appear that his students were responding very quickly, but with high accuracy; a finding that was replicated in this study. These figures imply that the exercises set within the software are not particularly challenging. Estimates based upon average response times suggest that the difference between a student being classified as a wholist, and a student being classed as an analyst are determined by a variation in response time to each question by a fraction of a second. At this level, other factors such as the student working out which key to press on the computer's keyboard may have a significant effect on the result. Similarly a minor distraction, when a student might momentarily lose concentration on the test, may also provide a bias to the results. Rayner (2000:141) argues that whilst a developing programme of empirical research is providing evidence

to support the construct validity, further work is needed on the reliability of the assessment tool.

(iv) With respect to all subjective, self -report inventories: CSI, LPQ, ASI, TSQ, Rayner (2000:140) and Riding (2000) both argue they are fraught with difficulty as firstly, people are not always good at knowing what they think about themselves and may not know themselves sufficiently well to be able to indicate objectively what they really think or would do. Secondly, what a researcher thinks makes a clear item to assess an aspect of style, is often in fact interpreted quite differently by the individual. 'The phrasing of the questions so that the respondent interprets the question just as the designer intended is far from easy' (Riding, 2000: 371). Thirdly, respondents are keen to be seen in a perceived good light and may be dishonest with their answers. In support of such views, Skehan (1989:149) adds:

> " it may be that self-report and questionnaire methods of data elicitation do not tally with actual behaviour [it is]...difficult to investigate learner beliefs and other affective variables."

(v) The Cognitive Styles Index (CSI) is more subjective than the CSA in that it is a paper and pen inventory. In interview, many of the students claimed that they had ticked the response that they 'felt was right' and that this was not necessarily an accurate depiction of their real approach. There is also the question as to how well do individuals know and understand how they learn; are perceptions indeed reality? In terms of face validity, the 25 students interviewed felt that the CSA result was a more accurate depiction of their approach than their CSI score.

(vi) The CSI was originally conceived as being a bipolar scale. Recent work by Epstein et al. (1996) and Hodgkinson & Sadler-Smith (in press) now suggests that instead of intuition-analysis being bipolar opposites along a single continuum they are in fact more likely to be separate modes of information processing, served by independent cognitive systems and therefore 'separate, unipolar constructs, but significantly correlated with

one another' (Hodgkinson & Sadler-Smith in press). Some students had problems completing the CSI because of language difficulties preventing access to some of the wording; this was also true for the other paper and pen inventories.

(vii) The version of the Approaches to Studying Inventory (ASI) was a shortened version with only moderate reliability. This version was chosen precisely because it was very quick and easy to administer; this was felt to be a serious consideration given the other questionnaires that were being completed at the same time. In retrospect it would have been more useful to have completed this questionnaire after the PGCE students had had experience of their course; what was being measured was the approaches to studying that students' had adopted, in most cases from their experiences of the education system to date. Alternatively a test-retest could have been used.

(viii) The Learning Preferences Questionnaire (LPQ) was administered right at the beginning of the PGCE course when the PGCE students had little experience of the course and therefore their views on teaching and learning were very much guided by their own experiences of being a learner in a classroom. The interviews carried out a term later gave further insight into some of the students' views on teaching and learning. It would have been very useful to have ascertained views from a larger sample later on in the course.

(ix) With regards to the Teaching Styles questionnaire (TSQ), although subject to a pilot, this was a new and untested instrument. Only 32 of the original 60 items on the questionnaire were used as some of the items did not hold up under scrutiny. A number of issues are discussed in later chapters to do with the length of the instrument, choice and use of terminology and organisation of the questions on the one hand. And on the other hand, the mentors' own awareness of cognitive styles, knowledge of the student and culture of the school will have varied, along with the ability of the mentors to interpret the statements honestly and accurately:

> " There .... is a tendency for teachers as mentors to have restricted perspectives, and especially a limited awareness of alternative teaching strategies, together perhaps with a lack of enthusiasm or ability to engage in systematic critical appraisal of different possibilities" (McIntyre and Hagger, 1994: 31).

- **Manipulation of the data:** For analysis purposes, the wholist-analytic scores using Riding's Cognitive Styles Analysis (CSA) were divided in to the 4 main style categories. Dividing continuous data into discrete categories reduces accuracy (Thompson, 1988). It may also be only at the extreme ends of the scale that differences can be observed. With the relatively small sample sizes there was also the risk that small sample sizes and large effect sizes could be under-interpreted, given the increased difficulty of getting statistical significance with a small sample (Mertens, 1998). In particular, the non-significant ANOVAs involving cognitive style, subject and teaching style may be the result of insufficient power (.4) far below the recommended .8 suggested by Pallant (2001).

- **Violation of assumptions:** The t-test and ANOVA make the assumption that samples are obtained from populations of equal variances, where this was not the case, SPSS provided an alternative t value which compensated for violation of this assumption. In the case of ANOVA, Pallant, (2001:172) and Stevens (1996) argue "[the test is] reasonably robust to violations of homogeneity provided the size of groups is reasonably similar".

- **Interview issues:** 25 out of a hoped for 35 students were able to attend interviews, the no-shows were due to pressures of the course and thus lack of time. No physical education students were involved in interviews. The issues associated with group interviews and the interaction of the researcher as to whether the cognitive style of the researcher caused an interaction effect with the interviewees has already been discussed. The data collected from this process was very rich and added valuable insight and in further research, follow-up interviews would be felt to be essential.

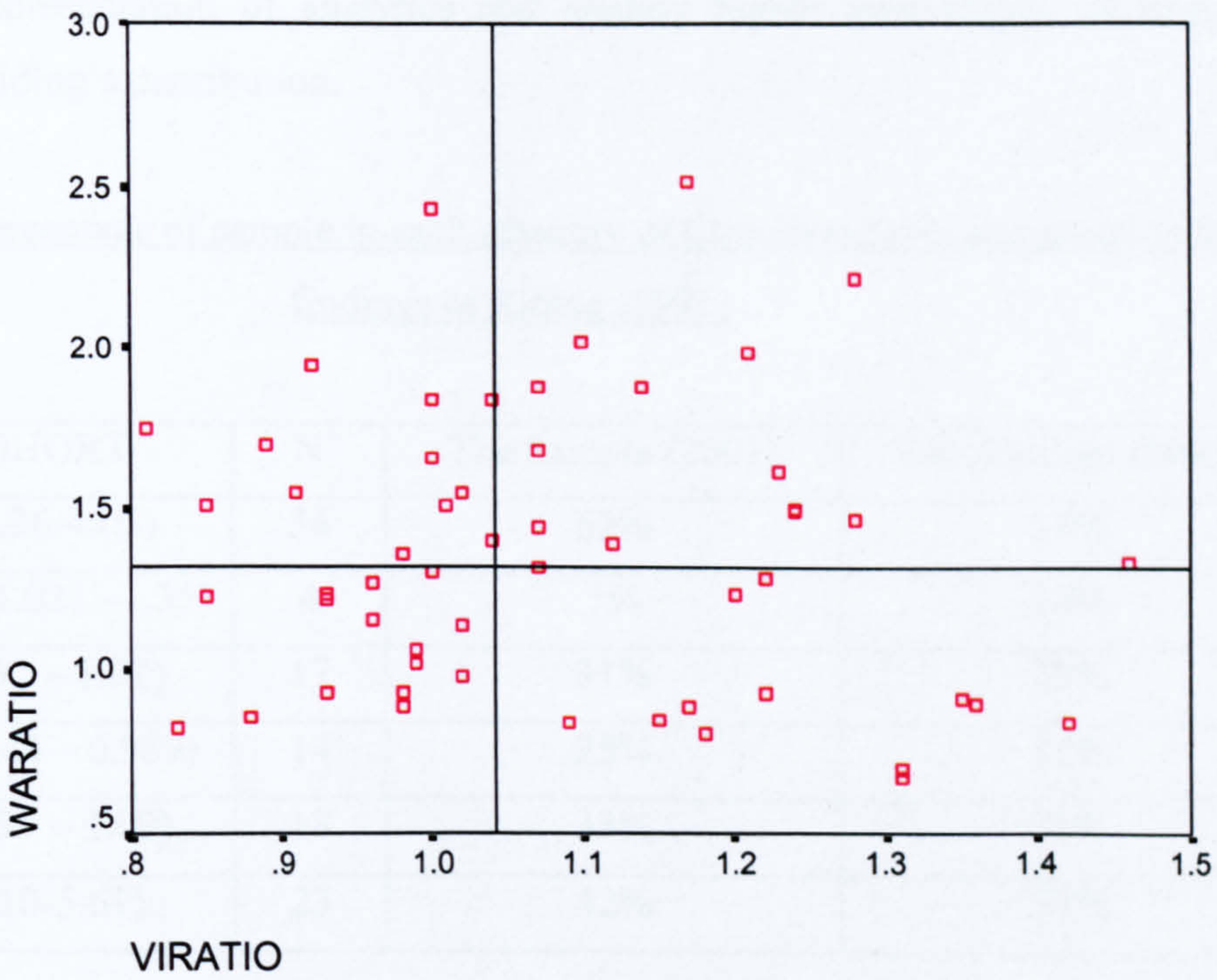
Having outlined the research process and instrumentation employed, analyses of data are presented in Chapters 7 to 9 along with discussion of the significance of the findings taking on board the limitations as outlined in this chapter.

Chapter 7: Analysis: CSA – CSI - ASI

7.1: *Sample Characteristics: The Cognitive Styles Analysis (CSA)*

Fifty five of the final 77 postgraduate teacher training students completed the computerised Riding's Cognitive Styles Analysis test (CSA) comprising 40 females and 15 males. An analysis of student results on all other inventories suggested that the results of the 55 on the Cognitive Styles Analysis were representative of the group as a whole; however certain subject areas such as religious studies, geography and physical education were under represented in this sample. Whether this under representation was due to the fact that tutors had arranged for their students to do the test in the second session where the disk was corrupted or other factors is unclear.

Figure 21: Distribution of scores along the WA and VI continuums



The distribution of wholist-analytic and verbaliser-imager ratios for all 55 students who completed the CSA is shown on Figure 21. The spread of values on both the wholist-analytic and verbaliser-imager dimensions for both males and females approximates that of a normal distribution as qualified by the results of the Kolmogorov-Smirnov statistic. In all cases, non-significant results were obtained, with all values above .05 suggesting normality: (WA ratio for males = .200 and females = .191; VI ratio for males = .200 and females = .108). For data analysis purposes, the WA and VI scores were subdivided into the four main cognitive style groups, (wholist-verbaliser, wholist-imager, analytic-verbaliser and analytic-imager), using median values. On the wholist-analytic dimension: <1.32 = wholist and on the verbaliser-imager dimension: < 1.04 = verbaliser.

The mean score on the wholist-analytic dimension was 1.36 (SD: 1.08) and thus higher and, therefore, more analytic than the 1.25 suggested by Riding (1991) from his study of 999 subjects. With respect to the verbaliser-imager dimension, the mean score of 1.08 (SD: 0.16) was found to be closer to the 1.06 found by Riding in the aforementioned study. From Table 15 it can be seen that the PGCE sample contained a notable overrepresentation of analytics and slightly higher percentages of imagers compared to Riding's distribution.

Table 15: Percentage of sample in each category of Cognitive Style compared to the findings of Riding (1991)

% OF COHORT	N	The Sample (2001)	UK Average (1991)
Analytic (1.36-4.05)	34	62%	34%
Intermediate (1.021 –1.35)	4	7%	34%
Wholist (0.37 – 1.02)	17	31%	32%
Verbaliser (0.44 – 0.989)	14	25%	32%
Bimodal (0.99 – 1.09)	18	33%	31%
Imager (1.10-5.61)	23	42%	37%

Whilst the small sample size limits the generalisability of the findings, the higher percentage of analytic students within this sample compared to Riding's norms is of interest and a finding replicated in other recent studies (Roberts, 2001). Further research is required to ascertain whether this is typical of other teacher training cohorts. Figure 22 demonstrates the distribution of scores across Riding's (1991) nine cognitive style groups. The data reveals a comparatively high representation of analytic-imagers (24% of the sample) and a relatively low percentage of wholist-verbalisers (6%) and intermediates. Whether this suggests that wholist-verbalisers are less likely to choose teaching as a career or the result of the nature of the subjects represented would be an interesting line of questioning to pursue.

Figure 22: The distribution of student WA and VI scores across the nine Cognitive Style categories

Analytic Verbaliser 18.2% n = 10	Analytic Bimodal 20% n = 11	Analytic Imager 23.6% n = 13
Intermediate Verbaliser 1.8% n = 1	Intermediate Bimodal 5.5% n = 3	Intermediate Imager 0% n = 0
Wholist Verbaliser 5.5% n = 3	Wholist Bimodal 7.3% n = 4	Wholist Imager 18.2% n = 10

The high percentage of analytics could possibly be related to the nature of the subjects being studied by this cohort of teacher trainees with over 73% studying 'hard subjects' (Biglan, 1973) favouring a more analytic approach. To consider this further, Table 16 looks at the distribution of the four main cognitive style groups across subject domains.

A one-way between-groups analysis of variance was conducted to explore the impact of subject on wholist-analytic and verbaliser-imager scores. On both counts, no statistically significant difference between the seven groups was found ($F = 1.738$, $p = .133$ and $F = 1.570$, $p = .177$ respectively).

Table 16: Subjects and Cognitive Style

Total Numbers (N=55)	Wholist Verbaliser	Wholist Imager	Analytic Verbaliser	Analytic Imager
SUBJECT				
Geography N = 5	2	2	0	1
Maths N = 10	2	3	2	3
Languages N = 18	6	2	5	5
Classics N = 2	0	0	0	2
PE N = 5	3	1	1	0
RE N = 5	1	2	1	1
Science N = 10	1	2	1	6
No. of females	10	9	10	11
No. of males	5	3	1	6
Mean age	27.9	23.9	24.1	28.7
Total = 55	15	12	11	17

An expectation from the literature would be that sciences and maths would attract more analytical types whilst geography and religious studies, for example, would attract more wholists. The pattern here is very inconclusive. Mean scores on the wholist-analyitc dimension are indeed lowest for geography, physical education and religious studies with higher scores being registered for modern foreign languages, classics and science as demonstrated in Table 17; these differences are small and not statistically significant. A larger study would be needed to develop this line of research.

With regards to gender differences, using t-tests no statistically significant differences in WA and VI ratios were found between male and female CSA scores; this finding is in keeping with that suggested by Riding et al. (1995). On the wholist-analytic dimension, t = .040, p= 0.968; on the verbaliser-imager dimension, t = 1.29 p =.203 and in both cases, using eta squared, the magnitude of the differences in the means were very small: eta squared = 0.00 and 0.03 respectively. And in relation to age, using a Pearson Product-Moment correlation test, a small but statitistically significant correlation was found between WA ratios and age (r = .268, p = .048); on the verbaliser-imager dimension of cognitive style no statistically significant correlation with age was found (r = .059, p = .670). Such results are corroborated by the work of Riding and Wheeler (1995) who have not found any significant correlations between age and cognitive style.

Table 17: Mean scores for each subject on WA and VI continuums

Wholist – Analytic				**Verbaliser – Imager**		
			Mean			Mean
1.	Geography	(n = 5)	.93 (.24)	1.	PE	1.01 (.10)
2.	PE	(n = 5)	1.13 (.27)	2.	MFL	1.02 (.13)
3.	RE	(n = 5)	1.30 (.45)	3.	RE	1.09 (.14)
4.	Maths	(n = 10	1.33 (.43)	3.	Geography	1.09 (.15)
5.	Science	(n = 10)	1.39 (.46)	5.	Maths	1.10 (1.10)
6.	MFL	(n = 18)	1.51 (.47)	6.	Classics	1.13 (.13)
7.	Classics	(n = 2)	1.73 (.16)	7.	Science	1.18 (.19)

() standard deviations given in brackets

7.2: Sample Characteristics: The Cognitive Styles Index (CSI)

The CSI like the CSA also claims to measure wholist (intuitive) and analytic (analysis) tendencies. It was hoped that results from this test would corroborate the findings of the CSA.

All 84 students who began the PGCE course completed the CSI (61 females and 23 males). Values varied from a minimum of 18 to a maximum of 62 with a mean of 42.86; the lower the value the more intuitive the individual and the higher the value the more analytic the person. The mean result for the PGCE cohort is in line with the mean suggested by Allinson and Hayes (2000) of 42.54 (n=74).

Further analysis was undertaken by dividing the CSI into two separate intuition and analysis scales as suggested by Sadler-Smith et al. (2001). Intuition scores ranged from 0.41 to 2.12 with a mean of 1.03 and standard deviation of 0.328. Analysis scores ranged from 0.48 to 1.9 with a mean of 1.24 and standard deviation of 0.332. The higher the value on each separate scale, the higher the intuition or analysis capabilities of the individual. A statistically significant correlation $r = -.474$, $p = 0.01$ was found between these two new scales.

Mean scores for each subject were calculated with little variation between subjects being observed, supporting the previous findings using the CSA. A one-way between-groups analysis of variance found no statistically significant differences in CSI scores amongst the seven subject areas ($F= 1.479$, $p = .197$). This was also the finding using the new separate scales for intuition and analysis ($F= 1.727$, $p =.126$; $F = 1.067$, $p = .390$) respectively; see Table 18 for mean scores.

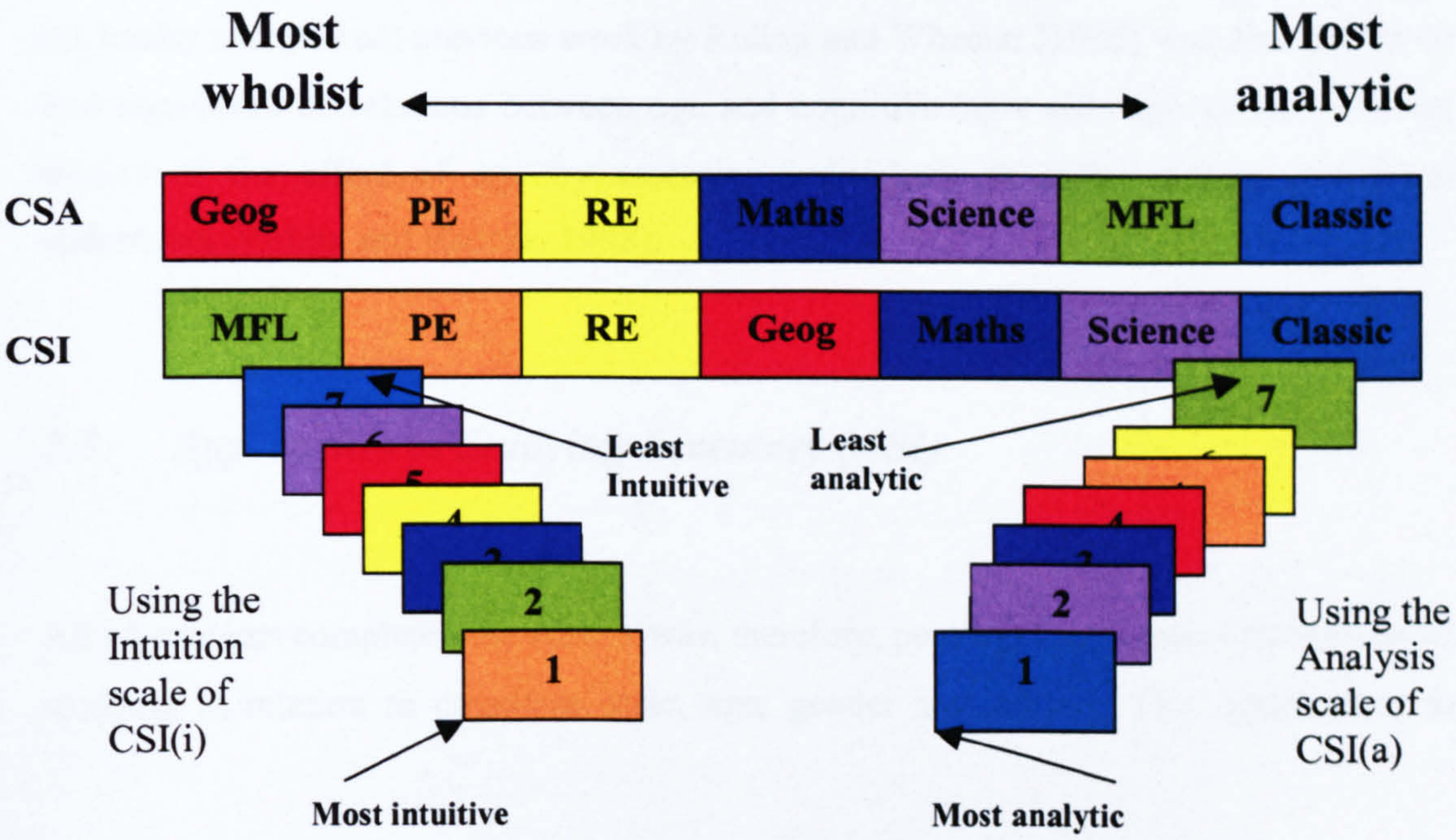
The question as to whether students following certain disciplines are more or less analytic is obscure. Using both the CSA and CSI patterns do begin to emerge, however the differences found within subject areas are as great as those found between them. Figure 23 demonstrates the position of each of the seven subjects in relation to the mean WA scores obtained on the different instruments as recorded in Table 18. With regards to the CSI, a continuum is also produced for the separate analysis and intuition scales. On both the CSA and CSI scales, physical education and religious education students appear as more intuitive with classics students represented as more analytical but the sample sizes are small. On both scales, mathematicians, scientists and classicists are identified as being more analytic; the most notable differences between the two scales

appear in the positioning of geography and modern foreign languages along the continuum.

Table 18: Mean scores using the CSI

SUBJECT	N	CSI mean score	csi (a) ANALYSIS mean score	csi (i) INTUITIVE mean score	CSA WA ratio mean score	CSA VI ratio mean score
Geography	10	43.3	1.2	0.95	0.93	1.09
Maths	13	43.9	1.3	1.09	1.2	1.1
Languages	18	38.6	1.12	1.13	1.5	1.01
Classics	3	55.5	1.41	0.67	1.7	1.13
PE	7	39.9	1.2	1.21	1.13	1
RE	15	42.5	1.18	0.98	1.3	1.1
Science	18	45.7	1.34	0.95	1.4	1.2
Overall means	**84**	**42.8**	**1.24**	**1.03**	**1.3**	**1.08**
Median		**43**	**1.19**	**1.058**	**1.32**	**1.04**

Figure 23: The Wholist-Analytic mean ratios for different subjects



When considering the two separate scales of the CSI: intuition and analysis, the following pattern is found: modern foreign languages, classics and physical education more or less reverse their positions with geography and mathematics staying in similar positions in the middle part of the scale.

As both the CSA and CSI are both measures of cognitive style and thus claim to measure the wholist-analytic dimension of cognitive style, a Pearson Product-Moment correlation test was undertaken to test this assumption. No statistically significant relationship was found between the CSA wholist –analytic dimension and the CSI ($r = .177$, $n = 55$, $p = .196$). No significant relationships were also found between the WA figures and the two new separate scales of the CSI thus suggesting that the two measures of cognitive style are actually measuring different things, supporting the earlier findings of Sadler-Smith as documented in Riding and Rayner (1998).

With regards to gender and age effects, like the aforementioned CSA, no statistically significant differences between males and females were found within this sample for CSI scores ($t = .720$, $p = .474$), confirmed by an eta squared value of 0.006 suggesting the magnitude of the differences in the means was very small. In addition, no significant correlation was found between age and the CSI ($r = .001$, $p = .993$). Such findings are not totally unexpected; previous work by Riding and Wheeler (1995) was also unable to find significant correlations between age and cognitive style although no longitudinal studies of the effect of age by assessing individuals at different ages has been undertaken (Riding and Rayner, 1998).

7.3: Approaches to Studying Inventory (ASI)

All 84 students completed the ASI. It was, therefore, possible to consider orientations to studying in relation to cognitive style, age, gender and subject. The Approaches to

Studying Inventory measures three approaches: a deep approach (meaning), a strategic approach (achieving) and a surface approach (reproducing). A maximum score of 30 was possible on each of these orientations. Scores recorded by the students on each of the three orientations were as follows:

(i) On the meaning orientation values varied from 26 to 7 with a mean of 15.84 and standard deviation of 3.97.
(ii) On the achieving orientation values varied from 23 to 8 with a mean of 16.23 and standard deviation of 3.48.
(iii) On the reproducing orientation values varied from 21 to 3 with a mean of 13.34 and standard deviation of 3.96.

It has been suggested that studying approaches differ across specialities (Curry, 1991; Hilliard, 1995; Jarvis 2001). To consider the impact of subject on approaches to studying, a one-way between-groups analysis of variance was conducted. No statistically significant differences were found between approaches to studying and subject area: subject and meaning ($F = .524$, $p = .789$); subject and achieving ($F = .768$, $p = .598$); subject and reproducing ($F = .865$, $p = .525$). This finding is in contrast to that found by Jarvis (2001:449) who had concluded from a study of over 400 students that in 'soft' subjects (English, art and humanities) students adopted a more deep approach compared to those studying 'hard' subjects such as maths, science and languages, who were observed to adopt a more surface approach. It must be noted that in the present study all the students completed the questionnaire before embarking on the PGCE course and therefore their comments are based on their pre university experiences in schools and approach is conditioned by the specific context (Entwistle, 2002).

In this study, a consideration of Table 19 reveals that mathematics and science scored highest on reproducing with maths also scoring lowest on meaning although as previously mentioned such differences were not of statistical significance. The situation was less clear for the so called 'softer subjects.' The geography and religious studies students appeared to be the most strategic. In terms of deep learning, the 3 subjects that

scored most highly were classics, religious education and physical education, with geography achieving unexpected lower scores similar to those of maths and science.

From the data it was also possible to identify students who could be identified as having strong learning styles and could be classified as deep, surface or strategic learners by looking at a student's scores on all three scales. A strong learning style could thus be defined as occurring when a student achieved a high score on one scale i.e. over 20 out of a possible 24, but only average scores on the other two scales. Using this approach, 8 'deep,' 6 'strategic' and 2 'surface' learners were identified. Whilst strong learning styles could be linked with certain subject areas such as modern foreign languages and religious studies, the sample numbers were small.

Table 19: Mean scores for each subject on the three orientations of the ASI (Entwistle and Ramsden, 1992)

SUBJECT	N 83	ASI Meaning mean	ASI Reproducing mean	ASI Achieving mean
Geography	10	15.5	13.8	16.9
Maths	13	14.6	14	14.6
Languages	18	15.8	11.7	15.8
Classics	3	18	11	8
PE	7	16.3	13.7	16.6
RE	14	16.9	13.3	16.9
Science	18	15.8	14.3	16.7
Overall means		15.8	13.34	16.2
Median		16	13	16

The influence of cognitive style on approaches to studying was explored and variations in scores between the four cognitive style groupings are shown in Table 20. A one-way between-groups analysis of variance was carried out to explore possible differences in approaches to studying between the four cognitive style groups. No statistically

significant differences in approaches to studying were found: cognitive style and meaning (F = .889, p =.453); cognitive style and achieving (F = 0.845, p = .476); cognitive style and reproducing (F = 1.293, p = .287).

Table 20: Mean scores for each of the 4 cognitive groups on the three orientations of the ASI (Entwistle and Ramsden, 1992)

Cognitive style	N 55	ASI Meaning mean	ASI Reproducing mean	ASI Achieving mean
Wholist Verbaliser	15	14.4 (2.8)	12.7 (4.2)	15.6 (4)
Wholist Imager	12	14.5 (4.2)	12.6 (3.3)	14.4 (3.5)
Analytic Verbaliser	10	16.6 (4.8)	12.6 (1.1)	16.4 (3.6)
Analytic Imager	18	15.4 (3.6)	14.7 (3.8)	16.4 (3.4)

Figures in brackets = standard deviations

The relationship between the two measures of cognitive style (CSA and CSI) and the learning styles measure (ASI) was also explored. To what extent did results on the three orientations correlate with the two cognitive style measures? The ASI is a measure of learning style and subject to change as a result of contextual factors whereas the CSA and CSI, as measures of cognitive style, are seen as less malleable. Using a Pearson Product Moment correlation test, a relatively small but statistically significant result was found between the wholist-analytic dimension of the CSA and achievement (r = .375, p = .001) suggesting that more analytic individuals were likely to adopt a strategic approach to studying. In contrast, positive correlations were found between the CSI and all 3 orientations to study; these were relatively weak but statistically significant: the CSI and meaning (r = .281 p = .011); the CSI and reproducing (r = .289 p = .009); the CSI and achievement (r = .337, p = .002). When considering the separate scales for intuition and analysis of the CSI, the analysis scale scored significant correlations on all

3 scales measuring approaches to studying with stronger values than the original version of the CSI: the CSIa and meaning (r = .333 p = .002); the CSIa and reproducing (r = .374 p = .001); the CSIa and achievement (r = .398, p = .000). The intuition scale of the CSI (CSIi) did not show any statistically significant relationships with the three approaches to studying. Both measures of cognitive style suggest that a more analytic approach is linked to a more strategic one.

Having found little difference between subject studied and approach taken, the impact of age and gender on approaches to studying was also explored. Previous research has suggested that age and gender have an effect on learning styles and studying approaches (Curry, 1991, 2000; Hilliard, 1995; Paul, Bojanczyk & Lamphear, 1994). A consistent finding is that age is positively related to the adoption of a deep approach and negatively to a surface approach (Duff, 1999, 2002; Richardson, 1995, 1999; Sadler-Smith, 1996, 1998). Using a Pearson Product-Moment correlation test, no statistically significant relationship was found between age and scores on each of the three orientations: achieving (r = .059, p = .600); reproducing (r = .008, p = .945); meaning (r = -.071, p = .530).

In addition, to consider gender differences an independent-samples t-test was conducted to compare the achieving, reproducing and meaning scores for males and females. There was no significant difference in scores for males and females on each of the three orientations: Achieving: (M = 15.54, SD = 3.68) (F = 16.48, SD = 3.4); t = -1.08, p = .283. Reproducing: (M = 14.36, SD = 3.1) (F = 12.96, SD = 4.19) t = 1.42, p =.159. Meaning: (M = 16.04, SD = 4.01) (F = 15.76, SD = 3.99) t = .280, p = .780. This is in keeping with previous studies investigating gender differences on the three learning orientations (Richardson, 1993). The sample in this case, was a predominantly female one and larger numbers would be needed to verify such findings. Alternative findings have been found by Duff (2002) with accounting and business economics students; females were found to be more likely to adopt a surface approach. Such results may be a reflection of the nature of the environment that males and females find themselves studying in and how accessible such environments are to both males and females. The

context in this particular example was that of teacher training and should not be ignored.

7.4: Analysis of Learning Preferences (LPQ)

Previous research by Riding and Read (1996) and Riding and Rayner (1998) suggests that the learning preferences of different cognitive styles will vary. In order to investigate these assertions, the PGCE students were asked a number of questions on their preferred orientations towards study in regards to format and content of learning materials, learning approach and preferred teaching methods. The students were also asked to consider what they perceived constituted good teaching and what were their greatest concerns about teaching for the first time; these issues will be considered in Chapter 9.

Statistical analysis enabled the influence of subject and cognitive style on learning preferences to be considered. The results are demonstrated in Figure 24. A two-way between groups analysis of variance was conducted to explore the impact of sex and cognitive style on favoured approaches to learning, as measured by a Likert Scale questionnaire to ascertain learning preferences. Students had been asked to rank in order of preference their preferred approaches to learning, a lower ranking indicating a greater preference: e.g. 1 = favourite learning approach. Students were divided into the four main cognitive groupings: wholist-verbaliser, wholist-imager, analytic-verbaliser and analytic-imager. Statistically significant results were obtained when considering the following methods of study: tutorials, individual work and giving presentations. Firstly, with regards to tutorials, as most favoured form of learning, there was a statistically significant interaction effect between cognitive style and sex on preferences for this form of learning ($F = 4.873$, $p = .005$). With regards to effect size an eta squared value of .237 suggested a large difference in the mean values using guidelines proposed by Cohen (1988) (.01 = small, .06 = moderate, .14 = large effect). This mode of learning was most favoured by AV and WV males and WI females and least favoured by WI males and WV females. One would expect that tutorials with a high verbal element would be preferable for verbalisers as suggested by Riding and Rayner (1998). The

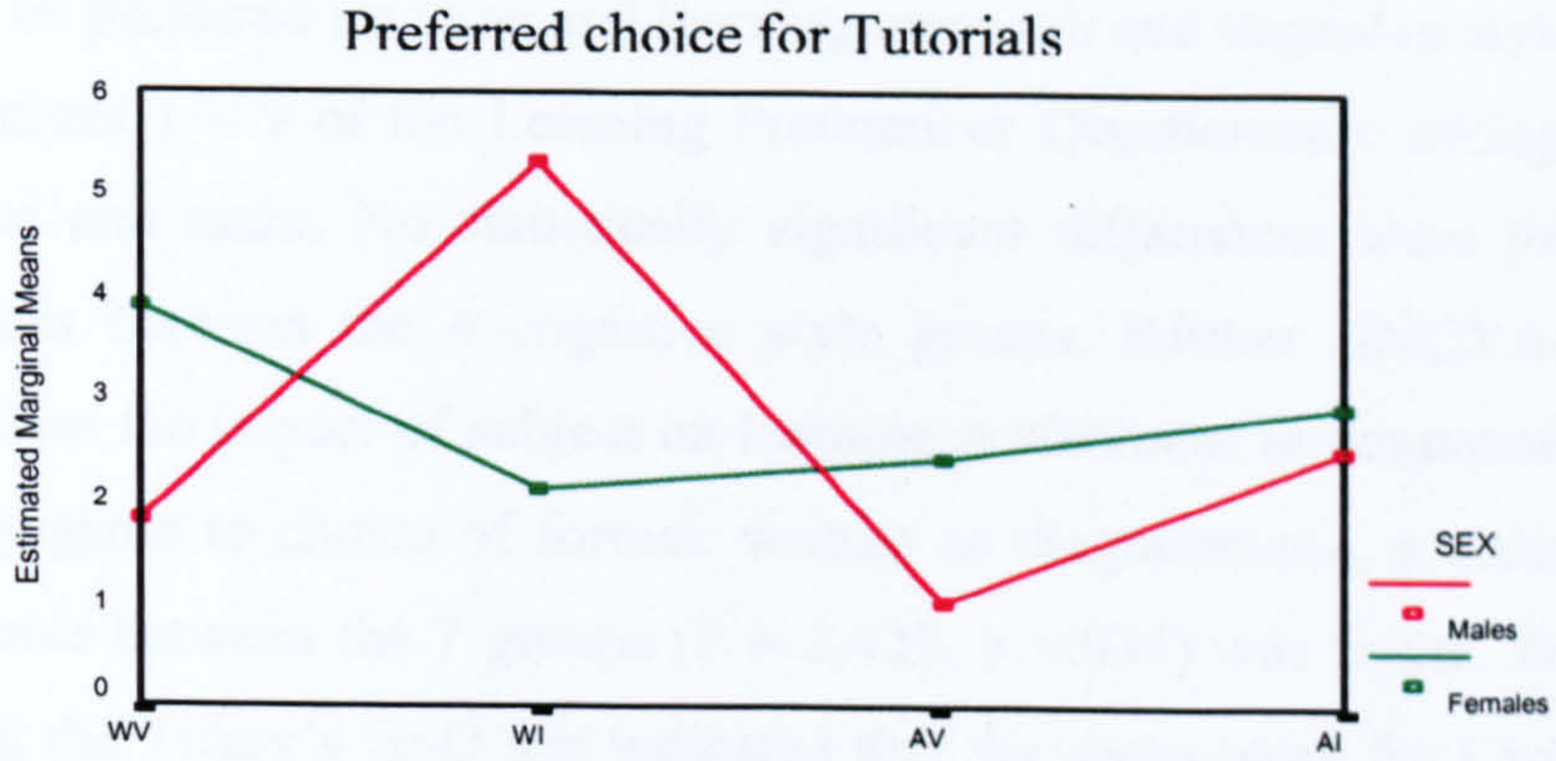
tutorial approach may also be perceived as less threatening to the analytic student, characteristically viewed as preferring to work alone (Riding and Read, 1996; Riding, 2002) and to the wholist verbaliser male who has been identified as being more likely to be affected by self-worth motivational style and therefore less likely to want to present to large audiences (Riding and Burton, 1998; Evans, 2002).

With regards to individual work as most favoured form of learning, there was a statistically significant main effect for sex ($F = 4.812$, $p = .03$). The effect size, using eta squared, gives a value of .093 indicating a moderate difference in mean values. Females were more likely to prefer working on their own compared to males with analytic females preferring this mode of learning most and WI males liking it least. Of the males, AV men were more likely to favour this mode of learning. These findings authenticate those of Riding and Read (1996) who found analytics least disliked individual work.

Giving presentations was most favoured by AV males and least liked by AV females. Using a two-way between-groups analysis of variance there was a statistically significant main effect for sex ($F = 4.904$, $p = .032$). The effect size, using eta squared, gives a value of .094 indicating a moderate difference in mean values. Males were more likely to favour this mode of learning compared to females. A students t-test corroborated this difference finding statistically significant differences between male and female scores ($t = -2.191$, $p = .031$) with a moderate effect size using eta squared of .05. The preference of verbalisers for giving presentations is as expected (Riding and Rayner, 1998). The gender differences are worthy of further investigation. As Riding and Rayner (1998:161) note:

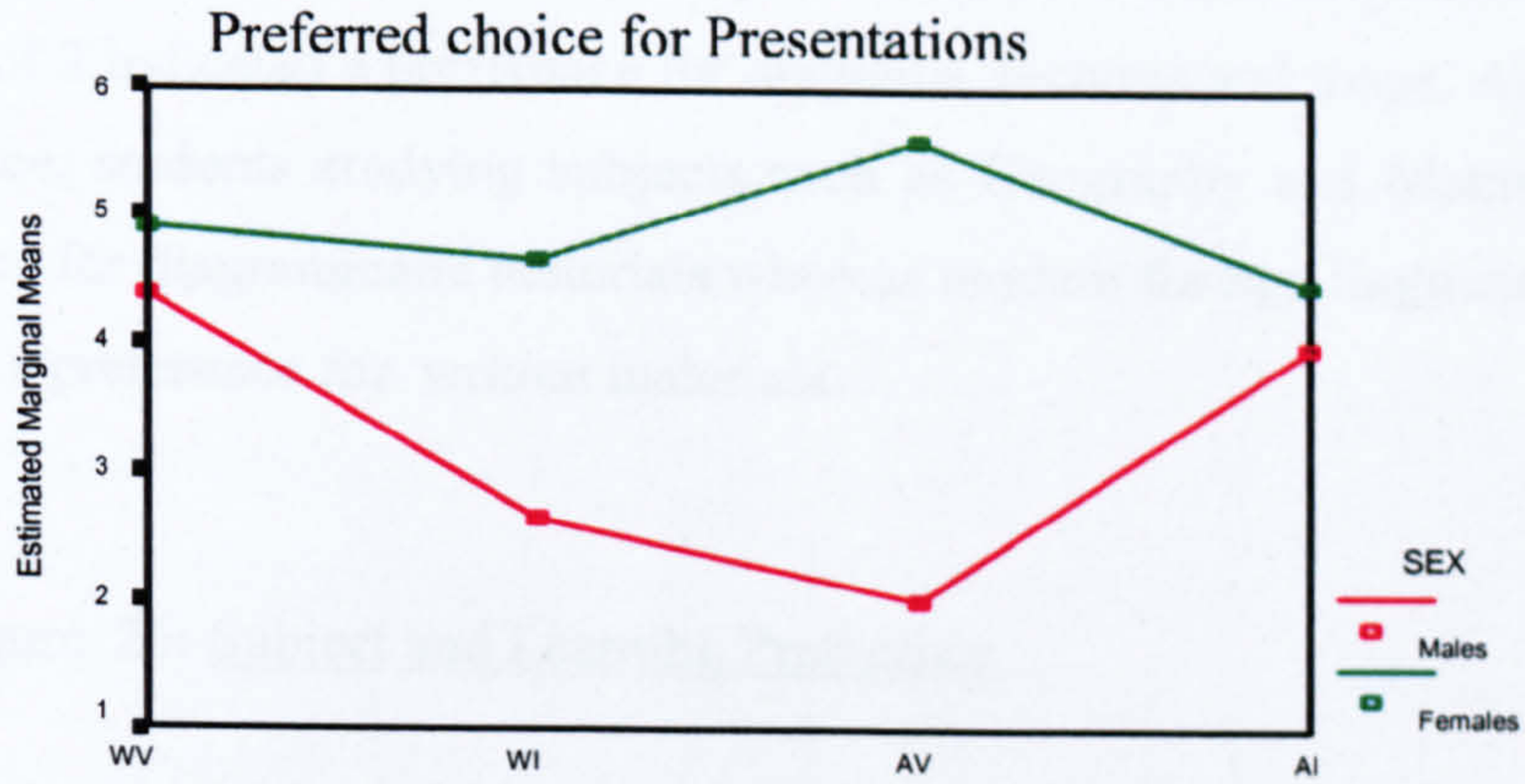
> "The occurrence of gender interactions needs careful study since these suggest a possible fundamental difference in information processing between males and females and if these were better understood then both sexes might be helped to learn more effectively."

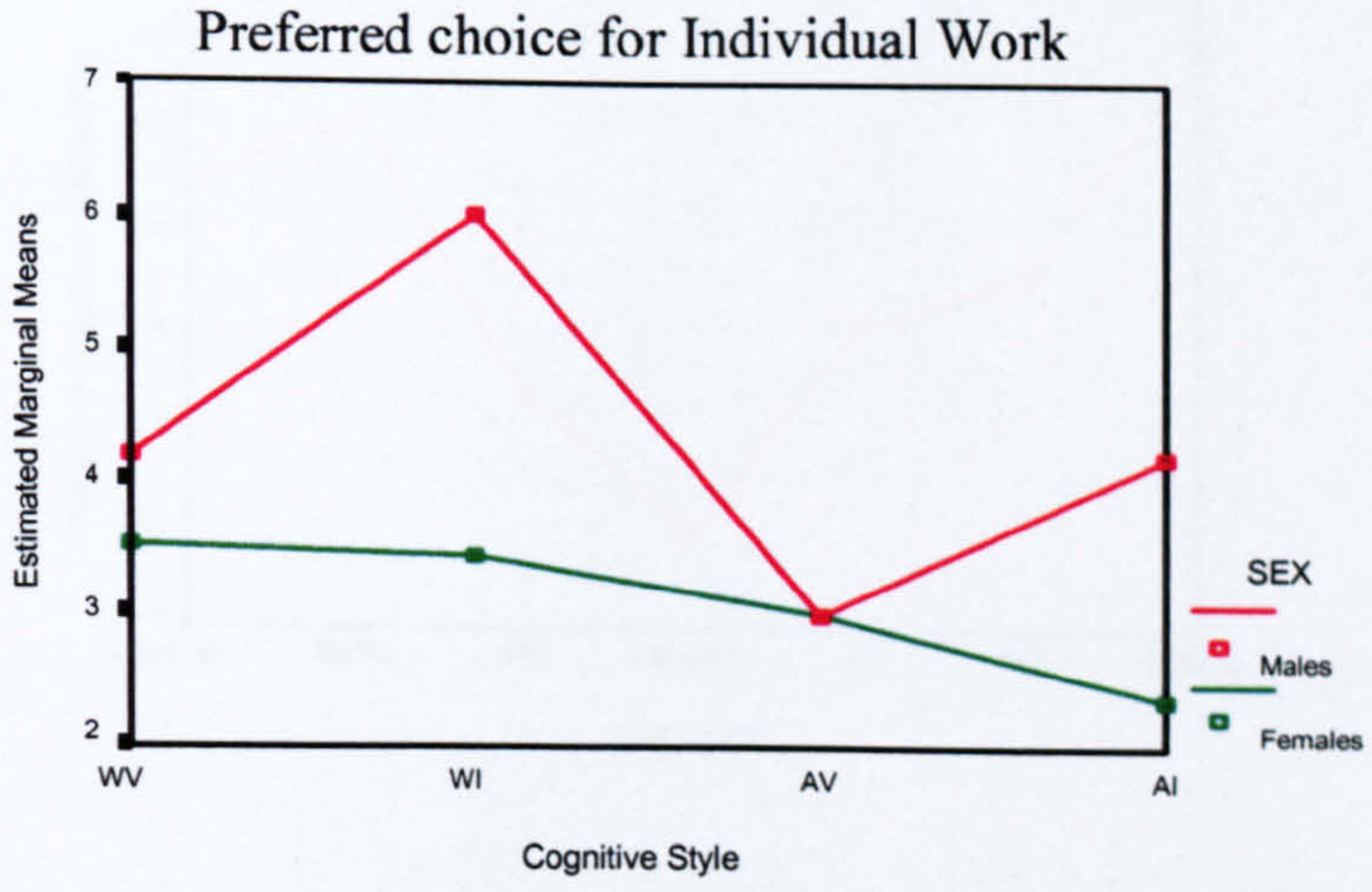
Figure 24: Preferred modes of Learning



KEY

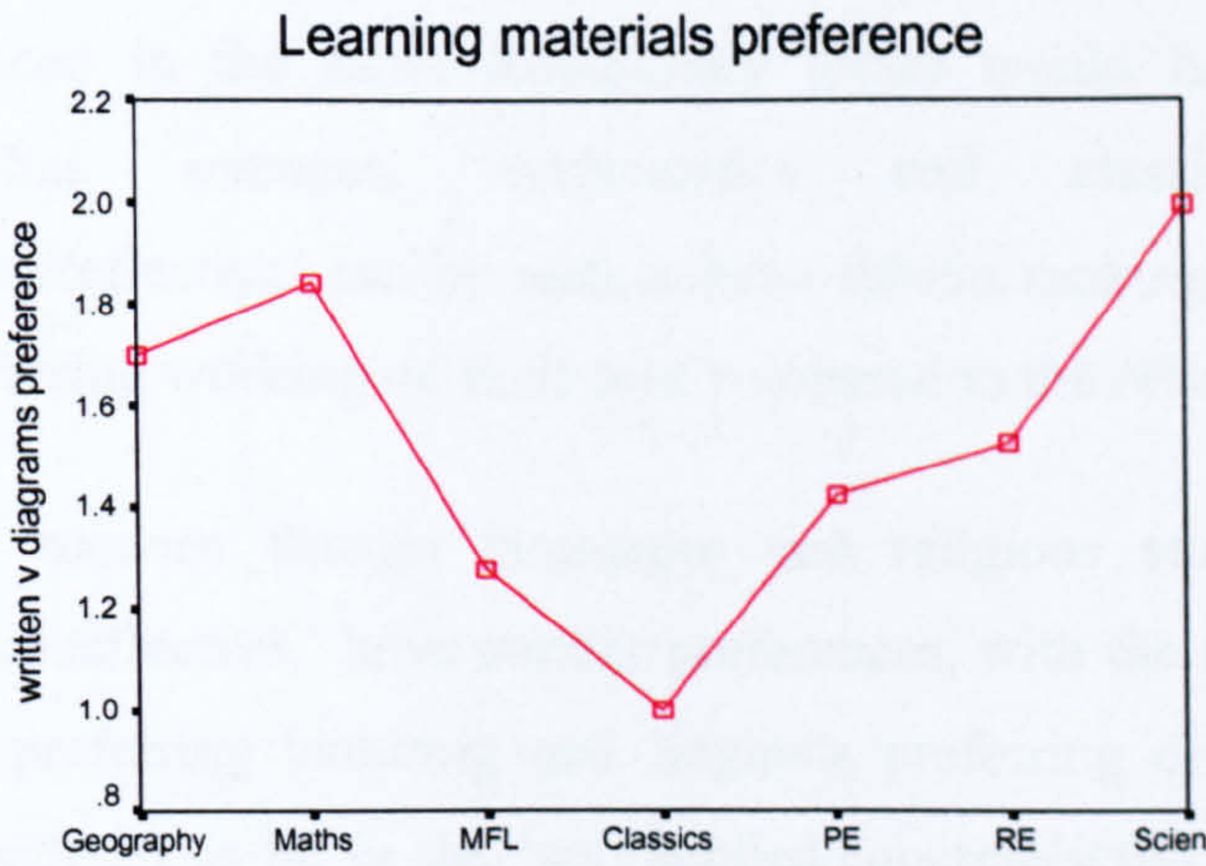
Students ranked, in order, from most favoured to least favoured mode of learning with 1 = most favoured approach and 7 = least favoured approach.





A one-way between-groups analysis of variance was undertaken to explore the impact of cognitive style on preferred teaching and learning approach and cognitive style using responses to questions 1 – 9 of the Learning Preferences Questionnaire asking about format preferences and tasks. No statistically significant differences were found in learning preferences between the 4 cognitive style groups. Further ANOVAs were carried out to explore the impact of subject on learning preferences as demonstrated in Figure 25. With regards to choice of format: written or diagrammatic, a statistically significant difference between the 7 groups ($F = 2.423$, $p = .034$) was found. Post-hoc comparisons using the Tukey's HSD test indicated that the mean score for Languages ($\underline{M} = 1.2778$, $\underline{SD} = .4609$ was significantly different from the score for Science ($\underline{M} = 2.00$, $\underline{SD} = .7670$ $p = .038$). A score of 1 indicated a preference for written/text based information and a score of 2 indicated a preference for diagrams, pictures and maps. As expected, and like science, students studying subjects such as Geography and Maths recorded a high preference for diagrammatic materials whereas modern foreign linguists and classicists expressed a preference for written materials.

Figure 25: Subject and Learning Preference



When considering preferred approach: lecture, tutorial, discussion group, computer assisted learning, peer tutoring and individual work; using ANOVA, no statistically significant differences were found between the subject studied and student learning preference. Table 21 demonstrates preferred learning formats for each of the seven subject areas represented in this study. Considering all subject areas collectively, lecturing appears the most popular preference, which is unsurprising given the formal nature of much teaching in schools (Bassey et. al. 2002).

The approach least favoured by the PGCE students is computer-assisted learning which may also reflect the level of access students have had to this mode prior to university; the pattern here is strong with this mode of learning being the least favoured by all subjects excepting geography and mathematics. Given that the cohort represented in this research is that of teacher training students it is, perhaps, surprising that the second least favoured learning approach for all subjects excepting physical education, is that of giving presentations. Of the more favoured approaches, lecturing was a popular choice with the exception of modern linguists, tutorials were favoured by all but physical education students and discussion groups were popular with the exception of physical education, religious education and classics students. If considering the disciplinary groupings as suggested by Nulty and Barret (1996) it would be reasonable to expect that subjects placed in the same disciplinary group would have similar learning preferences. Thus sciences, mathematics and classics classified as 'hard/pure/abstract/reflective' can be seen to have similar rankings, with the exception of classicists preferring working on their own compared to the other two.

In similar vein, modern foreign languages and religious studies, referred to as 'soft/pure/concrete/reflective,' have similar preferences, with the exception of religious studies students preferring lecturing and linguists preferring discussion groups. But geographers considered to be in the 'soft/applied/concrete/active' category, also have similar learning preferences to the scientists. The connection between subject and learning preference is not convincing as suggested by the previous statistical analyses undertaken and commented on previously.

Having considered the impact of cognitive style, gender and subject on learning preferences, further analyses were undertaken to explore the interaction effect of cognitive style and age and cognitive style and subject on learning preferences. No statistically significant differences were found using a two-way between-groups analysis of variance.

Table 21: Learning Preferences by subject
(Lower score = greater preference)
Ranks in brackets

Subject	Geog N =10	Maths N =13	MFL N = 18	Classic N = 3	PE N = 7	RE N = 15	Science N = 18	Overall rank
Lecture	2.4 (1)	3.2 (3)	3.8 (4)	2.3 (2)	3.4 (2)	2.3 (1)	2.8 (1)	1
Tutorial	3.6 (4)	2.5 (1)	2.8 (2)	2.7 (3)	4. (5)	2.8 (2)	3.2 (3)	3
Discussion group	2.9 (2)	2.8 (2)	2.6 (1)	3.7 (4)	3.9 (4)	3.5 (4)	3.1 (2)	2
Computer Assisted Learning	4.7 (5)	4.2 (5)	5 (7)	6 (7)	5.6 (7)	5.3 (7)	4.9 (7)	7
Peer Tutoring	5.1 (7)	4.3 (6)	3.8 (4)	4.7 (5)	4.9 (6)	4 (5)	4.1 (5)	5
Individual Work	3.1 (3)	4 (4)	2.9 (3)	2 (1)	3.7 (3)	3.1 (3)	3.9 (4)	4
Presentation to Class	4.8 (6)	5.8 (7)	4.6 (6)	5.3 (6)	3 (1)	4.7 (6)	4.3 (6)	5

And finally, with reference to the research questions posed in Chapter Six, in relation to whether the CSA and CSI are measuring the same dimension of cognitive style; the relationship between the cognitive style instruments and the learning styles instrument (ASI); the impact of subject on cognitive style and the impact of cognitive style, age and gender on learning preferences, the conclusions arrived at include the following:

(i) The cognitive styles analysis and the cognitive styles index, used for corroborating the wholist-analytic scores of the CSA, were not found to be measuring the same dimension.

(ii) Using both the CSA and CSI, statistically significant differences in wholist-analytic scores were not found between the seven subject disciplines. However, as previously mentioned, given small sample sizes, non-significant results need to be interpreted with caution (Stevens, 1996; Pallant, 2001).

(iii) Statistically significant relationships were identified between all three orientations of the ASI and the CSI and between the achievement orientation of the ASI and the CSA. In all cases, the relationships were relatively weak ones suggesting a tenuous link between learning styles and cognitive styles instruments.

(iv) With regards to gender and age effects, no statistically significant differences between males and females were found using both the CSA and CSI in wholist-analytic / intuitive-analytic respectively and verbaliser-imager scores on the CSA.

(v) Statistically significant gender differences were noted with reference to learning preferences. In addition, significant interaction effects between cognitive style and gender also impacted on preferred learning opportunities. With the exception of learning format, choice of subject was not found to significantly affect learning preference.

Chapter 8: Analysis: Teaching Styles Questionnaire

8.1: The internal consistency of the Teaching Styles Questionnaire

The teaching styles questionnaire was designed, as described in Chapter Six, to identify wholist and analytic traits in the classroom. Mentors in schools were asked to assess the teaching characteristics of their PGCE student according to a number of items included in the scale based on the work of Messick (1976), Entwistle (1983) and Riding and Rayner (1998). Fifty nine teaching styles questionnaire forms were returned; an eventual return rate of 75%. The questionnaire comprised 60 items; one relating to academic ability, 7 on verbal-imagery style and 52 on wholist-analytic characteristics.

The items measuring verbaliser-imager characteristics were found to have little internal consistency confirmed by a Cronbach's alpha of 0.3 for the items on verbal-imagery. This and discussions with students regarding their use of verbal and visual cues in lessons which were reported to be related heavily to situational factors resulted in a decision to focus on the wholist-analytic items.

Using the literature outlining the characteristics of wholist and analytic learners and teachers, 52 statements were developed to try to tap into these traits. The statements covered areas such as planning, decision-making, classroom management, relationships with students, teaching approaches and personal characteristics. Using a 5 point Likert scale, mentors observing the students in schools were asked to give a rating to each of the statements from 'strongly agree' to 'strongly disagree.' A low score indicated a more wholist approach in the classroom and a high score, an analytic one. Positive and

negative statements were interwoven to prevent patterns being detected or the assumption that one end of the scale was good and the other bad. The internal consistency reliability of the 52 items was examined to ascertain the degree to which items making up the scale were measuring the same underlying attribute. Using all 52 items, a Cronbach's alpha of .64 was recorded and it was evident that some items were actually scoring in an opposite direction. After further analysis, 32 items were retained giving an acceptable Cronbach's alpha of .88; Nunnally (1978) recommends a minimum level of 0.7. An investigation of the removed items revealed the following. It was evident that mentors had reacted strongly to items of a personal nature such as those on interpersonal skills and self esteem. Items focusing on relationships with students: use of children's names, feedback to students, knowledge of students and arrangement of classrooms gave some of the lowest reliability scores of all items suggesting difficulty on the part of the mentors in assessing individual relationships in the classroom. The other items that were removed all related to classroom teaching style and it may well be that mentors were unable to conceptualise what the questions were asking or that they were biased by their own cognitive style and interpretation of the classroom activities. Such items excluded from the analysis include:

7: Spontaneity – **able to think on his/her feet**
9: Student able to see '**bigger picture** ' when planning avoiding narrow focus –
22: High Levels of Interaction
23: **Focus on skills** rather than knowledge
24: Wide range of **strategies**
26: Discussion based
35: Focus on **high level tasks**
36: **Open rather than closed questions**
40: **Open-ended approach**
45: Realistic v Idealistic

Responses to these items requires an understanding of these concepts on the part of the mentor. It was clear from the mentor responses that they had made judgements about whether certain characteristics were positive or negative and had not viewed them as different approaches with both having merits. In their own eyes, and quite naturally, they had been reluctant to score a student highly on an item that they themselves considered negative. It also has to be acknowledged that the mentor is also influenced by his/her own cognitive style and thus interpretation of classroom interaction has to be

subjective. With the qualified teacher status standards (DfEE 4/98; TTA, 2002), there is a clear emphasis on planning, management of classrooms, subject knowledge and assessment. Mentors felt most comfortable when talking about planning and least sure when it came to items they viewed as more esoteric and not within their normal remit in terms of regular discussions focusing on particular attributes. With reference to specific items, some mentors felt that being 'able to think on your feet' and being spontaneous was not necessarily a good thing. Mentors were also concerned about the personal items as although they had had assurances from the university and researcher that the information gathered from the questionnaire would not be used for any assessment purposes they were concerned about assigning any value that might be viewed as negative from their own perspective and that it might affect the student's chance of attaining qualified teacher status.

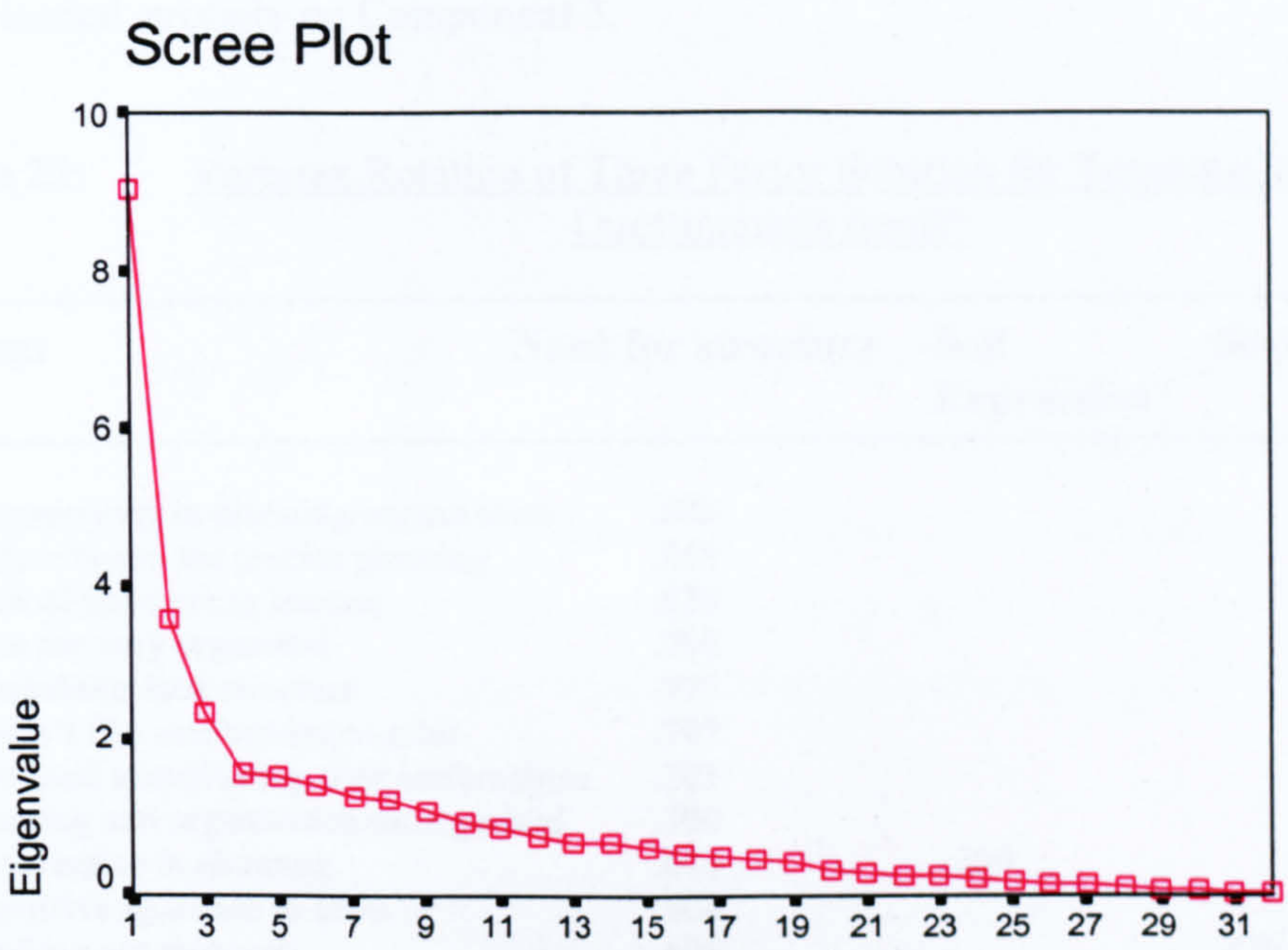
Given the size of the sample, an exploratory factor analysis, using 32 of the items in the questionnaire, was embarked on with caution. Tabachnick and Fidell (1996:640) suggest the need for 300 cases for factor analysis, however they do include a caveat "...[if there are] strong, reliable correlations and a few distinct factors a smaller sample size is adequate".

The 32 items of the Teaching Styles Questionnaire were subjected to principal components analysis (PCA) using Statistical Packages for Social Scientists (SPSS, 2000). Prior to performing PCA the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. The Bartlett's Test of Sphericity value was significant at .000, supporting the factorability of the correlation matrix, the Kaiser-Meyer-lkin Measure of Sampling Adequacy (KMO) was acceptable at 0.621 given the recommended figure of 0.6 suggested as the minimum value for a good factor analysis (Tabanchnick & Fidell, 1996).

Principal components analysis revealed the presence of 9 components with eigenvalues exceeding 1, explaining 72.5% of the variance. An inspection of the scree plot (Figure

26) revealed a clear break after the third component. Using Catell's (1966) scree test, it was decided to retain three components for further investigation. To aid in the

Figure 26: Scree Plot identifying the main factors



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.627
Bartlett's Test of Sphericity	Approx. Chi-Square	1036.828
	df	496
	Sig.	.000

interpretation of these three components, Varimax rotation was performed. The rotated solution, presented in Table 22, revealed the presence of a relatively simple structure, with all three components showing a number of strong loadings but with some overlap. The three factor solution explained a total of 46.79% of the variance, with Component

1 contributing 27.32%, Components 2 and 3 contributing 10.95% and 8.53% respectively. Items measuring lack of planning, structure and organisation loaded strongly on Component 1. Items measuring individualism/creativity loaded strongly on Component 2 and items indicating an informal/social and facilitator classroom approach, loaded strongly on Component 3.

Table 22: Varimax Rotation of Three Factor Solution for Teaching Style Questionnaire items*

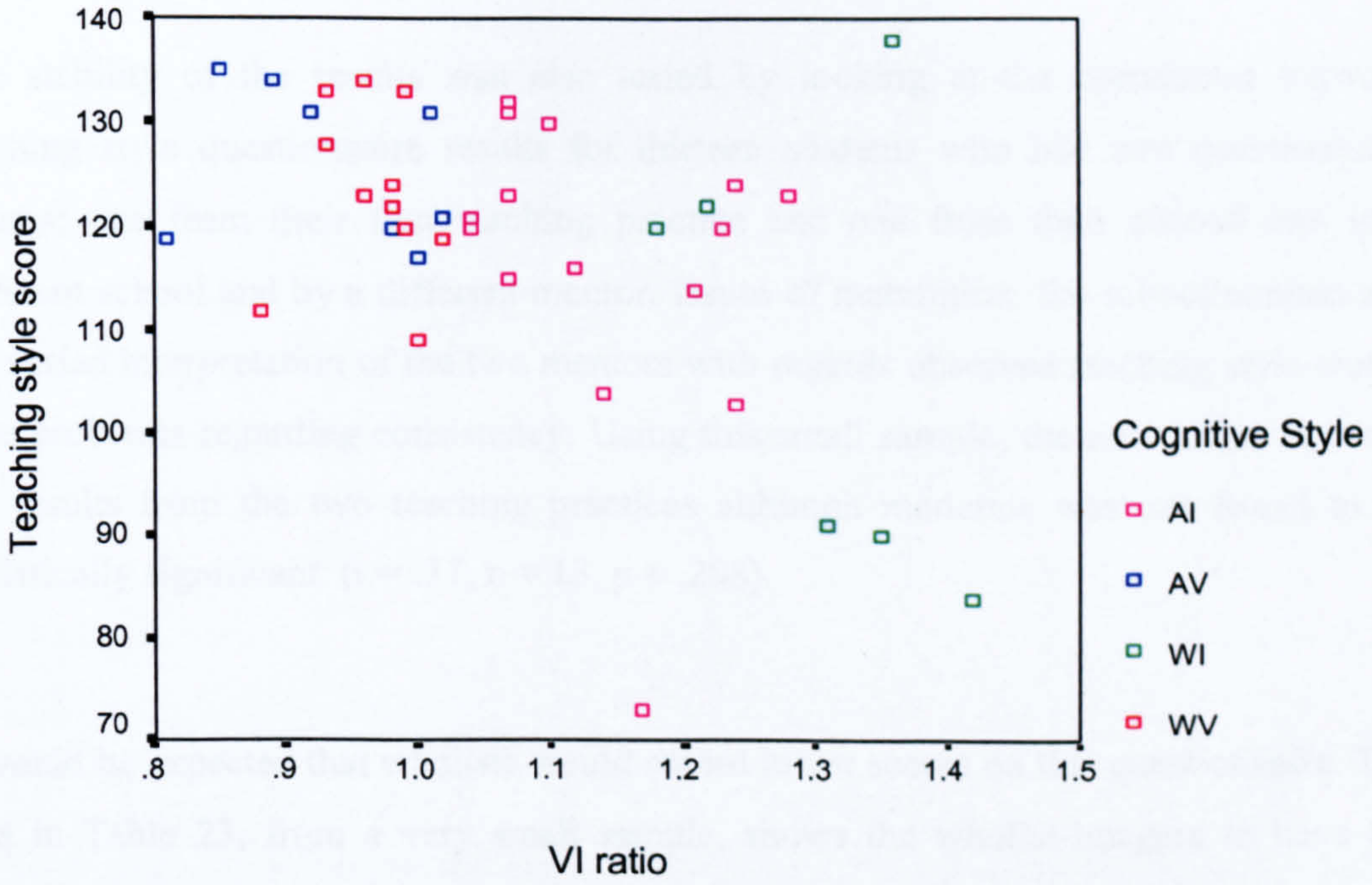
	Item	Need for structure	Self Expression	Sociability
46	Inconsistency in planning/organisation	**.883**		
13	Little concern for precise planning	**.858**		
33	Lack of structure to lessons	**.828**		
49	Files not very organised	**.790**		
52	Worksheets lack structure	**.777**		
4	Doesn't like conforming to rules	**.707**		
50	Not good at evaluating own performance	**.701**		
1	Planning and organisation disorganised	**.700**		
8.	Not creative in planning	**.676**	-.390	
3	Impulsive approach to tasks	**.654**		
44	Marking not thorough	**.605**		.356
18	Not a strong emphasis on discipline	**.601**		
31	Reluctant to give critical feedback	**.573**		.428
34	Low Frequency of questioning	**.568**		
6	Dependent learner – needs support	.518	-.350	
54	Values ICT highly	.506		
32	Preoccupation with facts	.485		
29	Less value placed on subject knowledge	.342		
43	Less emphasis placed on testing			
37	Individualised homeworks		**.758**	
14	Original thinker		**.727**	
15	Easy to express emotions		**.706**	
28	Personal approach		**.695**	
11	Social/Gregarious		**.624**	
12	Intuitive decision-maker		.564	
2	Extravert		.339	
30	Mixes freely/closely with students			**.711**
21	Sees role as facilitator			**.617**
39	Not very pragmatic in planning	.391		.489
5	Motivated by Extrinsic rewards	.415		.446
19	Prefers Informal classroom	.345		.439
25	Lessons focus on whole class rather than individual involvement			.377
% of variance explained		27.32	10.95%	8.53%

- Only loadings above 0.3 are displayed

8.2: Correlation with other measures

It was expected that measures of wholist-analytic tendency should correlate with the teaching style questionnaire results. The relationship between Riding's CSA wholist-analytic ratio and the sum of the wholist-analytic dimension of the teaching styles questionnaire was investigated using a Pearson Product-Moment correlation coefficient. Whilst no statistically significant relationship was found between the two variables: ($r = -.053$, $n = 41$, $p = .744$) a surprisingly significant relationship was found between the teaching styles questionnaire and verbaliser-imager score of the Cognitive Styles Analysis ($r = -.493$, $n = 41$, $p = .001$), suggesting that verbalisers are more likely to teach in a more analytic way. By calculating the coefficient of determination (29.35), it can be observed that the verbaliser-imager score helps to explain nearly 30% of the variance in respondents' scores on the teaching styles questionnaire; the nature of the relationship is demonstrated in Figure 27.

Figure 27: The relationship between Verbaliser-Imager ratios and Teaching Style



A small but statistically significant relationship was also found between the teaching styles questionnaire score and the achieving score on the Approaches to Studying Inventory ($r = .302$, $p = .023$), suggesting that those who were more analytical in their teaching style were also more strategic in their approaches to studying.

8.3: Examining relationships between Cognitive Style, Age, Subject and Teaching Style

Of the 59 teaching styles questionnaires returned, it was possible to correlate 41 of these with existing data using the CSA ratios (for the other 18 questionnaires returned, wholist-analytic ratios were not available). Table 23 shows the mean scores for each of the four cognitive styles on the teaching styles questionnaire. Using 32 items, the maximum score that could be achieved was 160 and the minimum was 32; a higher score would be attributable to a more analytic approach to teaching and a lower score to a more wholistic approach. Within this sample, the total WA score varied from 73 –138.

The stability of the results was also tested by looking at the correlation between teaching style questionnaire results for thirteen students who had two questionnaire returns; one from their first teaching practice and one from their second one in a different school and by a different mentor. Issues of maturation, the school context and the varied interpretation of the two mentors with regards observed teaching style would pose problems regarding consistency. Using this small sample, the correlation between the results from the two teaching practices although moderate was not found to be statistically significant ($r = .37$, $n = 13$, $p = .208$).

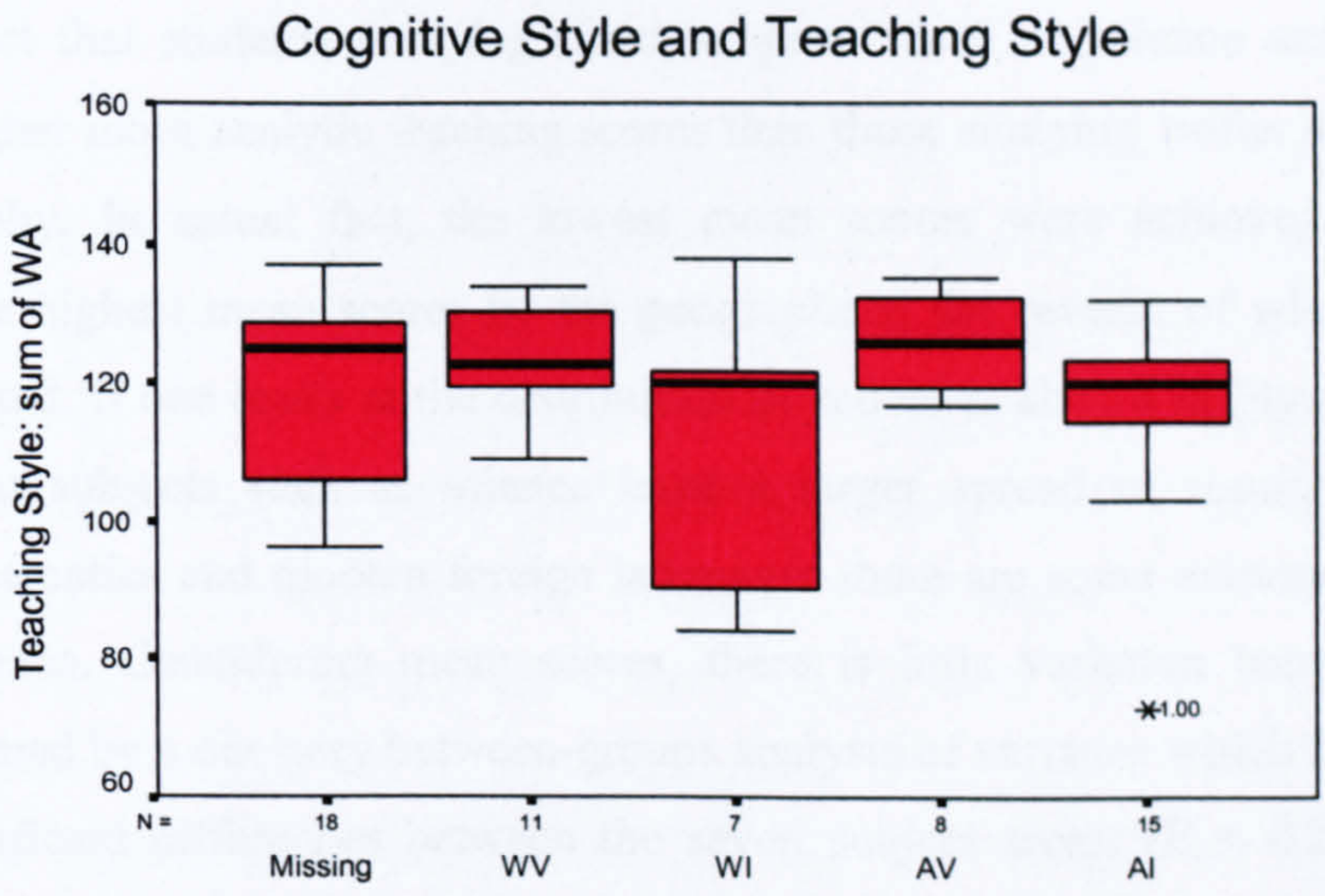
It would be expected that wholists would record lower scores on this questionnaire. The data in Table 23, from a very small sample, shows the wholist-imagers to have the lowest scores as expected but there are also some very high scores as well as shown in Figure 28.

Table 23: Cognitive Style and Teaching Style

Cognitive style	N 41	Mean teaching style questionnaire score using 32 items.
Wholist Verbaliser	11	123.4 (SD = 8.29)
Wholist Imager	7	109.6 (SD = 20.8)
Analytic Verbaliser	8	126 (SD = 7.4)
Analytic Imager	15	116.6 (SD = (14.8)
Mean		119.05 (14.18)

* Higher score on WA = more analytic

Figure 28: Box and whisker plots showing the spread of results for each Cognitive Style on the Teaching Styles Questionnaire



The distribution of scores for the other three groups is much narrower suggesting less variability in approach compared to the wholist-imagers. A one-way between-groups

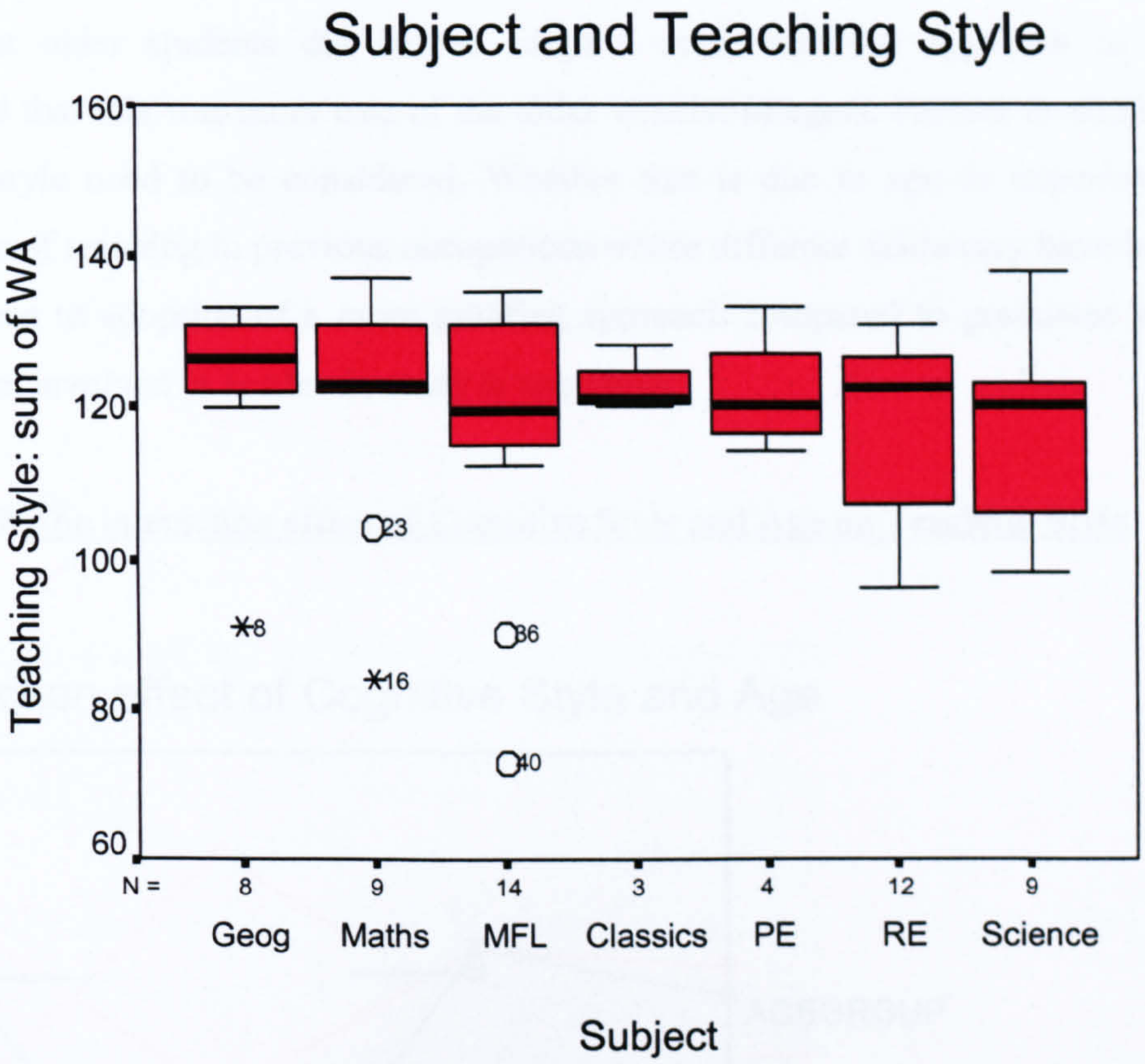
analysis of variance was conducted to explore the influence of cognitive style group on the questionnaire results. No statistically significant difference was found between the four groups: (F = 2.397, p = .084). Similarly, no statistically significant differences were recorded with regards to subject and WA questionnaire score: (F = .253, p = .956).

Table 24: Subject and mean Teaching Style Questionnaire scores
(Standard deviation scores in brackets)

SUBJECT N = 59	N	Mean WA questionnnaire score
Geography	8	122.8 (13.6)
Maths	9	120.7 (16.8)
Languages	14	117.7 (17.4)
Classics	3	123 (4.4)
PE	4	121.7 (8.1)
RE	12	117.7 (11.7)
Science	9	116.8 (12.9)
Overall means		119.25

One might expect that students studying 'hard subjects' such as science and maths would record higher more analytic teaching scores than those studying 'softer subjects' such as geography. In actual fact, the lowest mean scores were achieved by the scientists and the highest mean scores by the geographers; the reverse of what might have been expected. If one looks at the distribution of scores as shown in Figure 29, it can be seen that subjects such as science have a larger spread of results and in geography, mathematics and modern foreign languages there are some extreme results affecting the means. Considering mean scores, there is little variation between the groups as confirmed by a one-way between-groups analysis of variance which found no statistically significant differences between the seven subject areas: (F = 0.253, p = 0.956).

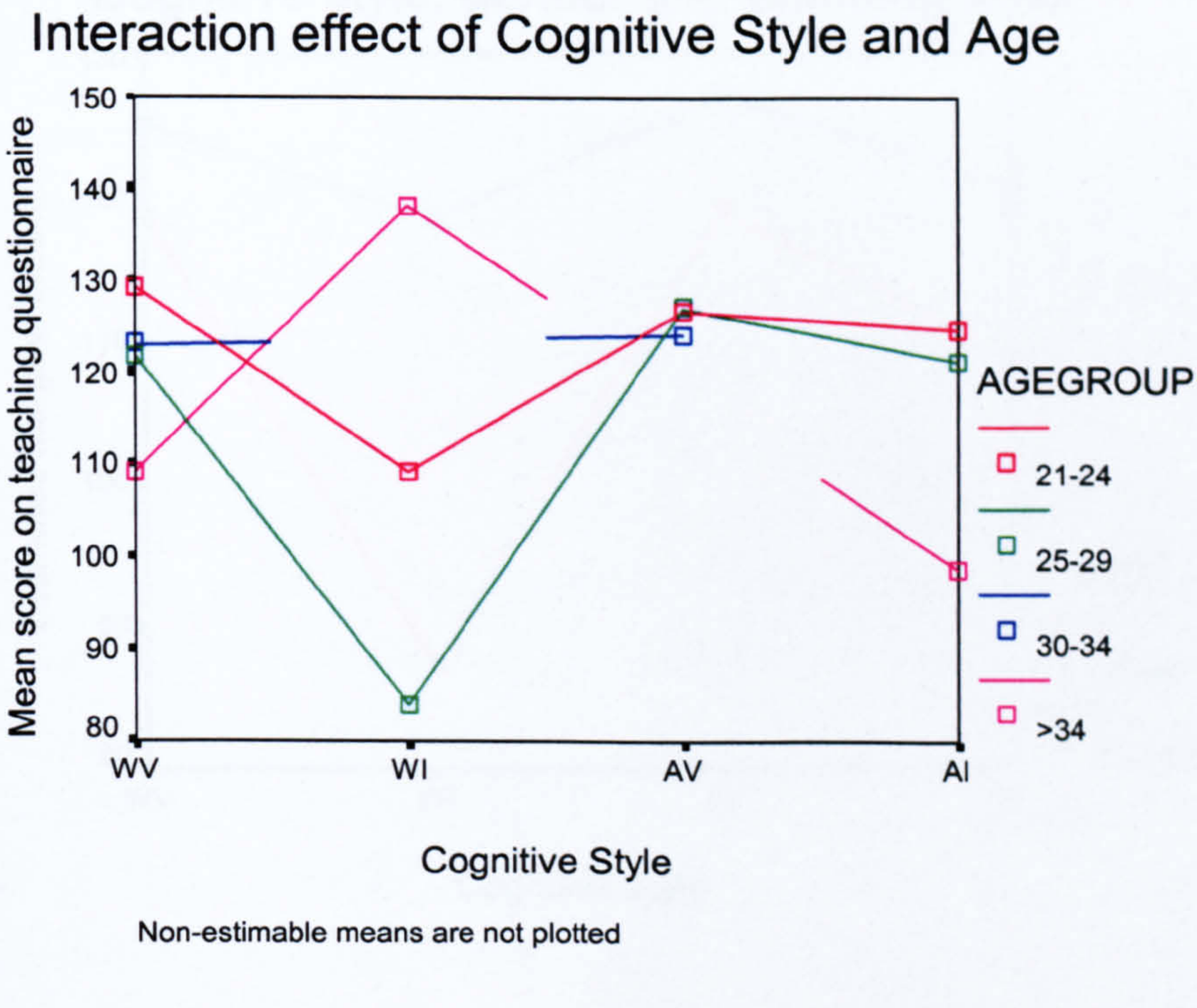
Figure 29: Box and whisker plots showing the spread of results for each subject on the Teaching Styles Questionnaire



Having explored the nature of the relationship between cognitive style, subject and teaching approach, the impact of age was considered. A two-way between-groups analysis of variance was conducted to explore the impact of cognitive style and age on total questionnaire score. Subjects were divided into the 4 cognitive style groups and 4 groups according to age (Group1: 21-24; Group 2: 25-29; Group 3: 30-34 and Group 4: 35 years and above). Whilst there was no statistically significant main effect for cognitive style or age; the interaction effect of cognitive style and age did reach statistical significance ($F = 4.075$, $p = .005$) with a large effect size of .466. Tukey's HSD test revealed significant differences between WV and WI and WI and AV. Wholist-imagers had both the highest and lowest scores; the lowest scores were found amongst over 34 year olds, with the 25-29 year olds achieving the highest scores suggesting a more analytic approach. When considering the relationship between age

and score on the questionnaire results, a statistically significant Pearson Product-Moment negative correlation coefficient of r = -.458 (p = .001) was obtained. This suggested that older students did indeed adopt a more intuitive approach in the classroom and that this was more true of the older wholist-imagers. Factors in addition to cognitive style need to be considered. Whether this is due to age or experiences gained outside of teaching in previous occupations where different skills may have been valued that lead to adoption of a more intuitive approach compared to graduates who have only been involved in academic study is uncertain.

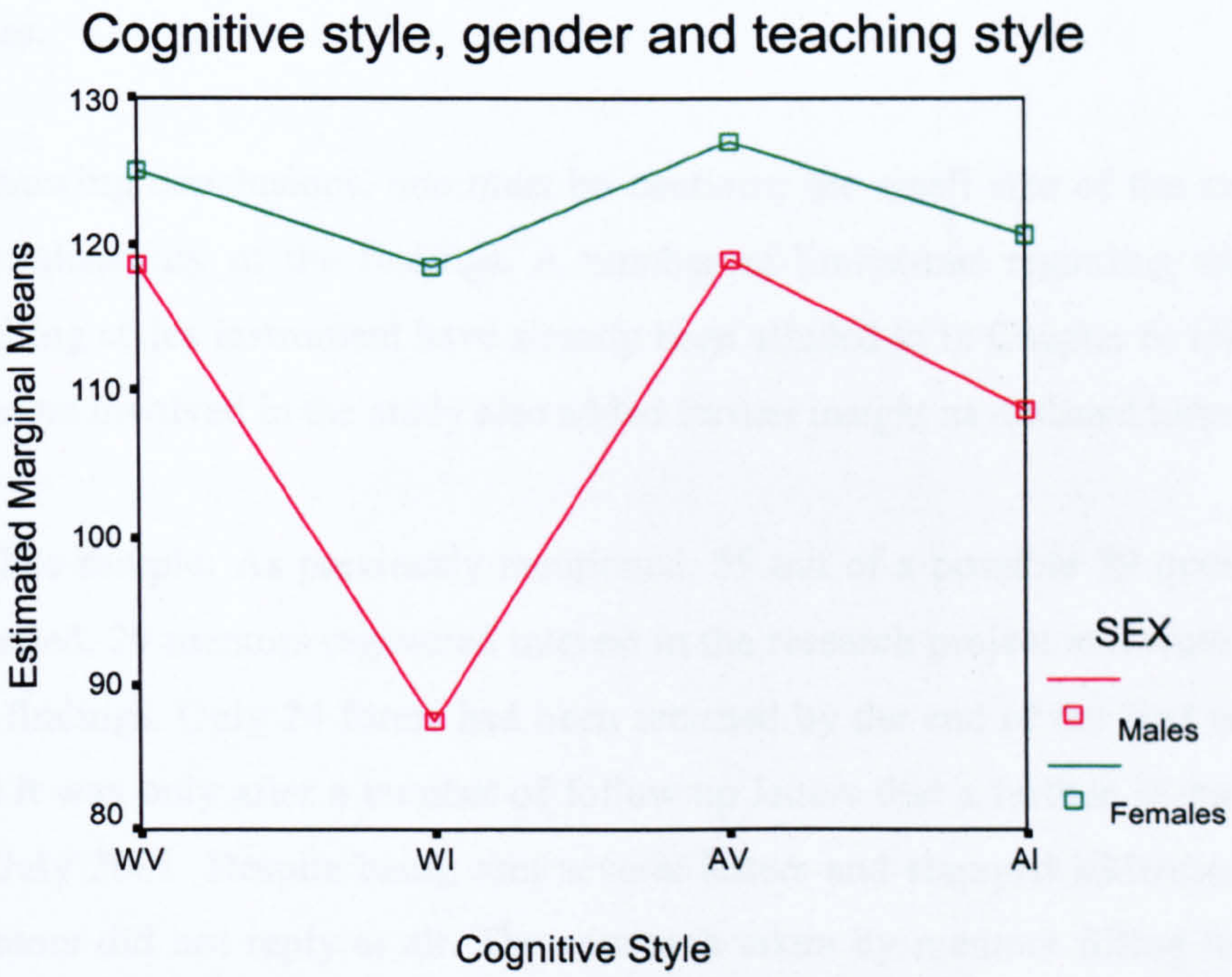
Figure 30: The interaction effect of Cognitive Style and Age on Teaching Style



The impact of gender and cognitive style on teaching approach was also explored. A two-way between-groups analysis of variance identified main effects for gender: (F = 8.789, p = .006 with a large effect size of .210) and main effects for cognitive style: (F = 3.393, p = .029 with a large effect size of .236). The interaction effect for gender and cognitive style did not reach statistical significance: (F = 1.331, p = .281). In Figure 31,

it can be seen that, in this study, males in each of the four cognitive style groups, had lower scores on the teaching styles questionnaire suggesting males to be more intuitive in their teaching style than females. Wholist-imager males were found to have the most intuitive style and analytic-verbaliser females were found to have the most analytical teaching style. In considering the differences between males and females of each cognitive style, the differences between male and female wholist-imagers on the teaching styles questionnaire is considerably greater than those of the other three cognitive styles.

Figure 31: The Impact of Cognitive Style and Gender on Teaching Style



To conclude, in answer to questions concerning the impact of gender, age, subject and cognitive style on teaching style some tentative, but cautious statements can be made. In relation to subject taught, no statistically significant differences in teaching style were noted for the seven subject areas represented here. A two-way between-groups analysis of variance exploring the impact of subject and cognitive style on teaching style mean

score, found no statistically significant differences. The main effect for cognitive style ($F = 1.125$, $p = .363$); main effect for subject ($F = .540$, $p = .772$) and the interaction effect ($F = .909$, $p = .550$) did not reach statistical significance. With regards to gender, males were identified as adopting a more intuitive teaching style than females. In relation to cognitive style and teaching style, male wholist-imagers were found to have the most wholist teaching style and analytic-verbaliser females the most analytic teaching style.

Finally with regards to age, older students were identified as adopting a more intuitive approach in their teaching and an interaction effect with cognitive style suggested that wholist-imagers of different age groups displayed both the most analytic and wholist styles.

In drawing conclusions, one must be cautious; the small size of the sample limits the generalisability of the findings. A number of limitations regarding the design of the teaching styles instrument have already been alluded to in Chapter 6; feedback from the mentors involved in the study also added further insight as outlined below:

(i) The sample: As previously mentioned, 59 out of a possible 79 questionnaires were returned. 29 mentors registered interest in the research project and were keen to receive the findings. Only 24 forms had been returned by the end of the first teaching practice and it was only after a number of follow up letters that a further 35 had been received by July 2001. Despite being sent several letters and stamped addressed envelopes, 20 mentors did not reply at all. The approach taken by mentors filling in the forms was highly variable from detailed to superficial.

(ii) Design of questionnaire itself. Whilst most mentors commented that they had not found the instrument difficult to complete, nine mentors felt the questionnaire to be too long. The reversal from positive to negative statements confused 4 mentors although 2 did comment that they understood why it was necessary to do this. With reference to the

nature of the questions asked, two mentors felt that the questions were too personal and were therefore uncomfortable completing the form.

(iii) Confusion over use of information. They were undoubtedly worries from mentors regarding the use of the information. The need for students to pass the Qualified Teacher Status standards (DfEE: 4/98; TTA, 2002) made mentors wary of making so called judgements despites assurances to the contrary. One mentor commented that it helped him to understand his student's own strengths and weaknesses although it was stressed to all mentors that the instrument was being used to measure cognitive style and was not suggesting that one way was good and the other approach bad.

(iv) Knowledge of students. Three mentors commented that they did not know their students well enough and did not observe frequently enough to make such judgements. Some forms were returned by the end of the first teaching practice term and others were returned at the end of the PGCE year; were these later forms completed with greater knowledge? Research (Evans, 2001) suggests that the quality of mentoring is indeed variable. One mentor commented that he was not sure what teaching style actually meant and another found it hard to generalise and assess the mentee over a number of lessons.

(v) Research design issues. There are both interrater and intrarater reliability issues, the former referring to the reliability of the responses from different mentors and the latter to the reliability of a single mentor. Whilst all mentors had been briefed on the purpose of the research, it was not possible to monitor procedures in the 84 schools. To what extent mentors were capable of completing the questionnaire accurately would have depended on a number of factors such as time available, experience, knowledge of teaching styles etc. The assessment of a PGCE student's style would also depend on the mentor's own style and own preferences and biases. There needed to be consistency in how the students were being assessed; this would only have been possible if all the students had been assessed by the same person on a number of occasions or if the mentors had received sufficient training to enable greater consistency of practice. There

was also the possibility of construct-irrelevance variance in which the assessment may have been too broad thus containing excess variance because of the intrusion of other constructs (Mertens, 1998:292).

(vi) Contextual factors. A number of mentors suggested that the situation that students found themselves in, did not enable them to teach in their own preferred 'teaching style' as much as they would like:

> "as the student has to work in someone else's class, she is largely bound by that teacher's established working and seating arrangements and is not able to set up her own style of teaching" [mentor reply no. 25].

> "the only problems were judging the students own preference compared to the departmental 'norm' which students tend to conform to...In the first practice, there is less opportunity for a wide variety of teaching styles" [mentor reply no. 75].

In addition to a teacher adjusting to the 'norms' within a school/ department in relation to teaching style (Sternberg, 1999), the extent to which teachers consistently adopt a single teaching style has been questioned (Bennett, 1976; Galloway et al. 1998).

(vii) Mentors were asked to describe the preferred teaching styles of their own departments. 19 mentors claimed that their preferred departmental approach to teaching was formal and didactic, favouring whole class teaching; this was found to be very much the case in modern foreign languages. Other subject preferences were in evidence: in mathematics, adherence to the text book was cited, whereas interactive and discussion- led work were commonly mentioned in relation to religious education. A further 19 mentors, across subject disciplines, said that their departments favoured a varied approach within the classroom.

Having identified a number of issues regarding the research design and having identified certain patterns within the data suggesting individual differences, further analysis of questionnaire and interview data was undertaken to corroborate these findings.

Chapter 9: Interview Analysis

9.1: Introduction

In Chapters 7 and 8, specific cognitive style effects on learning and teaching were noted in relation to age and gender. To further explore wholist and analytic differences in approaches to teaching, twenty five students were interviewed to ascertain their own perceptions of their teaching, influences on and concerns about teaching. The twenty five included 6 wholist-imagers, 4 wholist-verbalisers, 5 analytic-verbalisers and 10 analytic-imagers; the high number of analytic-imagers (40%) within this small sample is worthy of note.

The students selected for interview had been identified/chosen by their more extreme cognitive style scores on Riding's (1991) Cognitive Styles Analysis; the rationale was that if differences do exist between wholists and analytics in relation to teaching/ideas about teaching, these would more readily come to light in such a sample. Whether similar differences would have been found within a random sample would also be an interesting area to investigate.

The nature of the interview process and line of questioning has been documented earlier in Chapter 6. The students were asked a range of open-ended questions; the answers to which were later transcribed using content analysis procedures. Categories were determined from reading through all the notes taken by the researcher during conversation with the interviewees, and written answers submitted by the students. The aim was to look for patterns, themes, consistencies and exceptions to the rule. Verification of the findings was undertaken by cross-referencing with other sources of evidence such as responses on the Learning Preferences Questionnaire, available from

the larger sample. Computer software was not used in this instance, as the transcribing of the twenty five interviews was manageable without the use of programmes such as Ethnograph and NUDIST (Richards, 1991; Miles and Wietzman, 1994).

9.2: Wholist – Analytic patterns

9.2a: Subject choice and delivery

Having analysed the data a number of patterns came to light. Firstly, although no statistically significant relationship was found between the cognitive style of the student and their choice of subject with the larger sample, within this select group, subject differences were apparent. Within this smaller sample, scientists, classicists and mathematicians were predominantly analytic and imagers whereas the geographers were predominantly wholists and the religious studies students were a mixture of styles. The mathematicians and scientists felt that there was a preferred way of teaching their subjects: *"didactic with group work as a follow-up. "* All of the scientists stressed the need to teach theory in steps, using diagrams, discussions and chalk and talk: *" science should be taught by giving factual notes and answering questions."* The step by step sequential approach described here, is one typically favoured by analytic-imagers according to Riding and Rayner (1998). Equally worthy of note, is the fact that students from other subject areas did not feel that there was a specific approach to teaching their subjects; a view substantiated by Patrick (1998) and Molander (1997) who both found marked differences amongst teachers of the same subjects in the ways in which they presented and explained topics. In addition, the views of the students depended heavily on their experiences of being a learner in a classroom as one wholist-verbaliser geographer commented: *" From what I have seen there seems to be a tendency to teach through chalk and talk, copy from the book and do the worksheet..."* whereas another wholist-verbaliser's experience of geography teaching was that the approach taken by teachers was highly variable.

9.2b: Willingness to take on board new ideas

Secondly, there was a difference in the degree of receptivity of the wholist and analytic students to the notion of cognitive and learning styles. All students had received an introductory lecture on learning and teaching styles at the beginning of their PGCE course. The overall feeling from the majority of those interviewed was that this lecture had been too early on in their course for them to really benefit and they had been overwhelmed by the concepts that were introduced. But many had also felt that it had raised their awareness of an area that they had not given much thought to before; a telling indictment of the educational system.

It is interesting to note that whilst imagers commented on the difficulty of understanding the language and terminology used, this was not a key issue for the verbalisers. Whilst nearly 60% of the wholists found the lecture useful, in contrast, only 26% of the analytics did. Of those that found the talk useful, one wholist commented: *" I am now conscious of my teaching style and will try to change my style to help pupils...it has been very useful, but very challenging."* Some of the respondents had found the lecture useful in retrospect, but it had only made sense to them following further reading and experience in the classroom. Two analytic students said that it made them reflect on their own style and how this might not be appropriate for all children: *"I am aware that the way I immediately do things may not be suitable for all my pupils."* There were notable differences in response between analytic and wholist students following the talk on cognitive and learning styles. Whilst raising awareness amongst some of the analytic students, the wholist students were more galvanised into action to actually take the ideas away and to try and do something with them; this was especially true of the wholist-verbalisers: *" I actually took the basics away and tried to apply it to my own lesson planning.... I learnt that there are many different styles of learning and that it is important to take notice of this and to adapt my teaching style as appropriate. It has been very useful, but very challenging."*

Towards the end of the interview to follow up on initial conversations, all PGCE students were asked whether they would like to know more about teaching and learning styles. As at the beginning, the wholist students compared to the analytic ones, demonstrated a much greater enthusiasm and interest to learn more; they asked lots of questions during interview such as *"how can you cater for different learning styles in one lesson" " How flexible can a student be - can you teach them to be more analytical?" "How can I learn to teach in different styles?"* In contrast, the analytic PGCE students asked fewer questions and demonstrated less interest. All but one of the wholist students interviewed felt that the lecture given about learning styles at the beginning of their course had had an impact on the way they now taught compared to only one of the analytics. The wholist students had found the learning style concepts difficult to grasp at the time, but having completed their first teaching practice they now felt able to apply the ideas: *"...I know about the other learning styles and try to use methods of teaching I would not perhaps thought about before as a result." "Yes. I tend to think while planning every single lesson whether I am accommodating all learning types."* Only one analytic student commented that it had made him reflect on his own learning style*: " My awareness of trying to provide for each learning style has increased and I think I plan better for this."*

9.2c: Previous experiences of education and impact on teaching

All interviewees were asked about their own experiences of schooling and their preferred teaching approach. Research suggests that training teachers in their survival stage, (Fuller, 1969; Richards and Pennington, 1998), aim to attain control of the classroom and not experiment too soon. Teachers in the Richards and Pennington study, abandoned the principles that they had been taught and instead focused on maintaining a teacher-centred approach with their students: one of distance and authority. As Richards and Pennington (1998:190), comment: "instruction alone...new philosophies or innovative techniques – will not be sufficient to impact teachers' practices substantially and for the long term..." A vast number of factors may impact on practice such as variety of philosophies and practices, prior experience as school students,

significant others in teaching context, workload, class size, inexperience etc. A number of questions were asked to elicit the students' views on teaching and to ascertain the factors that they felt had impacted on their practice.

In terms of prior learning experiences, irrespective of subject, nearly 96% of the PGCE students interviewed, described their experience as being taught in a traditional, formal, 'chalk and talk' and didactic style with little evidence cited of discovery and alternate forms of learning. When asked about their preferred teaching style whilst at school, 66% of wholist-imagers stated a preference for interactive question / answer / discussion sessions. In contrast, with one exception, the wholist-verbalisers were happier with didactic exposition; with one commenting *" I liked chalk and talk and was quite freaked out by other styles of teaching"* and another added *" I felt really comfortable having information given to me. I enjoy lists and points and dictating."* Amongst the analytic-verbalisers no common preference emerged whereas the analytic-imagers were in agreement regarding their preference for structure and a step by step approach: *"structured and visual" and " methodical and logical but also creative working groups and working on my own."* Another analytic-imager student expressed a reluctance to try any other approach*: " I was allowed to do the lessons in my own style [logical, clear]. I didn't really experiment with much else."* Common threads emerge from the discussions that support the ideas of Riding and Ashmore (1980) that verbalisers will learn best from verbal presentations; that analytics will prefer control over their own learning (Riding and Rayner, 1998).

Developing the point on teaching style, all interviewees were asked of the teachers that they had observed during teaching practice, with which teaching styles had they been most impressed. Wholist-imagers were most impressed with good whole class and group instruction with an interactive approach: *" whole class discussion done well is unusual,"* whereas wholist-verbalisers had favoured an approach where students learnt from experience and were essentially describing a constructivist approach: *" I have been really impressed by staff who allowed pupils to discuss a topic and learn by experience."*

Generally, the wholists were also impressed with styles that entertained and captivated students whilst providing a clear balance of knowledge and skills. The analytic PGCE students preferred a more structured, teacher led and practical approach with pupils working on their own but guided by the teacher, thus supporting the findings of Allinson and Hayes (1996). The analytic-imagers were in favour of a discovery learning approach with teachers seen as facilitators helping pupils to learn by themselves. One analytic-imager clearly favoured a highly visual teaching style. Surprisingly, only 2 out of the 25 PGCE students referred directly to pupils in their answers to questions on what had impressed them in the classroom; this is consistent with the findings of Tann (1993) who found that student teachers' thinking about their classroom teaching is more dominated by a concern to maintain adequate classroom control than by pupil learning criteria. Loughran (1996) also notes how once student teachers have established themselves in the school and have built up confidence, there is a gradual shift away from the concerns about themselves and their performance towards a concern for the quality of their pupils' learning.

With regards to their own teaching, most of the PGCE students had great difficulty articulating their own teaching style which is not surprising given their limited experiences of teaching. Several felt that their style of teaching was highly variable depending on the time of day, group and subject. One analytic-verbaliser student felt unable to discover her own style as the scheme of work for science was so prescriptive. A wholst-verbaliser also referred to her current novice status as a teacher: *" I am not sure what style I am ... I am constantly changing at the moment."* Prior learning experiences did appear to impact on current practice. Interesting to note, was the fact that 41% felt that they taught in the same was as they themselves had been taught at school even though some of the PGCE students had acknowledged earlier that they had not enjoyed the way in which they had been taught in school. 50% of wholists described their style as predominantly didactic; a style that 40% of them had been taught in at school. In contrast, 33% of analytics described their teaching style as varied, interactive and collaborative compared to 20% of wholists. Some of the students had felt preparing

students for examination limited the options available to them in the classroom. One analytic-verbaliser commented: *"schemes of work are very prescriptive and restricting... I don't think I have developed a style just yet."* Whilst the sample size is small, the expectation would have been for wholists to demonstrate a less structured and more collaborative style and for the analytics to demonstrate a more formal approach; the influence of previous experience in the classroom as a learner may be a factor here and was certainly true for the scientists, (predominantly analytics), who all referred to structured learning environments as the way to expand knowledge as one commented: *"You remember the good aspects of your own previous learning."* Overall, the responses from both analytic and wholist PGCE students suggested a teacher focused, content oriented approach rather than a student focused and learning oriented approach. The line of enquiry was developed further by asking the students if they taught in the same way as they themselves learnt. 50% of the wholists said that they did learn and teach in the same way. One wholist-imager stressed that she liked to use a lot of visual aids in her teaching. Of the wholists who did not teach in the same way as they learnt, one respondent said that he would do so if he was teaching a top ability group but not for a lower ability one. Another wholist-imager commented *" No. I give them information in a very structured format but I did use a lot of questions which were open to allow pupils to make leaps."* A wholist-verbaliser commented: *" I don't think I do at all, because if that was the case my students would all be lectured at and would be doing a lot of reading."*

A similar percentage of analytics: 53%, compared to 50% for wholists, claimed to teach in the same way as they learned. One analytic-verbaliser said her teaching style depended on the group, time of day and the subject whilst another analytic-imager when asked if her teaching style reflected her own preferences, said: *" I try not to as I am now aware that not everybody learns in the same way. I try to use a number of strategies to give information."* The students were also asked whether they felt able to take risks with their teaching; whilst the majority felt able to experiment, the analytic-imagers stood out as a group who were more reluctant to try out new ideas and were worried that this would affect their classroom management. The influence of the school

context was also raised by one wholist verbaliser, who argued that she would like to try out new ideas but the school would not be receptive to this. The pressure of being observed was raised by an analytic-imager: *" Please allow more teaching on our own- we are capable ...we need less people on our shoulders."* It became clear from the interview discussions that the analytic students found being observed more intrusive than the wholist students did, this may reflect their need for more control over their own environments and the greater need to 'go it alone' as identified in the literature (Riding and Rayner, 1998; Riding, 2002). Wholist responses indicated a greater reluctance to try things out because of discipline problems and the culture of the school preventing them from trying out different approaches: *" It was an extremely high achieving school and they were more worried about the girls getting As than for me getting experiences."*

9.2d: Factors affecting teaching style

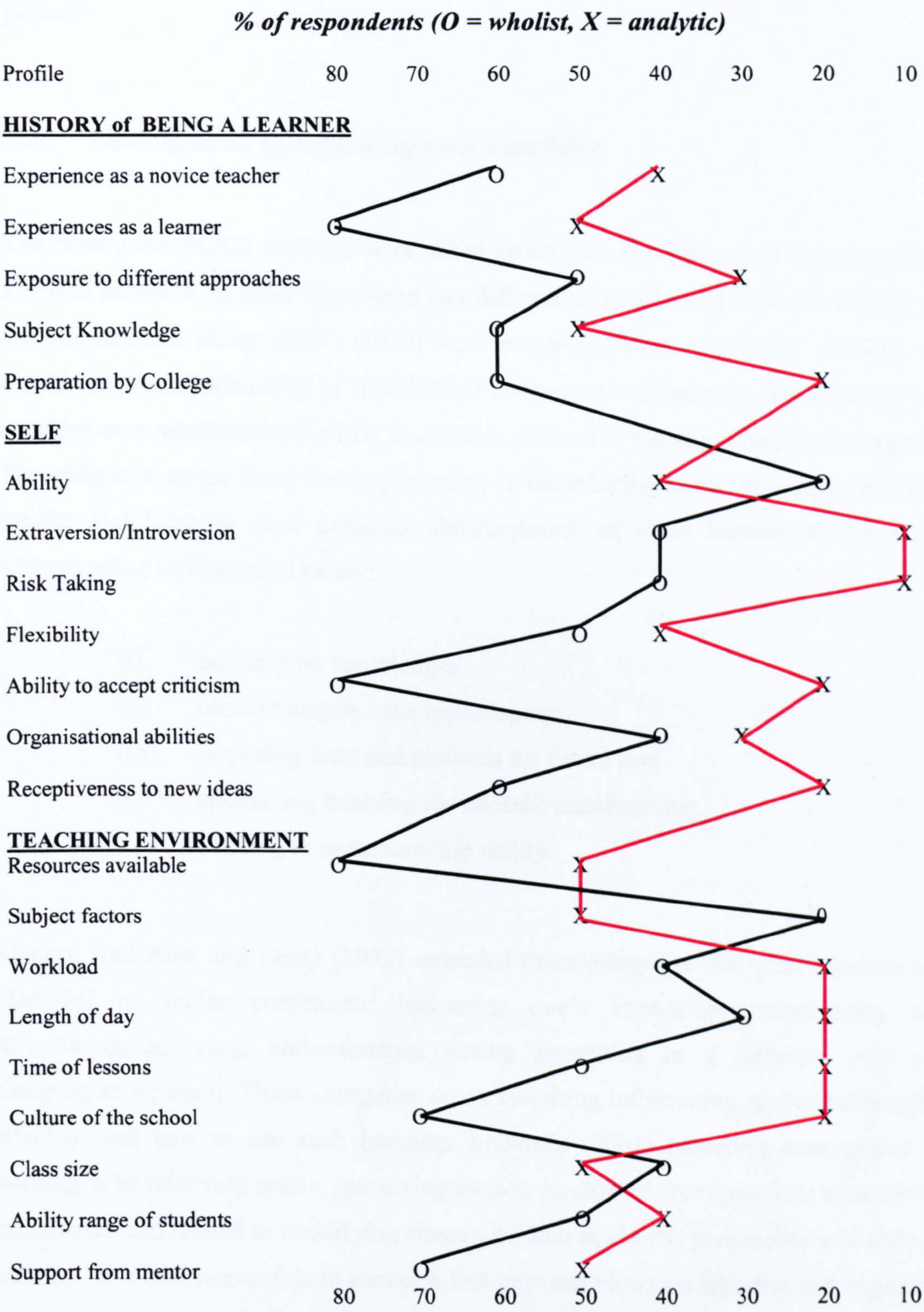
To try to ascertain whether analytic and wholist students' perceptions of the factors that affected their teaching varied, all the students were presented with a chart of factors to consider. Such factors included those pertaining to the individual and their experiences of being a learner, situational factors such as the school context and support mechanisms from school and university. All students were asked to identify which factors they felt were important in affecting their current practice in the classroom; a list of the factors can be seen in Appendix G. The students were also able to add any factors that they felt had been omitted and were pertinent to themselves. Specific differences in responses between wholists and analytics have been charted in Figure 32. The diagram plots profiles for wholists and analytics based on the frequency with which each group mentioned a specific factor. As can be seen in the diagram, there are differences in the wholist and analytic profiles. Wholists particularly stressed the importance of their pre-teaching preparation in affecting their teaching style along with their prior experiences as pupils. Wholists also placed greater emphasis on individual characteristics such as degree of extraversion, ability to take risks, willingness to accept criticism,

organisational abilities and receptiveness to ideas, than the analytics. In relation to the teaching environment, wholists perceived their teaching to be more affected by resources available, workload, length of the day, timing of lessons and the ability range of students. They were also more likely to refer to the degree of support they had received from mentors and the culture of the school, thus suggesting that an incongruous school placement might have greater impact on the teaching of a wholist student compared to an analytic one.

Analytics were more likely to refer to factors such as subject, class size and their own ability as factors affecting their teaching style. Wholists were more concerned about their own subject knowledge whereas analytics focused more on pragmatics such as the delivery of the subject. Both wholists and analytics stressed the importance of their mentors; to what extent such mentors affected the students' teaching styles is uncertain and an area worthy of further research. Four analytic students asked for another factor to be added to the list; rather than success as a learner as a factor, they felt 'failure as a learner' had had a tremendous impact on their approach to teaching. When asked who has been most useful to you in your PGCE year, analytics were more likely to say themselves whereas wholists were more likely to mention their peers; this supports the contention that analytics prefer to structure the learning experience for themselves whereas wholists are more likely to prefer working with others (Riding and Rayner, 1998).

Analytic students also questioned the ability of mentors to give constructive criticism, feeling that mentors shied away from having honest dialogue. Whilst wholist students placed greater emphasis on support from their mentors, it is interesting to note that analytic students appeared to make greater use of mentors. When asked whether they discussed subject content and styles of teaching with their subject mentor, 80% of the analytic students but only 55% of wholists claimed that they did. Whether this was because of the school mentors or down to the request of the PGCE students or an interaction effect between mentor and mentee is uncertain and a question that should have been developed further. Were the wholist students more reluctant to seek advice

Figure 32: Factors affecting Teaching Style



on subject teaching or were there less opportunities in the schools in which they were placed?

9.3: Conceptions of Learning and Teaching

The twenty five PGCE students were asked about their conceptions of learning (Säljö, 1979) to ascertain whether there were any differences in thinking between wholist and analytic students. Using Säljö's (1979) work into people's conceptions of learning and his developmental hierarchy of five distinct conceptions of learning, it was possible to consider as to what extent the PGCE students referred to the suggested five categories. The categories range from viewing learning as reproducing knowledge presented by a teacher and learning as a personal transformation of ideas leading to conceptual understanding as illustrated below:

(i) building up knowledge;
(ii) memorising by rote; reproducing;
(iii) acquiring facts and methods for future use;
(iv) abstracting meaning for oneself; transforming;
(v) Seeking to understanding reality.

Marton, Dall'Alba and Beaty (1993) extended these categories for adult learners and identified a similar continuum: increasing one's knowledge, memorising and reproducing, applying, understanding, seeing something in a different way and changing as a person. These categories cover acquiring information, understanding the effect of and how to use such learning. Entwistle (2001) perceives conceptions of learning to be relatively stable, perceiving them to be derived from previous educational experiences and related to underlying constructs such as ability, personality and style of learning. It is thus reasonable to expect a link between views on learning and cognitive style.

When asked about their understanding of the term learning, most of the PGCE students' replies were relatively unsophisticated, viewing learning as predominantly about absorbing ideas. There were few references to higher order qualitative conceptions involving insight and changing as a person. Learning was very much seen by the students as reproducing knowledge rather than seeing learning as a personal transformation of ideas and evidence leading toward conceptual understanding. Wholist-verbalisers and analytic-imagers referred frequently to skill acquisition: "to give the skills to children to achieve" (WV) and " providing them with skills to be able to continue learning independently" (AI). The key words used by all styles were *explaining, passing on information, giving information, acquiring skills*; understanding of the learning process was quite rudimentary. In summary, the majority of wholists saw learning as predominantly about retaining, reproducing, recalling/remembering and gathering information, acquiring skills along with understanding. Being able to use, experiment and develop ideas and apply them, were mentioned sparingly. The analytic students placed greater emphasis on understanding but, in similar fashion, stressed the assimilation of ideas: taking in information, internalising knowledge, rote learning, listening, note-taking, reiterating, retaining, memorising, absorbing. Only two analytics and one wholist mentioned being able to use knowledge.

With regards to good teaching, how do teachers' views of learning relate to their views of teaching? It was hoped that by eliciting student views on good teaching, it would be possible to gain an understanding of how they operated in their own classrooms: "Teachers' conception of teaching are an important focus. There is some evidence that they relate significantly to the teaching strategies which a teacher operates in the classroom" (Mortimore, 1999: 10). Samuelowicz and Bain's (1992) conceptions representing different profiles on five dimensions, the learning outcome, the view of knowledge, the role of the students' knowledge, the degree of reciprocation, and the control of content, suggest an additional way to look at student responses in relation to these:

1. Imparting information
2. Transmitting knowledge
3. Facilitating understanding
4. Changing students' conceptions
5. Supporting student learning

Both analytic and wholist answers to questions on what constituted good teaching, said little about the actual mechanisms and specifics of teaching. Responses focused on the passing on of subject knowledge without a basic understanding of how this could be done to best effect with different types of learners. As would be expected, similar responses to those on what constituted good learning were found, with the focus being on imparting and transmitting information. Wholist-verbalisers and analytic-imagers again, focused on skill acquisition, wholists stressed facilitating understanding with analytics stressing the transmission aspect of learning. To corroborate the findings of the twenty five students involved in the interviews, it was possible to look at the responses of the larger sample of 55 students who had completed the Cognitive Styles Analysis; all students had been previously asked on the Learning Preferences Questionnaire what they felt constituted good teaching. The responses from this questionnaire were coded and broken down into a number of categories as shown in Table 25.

It is interesting to note that the majority of respondents commented on a more transmissive mode of teaching rather than a facilitator one; which ties in closely with the interview answers of the smaller sample and the experiences of learning that those involved in interviews had received whilst at school. Whilst all students referred to imparting, transmitting, facilitating and supporting students' learning, there were no references to changing students' conceptions of learning, supporting the interview findings.

The responses of the PGCE students were grouped under the headings shown in Table 25 to see if there were differences between wholist and analytic students' views on good teaching, as measured by Riding's CSA. Certain differences were apparent in that

Table 25: What constitutes good teaching (source: LPQ responses)

Factor	Wholist % N = 26	Wholist rank	Analytic % N = 26	Analytic rank
Personal attributes	77	1	38	3
Delivery	54	2	100	1
Focus on Learning	38	3	42	2
Subject Knowledge	35	4	27	5
Discipline	19	5	7	7
Planning	11	7	19	6
Adaptability	19	5	31	4
Approach	3	8	7	7

wholists were much more likely to focus on personal factors as being important in teaching whereas all the analytic students stressed the importance of subject delivery and the imparting of knowledge compared to just over half of the wholists. Knowledge of the subject was seen as more critical by the wholists. Notable differences between the two groups included the greater emphasis on classroom management raised by wholists and the importance of being adaptable raised by the analytics. Such differences may be as expected given the need for structure of the wholists, the greater people orientation of the wholists and the perceived characteristic of analytics as inflexible compared to wholists (Riding and Rayner, 1998).

Whilst maintenance of discipline and pedagogy in terms of teaching approaches were mentioned, very few PGCE students talked about pupils' thinking and learning; this supports Kagan's (1992) findings that most beginning teachers are not very pupil-oriented. Research by Kyriacou and Stephens (1999) also found that very few student teachers raised concerns about getting the teaching right in relation to pedagogical skills. They were more concerned with the immediate demands, rather than in developing the understanding and skills needed for their professional development.

9.4: Concerns about Teaching

During interview, the students were asked about the main difficulties they had experienced on their first teaching practice. The predominant concerns of wholist students were with classroom management, lesson planning, and delivery: how to pace a lesson, being able to give clear instructions, being able to answer pupil questions, ascertaining pupil needs and managing so many things at one time. One wholist-imager commented *" I found it so difficult to find the right words to use and I left long pauses between sentences..."* Whereas the wholist-verbalisers were more concerned about the organisation of lessons, breaking down lessons into stages and knowing the students: *"I didn't know the pupils and their needs well enough."* Planning was a major concern for some of the wholist students: *" I did not do my planning pupil orientated enough. I was not think about what the pupils were learning, more what I wanted to teach them."* The analytic PGCE students made greater reference to worries about subject knowledge, using differentiation strategies and gaining control of the learning situation as one analytic-imager commented: *"I couldn't implement the procedures I wanted to in a short placement....getting attention...being able to focus on what I was saying, as I was saying it...."* For the analytic students, concerns were more about being observed, projecting one's voice, getting the attention of the students, pace, sequencing, making too many assumptions, asserting themselves in the classroom and discipline. Analytic students were more critical of their university tutors and school mentors than the wholist students were.

The responses of the students at interview were compared with their responses on the Learning Preferences questionnaire, which was completed prior to teaching practice; these responses along with those of the other students who completed the Cognitive Styles Analysis were considered and are represented in Table 26. The concerns are summarised under the following headings: discipline and class management, pedagogy, assessment, planning and relationships.

Table 26: Teaching concerns

Teaching Concern	Wholist N = 26	Analyst N = 26
Discipline & Class Management	73% (1)	88% (2)
Pedagogy	58% (2)	100% (1)
Assessment	8% (5)	19% (4)
Planning	31% (3)	8% (5)
Relationships/Personal Factors	27% (4)	46 (3)

() figures in brackets = rank

With reference to the larger sample (n= 52), all analytic students referred to concerns about pedagogy compared to just over half of their wholist counterparts. A greater percentage of analytics were more concerned about how to assess and being assessed themselves. This suggests a greater preoccupation with the need to get it right and in addition, analytics are perceived as preferring to work on their own (Riding and Rayner, 1998); therefore, being observed may appear more threatening to an analytic student. Compared to the wholist students, a greater percentage of analytics were anxious about developing relationships with classes, mentors and other teachers; this concurs with the views of Witkin and Goodenough (1971) who identify wholists as being more effective in developing interpersonal relationships thus making this a bigger concern for the analytics.

In comparison, wholists appeared more concerned about planning compared to the analytic students and less concerned about developing relationships in the classroom; this is consistent with the interview findings. The wholist concern about planning is congruent with the research findings of Riding and Rayner (1998) and Riding (2002) who found wholists to be less well organised compared to analytics and less able to work to deadlines and also more able to develop interpersonal relationships. Being assessed and assessing others did not figure highly as a concern for the wholists. Wholists are characteristically viewed as being more able to deal with situations requiring social perceptiveness and interpersonal skills (Guilford, 1959) and perhaps, the process of being observed may be less harrowing for wholists compared to the more self-critical analytics (Riding, 2002).

Wholists are also perceived as being less critical and less thorough with marking than their analytic counterparts (Saracho, 1987, 1991); this may account for the lower priority of assessment amongst their concerns.

With regards to discipline, 73% of wholists and 88% of analytics both had anxieties related to the issue of discipline. This was the principle concern for wholists and the second highest concern for analytics. This result is unsurprising, given the fact that the students were new to teaching. Such concerns were also raised by the sample of students that were interviewed; however in this situation, it was the wholist students who more preoccupied with this concern. The literature suggests that discipline should be a greater concern for analytics with their greater need to have control over their own learning, however it could equally be argued that the wholist characteristic of 'going off on tangents' and not being able to plan as precisely as an analytic may have impacts on classroom management.

In conclusion, face to face dialogue and later transcription of interview data, along with information students had recorded on the Learning Preferences questionnaire, revealed that certain differences between analytic and wholist students in their attitudes and approaches to teaching. The small size of the sample limited further breakdown of the

results, preventing detailed analysis of possible gender and age interrelationships with cognitive style; such potential differences are areas worthy of further research.

The results need further corroboration and thus a larger study is recommended to substantiate and further develop the conclusions reached in this study. It is possible, that for students with more extreme cognitive styles that patterns of delivery need to be adapted/modified to accommodate the needs of such learners. A study comparing students with more extreme scores compared to those with more moderate styles is also required; thus a random sampling procedure is recommended.

It became obvious from discussions with the twenty five students during interview that they had given little consideration to their own learning styles before. The need for further work in this area is highlighted by one wholist-verbaliser student: *" I don't think many people are aware of their own preferred styles ...another session, later on, would be useful."*

Chapter 10: Conclusions and Recommendations

10.1: Conclusions

The principal aim of this research was to identify the cognitive styles of a cohort of trainee teachers and to consider how this attribute impacted on their teaching styles: a formidable task given the educational 'swampy lowland' (Schön, 1989) in which the research was carried out. Using a combination of quantitative and qualitative techniques, a number of conclusions were arrived out which, indeed, raise further questions.

Firstly, contentions were raised concerning the nature of cognitive style. The Cognitive Styles Analysis and Cognitive Styles Index of Riding (1991) and Allinson and Hayes (1996) respectively, were not found to be measuring the same aspect of cognitive style; a finding congruent with that of Riding and Rayner (1998) and Sadler Smith, Spicer and Tsang, (2000). This raises questions about the meaning of cognitive style as used by Riding and by Allinson and Hayes. The mild overlap between measures of cognitive style and the learning styles instrument of Entwistle (1981, 1983) also raises questions regarding the independence of cognitive style and learning style constructs.

Secondly, in considering the impact of the findings, one needs to consider to what extent the population represented here, that of trainee teachers, is representative of the wider population. As noted in Chapter 7, the trainee teachers' wholist-analytic ratios on the CSA, appeared more analytic than those of Riding's (1991) much larger sample, going against the contention of Witkin (1977) that those who choose teaching are more likely to be more wholist. In another study by Waring and Evans (under review), looking at a cohort of physical education students, the wholist-analytic mean was 1.25, the same as Riding's figure. This raises the question as to whether the analytic nature of

the cohort under study reflects the nature of the subjects represented and or the nature of selection on to courses at the university concerned. Furthermore, the distribution of scores of the students along the wholist-analytic and verbaliser-imager continuums, placed nearly a third of the students into 'intermediate' and 'bimodal groups' according to Riding's norms, thus assignment to one of the four main cognitive style groups may, in fact, distort the findings, given the fact that many of these students were not strongly wholist or analytic.

Thirdly, to partially answer the previous question regarding subject choice and style, student teachers studying the seven different disciplines did not have statistically significant differences in their wholist-analytic scores or teaching scores, suggesting in this case, the lack of an effect of cognitive style on subject choice and vice-versa or alternatively, the non-significant result may have been due to insufficient power given the small sample size (Stevens (1996); larger sample sizes are required here to ascertain the bigger picture. Patterns, however were evident with the students that were selected for interview, based on their more extreme scores, where analytic students were predominantly found to be studying sciences and mathematics. Using the CSA, looking at mean scores on the wholist-analytic dimension, geography, physical education and religious education students were more wholist than mathematics, science, modern foreign language and classics students. With regards to learning and materials preferences, geographers, mathematicians and scientists demonstrated a preference for diagrammatic materials with linguists preferring written materials as one would expect. With regards to working alone or in groups, taking control, type of task, and type of question, there were no notable differences recorded by PGCE students from different disciplines. As far as teaching preferences were concerned, some slight subject differences were discernible but not statistically significant. For religious education, science and geography PGCE students their most favoured form of learning was attending lectures. For other subjects the most preferred form of learning was tutorials for maths students; discussion groups for linguists; individual work for classicists, and presentations to the class for physical education students. In fact, for all the subject areas represented here, attending lectures was a popular form of learning

followed by discussion groups and tutorials with computer-assisted learning being the least popular for all except mathematicians and geographers and surprisingly, given the fact that all are training to be teachers, presenting to the class was the second least popular option.

Fourthly, the influence of age on cognitive style and the interaction of cognitive style with age are worthy of consideration. Taking the first part of the equation, the influence of age on cognitive style, as already noted, the trainee teacher population was found to be more analytic than the 'norm' suggested by Riding (1991) and also more analytic than that found in two studies of 16 –18 year olds by Evans (2001, 2002) where much lower wholist-analytic means of 1.17 and 1.125 respectively, were recorded; a finding also replicated by Lõfstrom (2001). Such findings support the views of Dunn and Griggs (1995:31) who concluded from their own research that there is evidence that:

" either the older the students or the longer they remain in school, the more analytic their processing style becomes.'

Whilst Riding and Wheeler (1995) found no significant correlation of age with the wholist-analytic dimension of cognitive style, within this study a relatively weak but significant correlation of the two parameters did suggest that older students were more analytic, although no statistically significant relationship was found between the other measure of cognitive style used in this study, the CSI and age. The relatively weak figure of $r = 0.268$ on the WA dimension of the CSA, supports the contentions of Armstrong (2001) and Löfström (2002) that how analytic or intuitive a person may be will also depend on the nature of work being undertaken and the status of the individual within the organisational setting rather than being just a function of age.

Considering approaches to studying, age was not found to be a significant factor in contrast to the findings of Duff (1999), Sadler-Smith (1996) and Duff (2002) who found age correlated with a deep approach and negatively with a surface approach. There were no such findings in this study, with no statistically significant correlations between age and the three orientations of the ASI, (meaning, achieving and reproducing), being found.

In this study, a statistically significant relationship was found between teaching style and age suggesting that older students did adopt a more intuitive approach; however the r value of –0.458 suggests that age is but one of several factors accounting for this. In terms of the effect of age on teaching style, a statistically significant interaction effect of cognitive style and age was found suggesting significant differences between the four cognitive style groups, with wholist-imagers of different age groups exhibiting the most intuitive and analytic teaching scores. Of particular note were the wide variations in scores of the wholist-imager group compared to the other cognitive styles groups; this raises the question as to whether certain cognitive styles are more receptive/flexible to trying out different approaches.

Fifthly, with respect to gender, in terms of raw scores on each of the cognitive style and learning styles instruments, (CSA, CSI, ASI), male and female scores were very similar. Such findings are in line with those of Riding (2002) who found little difference between males and females on the WA dimension, with males being slightly more analytic than females and no difference at all on the VI scale. In this study, women had slightly lower WA and VI scores than men, suggesting a more wholist and verbal approach but there was no statistically significant difference between the two groups.

With respect to learning preferences, Riding and Rayner (1998) see gender as interacting with cognitive style and there was evidence of this with significant differences found between males and females in particular contexts. Using two-way between-groups analyses of variance tests looking at cognitive style and gender, certain statistically significant patterns were found as outlined in Chapter 7. Main effects for gender were noted suggesting that females prefer working on their own, especially analytic females, and are less in favour of giving presentations compared to males. A statistically significant interaction effect between cognitive style and gender also suggested that analytic-verbaliser males and wholist-imager females appreciated tutorials most whereas wholist-imager males and wholist-verbaliser females liked them least.

In terms of teaching style, with reference to the Teaching Styles Questionnaire, females were found to have higher, (more analytic) scores (mean score for females = 121.9; mean score for males: 112.3) but t-tests were not statistically significant (t = 2.01, p = .058, although the magnitude of the differences in the means was moderate (eta squared = .07). A statistically significant main effect for gender was found using a two-way between-groups analysis of variance test, supporting the previous finding that the teaching of the female students was more analytic than that of the males.

Finally, with respect to cognitive style, learning preferences and teaching style, a number of patterns come to light. Firstly, with reference to learning preferences no statistically significant differences were found between wholists and analytics. The only statistically significant relationship that was found was that between verbalisers and imagers with respect to preference for open and closed questions with the former preferring open questions and the latter closed ones (t = 2.14, p = .037). The magnitude of the differences in the means was moderate (eta squared = .08). Riding and Read (1996) had found imagers' preferred format for learning was to use pictures with verbalisers choosing writing; no such differences were found with this adult population. In the Riding and Read study, all students preferred group or pair work to individual work whereas in the PGCE study, individual study was the favoured choice of over 50% of the students with approximately 25% favouring group or pair work. Whilst not statistically significant, certain patterns as indicated in Table 27 did emerge which would be worth investigating further. There appeared to be a greater preference for open questions by verbalisers with imagers preferring closed ones. Verbalisers also expressed a greater preference for skills based questions whereas imagers preferred learning facts and imaginative tasks. The suggested greater preference of imagers for pictorial sources of information and of verbalisers for written sources did not emerge (Riding and Read, 1996); however, analytics expressed a greater preference for written materials compared to wholists. Surprisingly, wholists were more likely to prefer working alone which goes against type (Riding and Rayner, 1998) and were more likely to be reluctant to answer questions, fitting with the findings of Evans (2002) where wholist-verbalisers were

found to be more affected than other cognitive styles by self-worth motivational style. In terms of managing groups, wholists showed a greater preference for leading compared to analytics.

As already noted, interaction effects between cognitive style, gender and age were found with respect to teaching styles; suggesting that wholist-imager males had the most intuitive teaching style and analytic-verbaliser females had the most analytical style. In addition, the t-test revealed statistically significant differences in teaching styles between verbalisers and imagers and a relatively large effect size (eta squared = 0.11). The verbaliser mean score = 123.9 SD = 18; imager mean score = 115.3 SD = 23; $t = 2.166$, $p = .038$), suggesting that verbalisers teach in a more analytic way; this was corroborated by the statistically significant relationship between VI score and teaching styles score ($r = .493$, $p = .001$).

With regards to their views on teaching and learning, over half of the group claimed to teach in the same way as they had been taught themselves even though some claimed to prefer alternative methods. For reasons to do with the placement schools, preparation by the university or to do with the self, the majority had not been able to alter their own frames of reference but the interviews and questionnaires were undertaken early on in their course which would have a large effect on the findings. It would have been interesting to have interviewed the student teachers at the end of the course to ascertain changes in beliefs and practices and to have compared the degree of movement in opinion/practice between wholist and analytics.

During interview, wholist students did appear far more open and receptive to the concept of learning styles than the analytic PGCE students. A much greater percentage of wholists compared to analytics stressed the importance of preparation by the college in affecting their teaching style whereas a much smaller percentage of analytics felt that exposure to different approaches would affect their teaching. This supports the findings of Sadler-Smith and Riding (1999) who found from a study of 245 business studies students that analytics preferred to have the control themselves rather than to be

controlled, whereas wholists had no preference. In interview, the analytic students gave the impression that they relied on their own resources far more than the wholists and were less receptive to change. Supporting the research of Riding (1991) in relation to preferences of different cognitive styles, wholist-imager students did assert a preference for interactive and group work, which also came through on the responses to the learning preferences questionnaire, although many did not teach in this way. At interview, wholist-verbalisers expressed a preference for didactic exposition, playing to their verbal and written strengths, but analytic-imagers preferred structured and visual approaches and analytic-verbalisers had no dominant preference; these views were not necessarily representative of the larger cohort with less extreme cognitive styles. In relation to concerns about teaching, wholists were more likely to raise issues to do with classroom management, lesson preparation and organisation, supporting Riding's views about wholists needing help with structuring.

Table 27: Cognitive Style and Learning Preferences

Analytics showed greater concern about subject knowledge and developing pedagogy;

Context	Specifics	Wholist Verbaliser	Wholist Imager	Analytic Verbaliser	Analytic Imager
Presentation of materials	written			X	X
	diagrammatic	X			
Questioning	open	X		X	
	closed		X		X
Reluctance to answer questions		X			
Leading groups		X	X		
Interaction	group		X	X	
	individual	X			
	partner				X
Focus	on product / outcome				X
	on process		X		
Learning	facts		X		X
	skills	X		X	
Task	imaginative		X		X

they also revealed more concern about the self, being more worried about being observed and assessed and developing relationships. This also fits with the view that analytics are less confident in interactive situations and more introverted compared to wholists. A greater percentage of wholists felt that their own experiences as a learner had a much greater impact on their teaching than the analytic teachers, whereas analytic teachers were more likely to stress their own ability as a factor affecting their teaching. Wholists appeared far more sensitive to situational factors such as the culture of the school, support from a mentor, ability to accept criticism as well as resource provision whereas few analytic PGCE teachers raised these issues; instead, they raised the demands of the subject they were teaching as being dominant along with the lack of critical feedback they had received from mentors. Both analytic mathematicians and scientists felt that their disciplines demanded a specific teaching approach. In relation to seeking support, a much larger percentage of analytic students compared to wholist students had regularly discussed subject issues with their mentors; it seems unlikely that this was solely down to mentor provision at the different schools and begs the question as to whether analytic students wanted / demanded such discussions more than the wholists as suggested by their greater concern about pedagogical issues compared to the wholists. Clear differences between the wholist and analytic responses were discernible and the interviews provided a rich source of data. The indications from the discussions suggest that wholist and analytic students do have varied needs. Such differences do need to be teased out by further research and acted upon by teacher training institutions.

10.2: Key Issues

From a thorough study of the literature there appears to be little current work on cognitive styles and teaching styles, or for that matter, on teaching style, subject and cognitive style. This contention is supported by Woodrow (2002) and Vermunt (2002). Vermunt (2002) argues that we have not advanced very far in the last 20 years with respect to knowledge of how teachers learn and cites the paucity of research in this field: thirty references in the last 20 years. With reference to Figure 1 in Chapter 1, which demonstrates the number of entries to the ERIC data base on cognitive style and

teaching style, it can be seen that the number of studies published has actually fallen considerably in the last ten years. The work of Richard Riding (1991) whilst considerable, has had very limited impact in schools. One way in which this issue is beginning to be addressed is through the work of the European Learning Styles Information Network (ELSIN), established in 1996 to address the question of human performance and individual difference. It has amongst its aims the need to disseminate knowledge about cognitive and learning styles as Rayner (2003:1) comments: " A gain for education and management is unlocking the potential of the style construct, and enhancing performance, [it] is exciting, tantalizing and yet far from actually realised".

The relative lack of work on individual differences in learning and the characteristic small scale of research that has been carried has also been raised by Oosterheert, Vermunt & Denessen (2002:61) who comment: " ...studies of the interrelations between personal variables and different ways of learning to teach are, to our knowledge still scarce and small scale if conducted at all". In such small studies, the influence of outliers/anomalous results can have a large influence on findings. In addition, for every statistically significant finding, how many are non-significant?

The small scale nature of the research compounds the problem in relation to whole school impact. However, even where a considerable amount of work has been carried out, such as the work of Entwistle on learning styles, " the effect on practice has been neither as strong, nor as widespread, as had been anticipated" (Sternberg & Zhang, 2001:131). Similarly, Riding and his colleagues at the University of Birmingham and Allinson and Hayes at Leeds have carried out considerable research using their respective instruments, the CSA and CSI, but much of this has been concentrated at the university level with very little of it permeating into schools.

Clearly, another key issue is how you make such research both accessible and plausible to teachers. With this in mind, dissemination of cognitive style research has been marred by the volume of poor instruments presenting a confusing picture. Even with more robust instruments such as the Cognitive Styles Analysis, the stability and internal

consistency of the measure has recently been called into question by Roberts (2001), Peterson (2001, 2002) and Redmond et al. (2002). In particular, the stability of the verbaliser-imager dimension of cognitive style has been disputed. Indeed, how good is the CSA as a measure of cognitive style? The CSA arguably measures both wholist-analytic and verbaliser-imager dimensions of cognitive style and encompasses many previous models attempting to measure wholist-analytic tendencies. However, the nature of the link between the CSA and other cognitive style instruments such as the CSI remains unclear.

In addition, much of the work on the characteristics of wholist and analytic teachers, with the exception of the work of Riding, was carried out by researchers such as Witkin (1962, 1964, 1973, 1976), and Messick (1970, 1976, 1984) in the 1960s and 1970s. This poses the question as to whether the basic premises about characteristics of wholist and analytic teachers are accurate and relevant to present day classrooms. With a more prescriptive curriculum in British schools, the scope for individuality in delivery is, perhaps, less than several decades ago. Early measures of teacher style (Bennett, 1976), were overly simplistic. Measuring teaching style is made more difficult given the relative lack of current studies and tools designed for this purpose. It could also be argued that the way in which a teacher delivers will depend on how well they know their material, how comfortable they are with it, how frequently they have delivered it and how well they know their audience. In this study, many of the students felt that their teaching style was affected by the schemes of work in place in the departments in which they taught and that the nature of the class, the area of study and time of day were all contributing factors in affecting their delivery.

Also central to the discussion is, if we accept that style can be identified accurately, how modifiable it is? Vermunt (1996) argues that students tend to approach and interpret their learning environment using their existing mental models and learning repertoire. Curry (2000:250) whilst accepting that individuals have "... inherent styles, approaches, and preferences, [adds] ...these predilections are modifiable through conscious choice of strategy or tactic in particular task situations". Are they more

adaptable for certain individuals? This raises further questions such as how easy is it to identify versatile and specialised students and why are some learners more fixed in their ways of learning than others? Oosterheert, Vermunt & Denessen (2002:61) also question whether certain learner characteristics are more endurable than others:

> " It may also be that certain orientations 'endure' longer than others...or do not shift at all. We also wonder whether a fixed order exists for how student teachers develop as experiential learners."

10.3: Recommendations

Further research is certainly required to verify the validity and reliability of key cognitive style measures. As Riding (2002) comments, there is certainly a need for further research to confirm/repudiate/develop our understanding of the learning preferences of different cognitive styles. The interaction effect of cognitive style and gender is also worthy of additional exploration. To address the resolute nature of cognitive style, there is a desperate need for more studies on the impact of cognitive styles on teaching styles, especially more longitudinal studies of a phenomenological nature to explore 'changes in an individual's way of seeing, experiencing, understanding, conceptualising something in the real world' (Marton & Ramsden, 1988:271), and seeing how these relate to cognitive style and approaches in the classroom. Curry (2000) also argues the need for larger samples in studies to substantiate findings. Yates (2000) questions some of the current findings, arguing that even with the information we do have, we do not possess a clear technology for matching style to instructional treatment and suggests that knowledge claims made by writers such as Sternberg are not substantiated in the current literature. Riding (2002) also advocates further research into the learning preferences of different cognitive styles.

Making research findings accessible to teachers and gaining their acceptance of the principle that styles matter is another area worthy of development. Entwistle (1991)

talks about ' pedagogical fertility' in relation to the ability of a piece of work or concept to generate new lines of research; the work on cognitive styles has to describe 'a recognizable reality' if teacher practitioners and those associated with teacher training are to buy into this concept wholeheartedly. There is no doubt that the concept has face validity as demonstrated through this study by working with teachers and students. In the studies carried out by Evans (2001, 2002) in schools where research has been carried out directly with students, there has not been a single student who has not been interested to find out what their own cognitive style was, what it meant and how they could develop their own learning repertoire. In the aforementioned studies it was possible to recognise students who were 'more at risk' from underperforming at GCE level given their style inflexibility.

In addition to the usefulness of cognitive styles research as a predictive tool, one of the key benefits of cognitive styles work, already alluded to, has to be the empowerment of learners including both teachers and students. There is certainly a need for teachers to understand their students' conceptions of learning if they are to develop them. The mapping of learning profiles is advocated by Rayner (2002) and Pheiffer, Andrew & Green (2001:144) who comment:

> "... that explicit acknowledgement of cognitive style and learning preferences (along with learning styles and approaches to studying) perhaps through comprehensive " profiling" of these attributes, may be an important step forward in bringing learners and educators together in an understanding of each others styles and their mutual interdependence."

In support of individuality in learning, Hargreaves (1996) and Dallat and Moran (1998: 34) contend that an evidence based approach to teaching can be a powerful strategy for enhancing professional development. There is also a need for those responsible for training teachers to understand how they learn as commented on by Oosterheert, Vermunt & Denessen (2002:42): " Educators must better understand what it takes for different student teachers to learn to teach and which activities help different learners

grow in this process." Further support for such an approach comes from Fielding (1996) and Rayner (2000:169) who comments:

> " [the] learning style construct is central to an approach that has the potential to enrich the teaching and learning process, providing it is set within the wider context of humanist psychology and grounded in the interaction between teacher and learner."

By appreciating the fact that students learn in different ways, knowledge of differences in cognitive style can help teachers / teacher educators to provide a greater variety of learning alternatives and even a greater range of expected learning outcomes for students through diversity of curricula and teaching effects. This raises the issue of adapting instruction to the students' needs, thus requiring the teachers to become flexible in their cognitive style. As Fisher (quoted from Wade, 2002:412) comments:

> " If a teacher is to be "good", then an awareness of learning styles and strategies is essential to help focus on the needs of any group of students, and an attempt should be made to understand the particular profile of the students being taught so that the teacher can adopt appropriate teaching styles that will enhance the students' learning experiences."

It is through an understanding of individual needs that greater progress can be achieved. Whilst the national Key Stage 3 strategy has lead to improvements in teaching (TES 7/3/03), disappointing improvements have been recorded in relation to student performance. A 'one model fits all' approach is unlikely to lead to enhanced learning outcomes unless such programmes are tailored to the needs of individual students.

To this end, Yates (2000:361) sees the cognitive style construct as an additional tool making up the teacher's toolkit enabling a teacher to be more aware and understanding of individual needs, providing 'another lens' through which to examine the nature of human learning: "The extent to which it makes us sensitive to difficulties experienced by certain individuals with certain tasks, then it becomes a construct valuable to both researchers and teachers." Rayner (2002) similarly postulates that an understanding of

cognitive style can provide a vital piece of the jigsaw in trying to understand how students and teachers learn both independently and in conjunction with each other.

In addition to an understanding of cognitive styles having the potential to improve relationships between teachers and students (Saracho, 2000 ; Doebler & Eiche, 1979), students will also have greater control over their own learning through enhanced metacognition. Ireson, Mortimore and Hallam (1999:227) postulate " An important aim for education in the future might be the establishment of a planned and progressive increase in the learner's responsibility in relation to their own learning as they progress through each phase of education;" a knowledge of cognitive styles would certainly help to facilitate this. Proposed changes to the 14-19 curriculum (DfES, 2003) which may enable students to adopt more individualised learning plans makes an understanding of how to learn even more critical.

A challenge for all those in the educational world, having raised the profile of learning styles, is in identifying the strategies to enable individual learners to adapt their approaches to suit the demands of a situation. Researchers such as Graff (2000), Witkin and Goodenough (1981), Saracho (2000) and Ramfrez, Cast and Castañeda (1974) have all identified learners who exhibit characteristics of both cognitive styles using terms such as 'the ability to switch gears'; 'cognitive flexibility;' 'bio-cognitive development' to describe such individuals. The extent to which learners can become more flexible, has been questioned by Miller (1991). Whilst the 'ability to switch gears' may be more problematic for some, an understanding on the part of the learner of why s/he learns in a certain way and support from a teacher willing to try out varied approaches, should enable some movement. This leads to a further question as to whether certain styles of instruction are more likely to develop cognitive versatility than others.

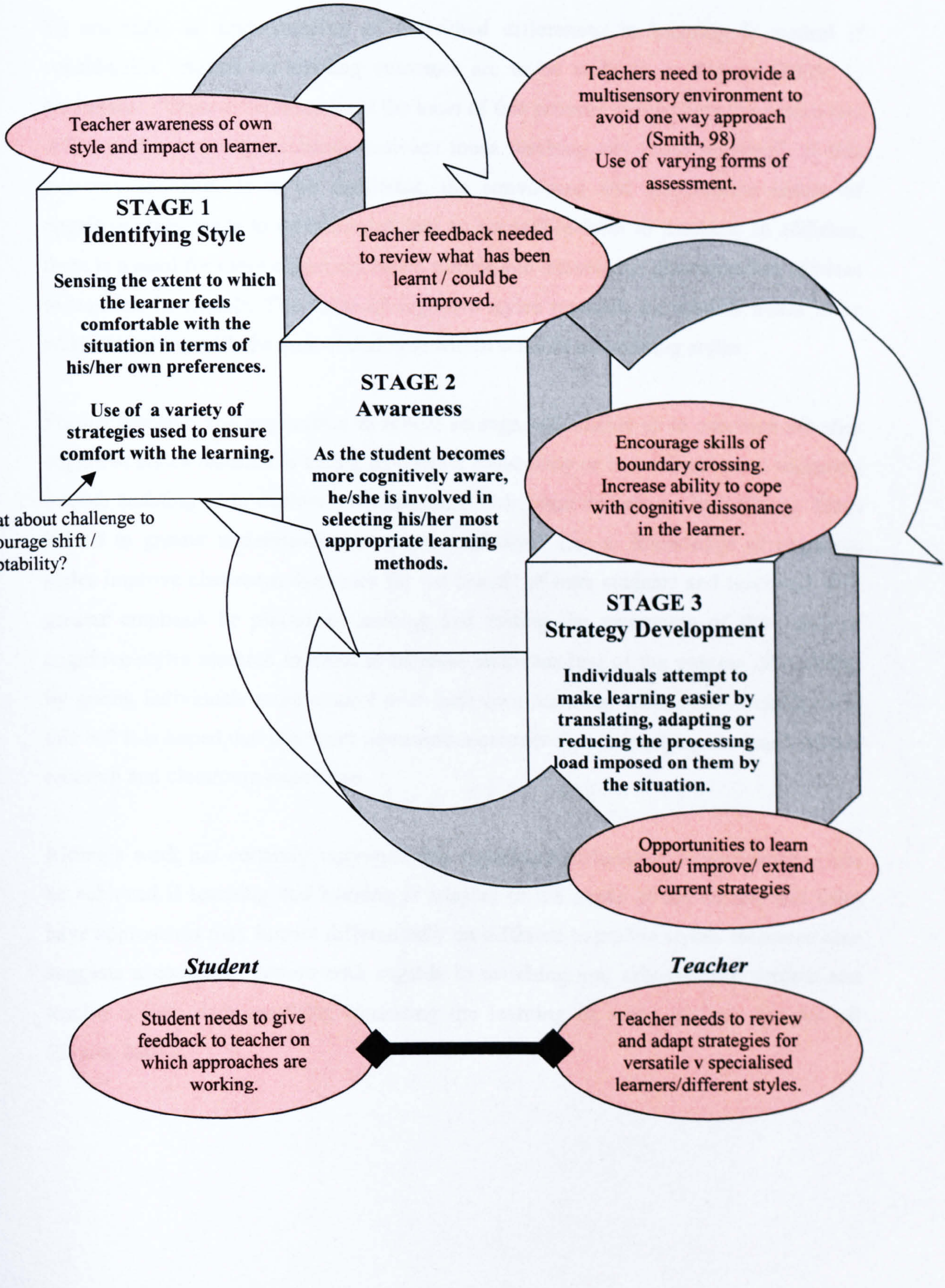
In order to effect greater versatility in approaches to learning, Smith (1998) and Sadler-Smith (1999) suggest that students could benefit from exposure to a variety of methods/styles of learning to increase their range of learning and of learning how to learn. In support of such a stance, Sadler-Smith (1999) proposed a three stage model, as

demonstrated in Figure 33, which takes on board the notion of explicit discussion between teacher and learner regarding the learner's 'learning profile.' Suggestions regarding the role of the teacher, in the learning process, have been added to the three learning points suggested by Sadler-Smith. In the 3 stage model proposed by Sadler-Smith, the learner is seen as central to the process, taking responsibility once knowledge is acquired for developing his/her own strategies, which in turn can inform new choice; such an approach is also advocated by Bruner (1996:64):

> "Modern pedagogy is moving increasingly to the view that the child should be aware of her own thought processes, and that it is crucial for the pedagogical theorist and teacher alike to help her to become more metacognitive – to be as aware of how she goes about her learning and thinking as she is about the subject matter she is studying. Achieving skill and accumulating knowledge are not enough. The learner can be helped to achieve full mastery by reflecting as well upon how she is going about her job and how her approach can be improved. Equipping her with a good theory of mind – or a theory of mental functioning – is one part of helping her to do so."

Adding support to this argument, Desforges (2001:17) comments on the massive significance of individual differences in learning and that to ignore the importance of individuality is 'akin to designing flying machines whilst ignoring gravity'. If teachers are to enable their students to fly, then they first require an understanding of their own style and how this may impact variably on different learners. Teachers also require the training and skills to enable them to encourage their own students to become reflective practitioners. In contrast to the suggestion in the Sadler-Smith model that one should ensure comfort with the learning for the student it could also be argued that learners may need to experience some discomfort if their existing learning patterns and frames of reference are to be challenged. As demonstrated in Figure 33, students also need regular feedback and opportunities to review what they have learnt and how they have done so most effectively. To this end, they need to be given opportunities to extend their learning repertoire toolkits. Teachers also need to be challenged, through good

Figure 33: Empowering the learner



continuing professional development, to question, elucidate and articulate their own teaching style and to consider the differential impact their style may have on a class.

To conclude, an understanding of individual differences in learning is central if considerable impacts on learning outcomes are to be realised; as Rayner (2003: 1) comments: "Style differences lie at the heart of this process, influencing the nature and efficacy of a two-way exchange between those teaching and those learning". If this two-way exchange is to be facilitated, the convoluted and labyrinthine nature of cognitive style needs to be translated into an accessible form to teachers. In addition, there is a need for more classroom based studies and subsequent dissemination of ideas to teachers in schools. The value of cognitive styles research for schools needs to be addressed along with the lack of dialogue within schools on teaching styles.

Further research and application in school settings will enable us to ascertain whether cognitive styles research is taking us down a blind alley or is a valuable and widening avenue enabling us to explore and understand individual differences in learning. Does it lead to greater understanding or more confusion? Can a knowledge of cognitive styles improve classroom dynamics for the benefit of both students and teachers? Will greater emphasis be placed on training and raising the awareness of the value of cognitive styles research in order to increase understanding of the process of learning, by giving individuals more control over their own learning; whose responsibility will this be? It is hoped that this work represents a contribution to bridging the gap between research and classroom exposition.

Riding's work has certainly suggested that significant differences in performance can be achieved if teaching and learning is adapted to the needs of the learner and links have approaches may impact differentially on different cognitive styles. Research also suggests a complex pattern with regards to matching and mismatching student and teacher styles; with matching enhancing the learning of some students but not all (Evans, 2001).

This research suggests, as documented in Chapters 7 – 9, that learning preferences/ teacher concerns/attitudes towards teaching may be influenced by cognitive style. In addition, cognitive style was found to interact with gender in affecting learning preferences and with gender and age in influencing teaching approach. Attitudinal variations were definitely apparent during interviews, with analytic and wholist students demonstrating different concerns and views about teaching. One of the biggest gains was encouraging teachers, new into the profession, to think about how they would cater for individual differences in learning: *"it made me think about the need to adapt to different learning styles."*

Some of the trainee teachers in this study had found discussions on style rewarding and were keen to know how they could encourage stylistic flexibility in their students, how to apply different styles, how to use strategies for different learning styles and how to understand their own style: *" I tend to think while planning every single lesson whether I am accommodating all learning styles", "my awareness of trying to provide for each learning style has increased and therefore I think I plan better for this."* The fact that the research programme had impacted on their practice was most rewarding.

An established attempt to evaluate the impact of applying new understanding about how we learn is that of the Campaign for Learning's Action Research programme; the aims of which are articulated by Bill Lucas, the chief executive of the project:

> " Learning to learn is the key skill of the twenty first century. In a rapidly changing and uncertain world it has to be the most important element of the curriculum, and I am quite clear that it should be the goal of every school to ensure that all pupils leave knowing how they learn best, ready for a lifetime of learning with confidence and enjoyment" (Lucas, 2002. In: Burnett, (2002:v).

The project is currently operating in 24 schools in England and Wales; Figure 34 identifies areas that are being researched. The majority of these studies focus on visual, auditory, kinaesthetic learning and Gardner's multiple intelligences; more is definitely needed on cognitive styles. All schools involved in the project have implemented

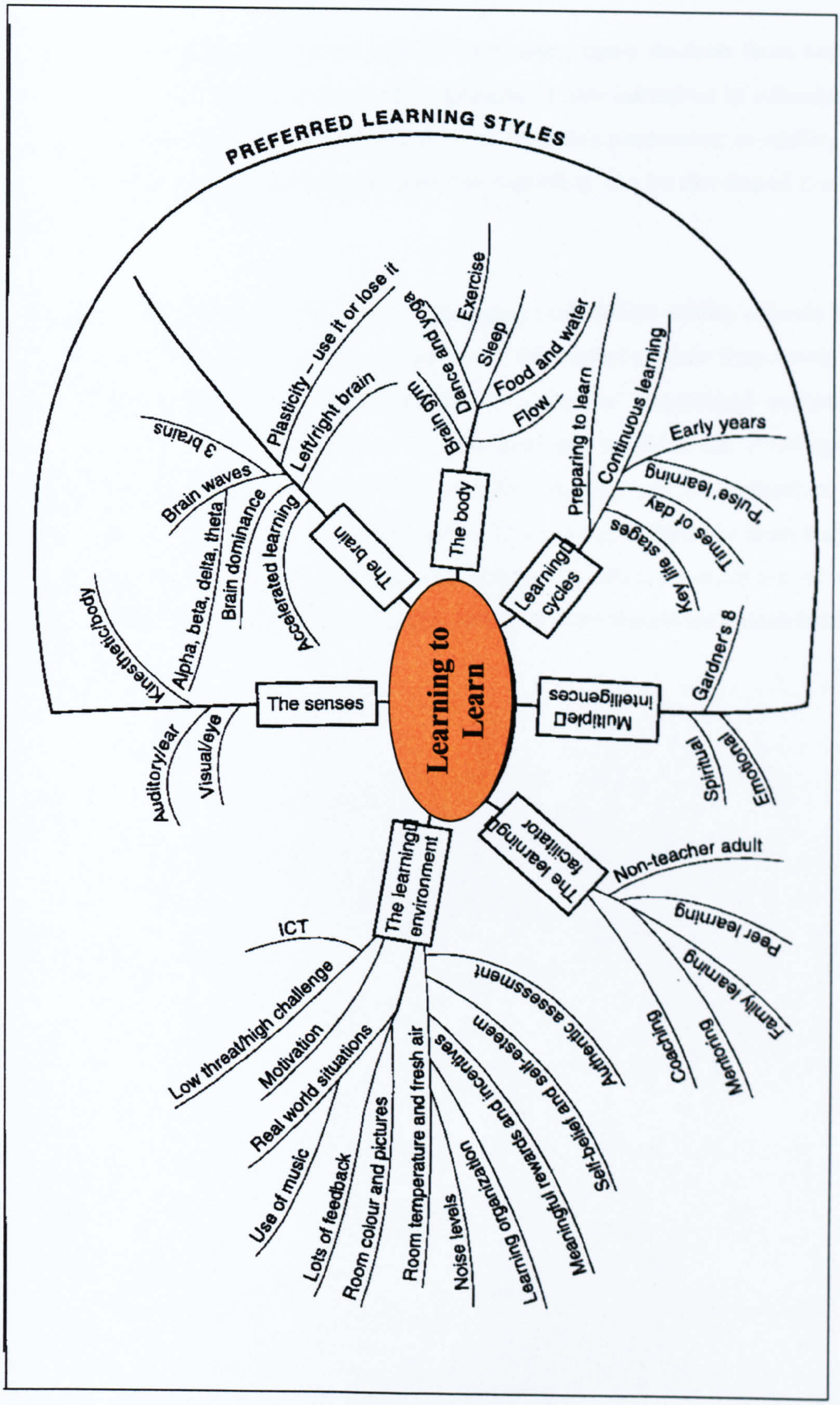


Figure 34: What is learning to learn?
Source: Craft, 2001

learning to learn modules although as Rodd (2003) notes, many teachers have beeen reluctant to try out new ideas because of the onslaught of new initiatives in schools. If improvements are to be made an understanding of cognitive processing capability is essential along with an understanding of how this capability can be developed (Aday and Shayer, 1994).

Cognitive styles research as a vehicle for encouraging such debate within schools has mileage. If teachers can gain a greater awareness of the impact of how they teach on individual student learning, then the possibility for enhanced educational outcomes could be considerable. In order to achieve this, teachers need to widen the 'lived space of learning' (Boulton-Lewis et al., 2001:158) for each individual and for themselves by introducing variation in teaching, enabling learners to see things differently from before and empowering them to explore alternative options. In raising awareness of the importance of individual differences, it is hoped that this work represents a contribution to such a process.

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Appendix A

Cognitive Styles Index

People differ in the way they think about problems. Below are 38 statements designed to identify you own approach. If you believe that a statement is true about you, answer T. If you believe that it is false about you, answer F. If you are uncertain whether it is true or false, answer ?. This is not a test of your ability, and there are no right or wrong answers. Simply choose the one response which comes closest to your own opinion. Work quickly, giving your first reaction in each case, and make sure that you respond to every statement. Indicate your answer by completely filling in the appropriate oval opposite the statement:

Like this ● not like this ●

T True	? Uncertain	F False

		T	?	F
1.	In my experience, rational though is the only realistic basis for making decisions.	O	O	O
2.	To solve a problem, I have to study each part of it in detail.	O	O	O
3.	I am most effective when my work involves a clear sequence of tasks to be performed.	O	O	O
4.	I have difficulty working with people who 'dive in at the deep end' without considering the finer aspects of the problem.	O	O	O
5.	I am careful to follow rules and regulations at work.	O	O	O
6.	I avoid taking a course of action if the odds are against its success.	O	O	O
7.	I am inclined to scan through reports rather than read them in detail.	O	O	O
8.	My understanding of a problem tends to come more from thorough analysis than flashes of insight.	O	O	O
9.	I try to keep a regular routine in my work.	O	O	O
10.	The kind of work I like best is that which requires a logical, step-by –step approach.	O	O	O
11.	I rarely make 'off the top of the head' decisions.	O	O	O
12.	I prefer chaotic action to orderly inaction.	O	O	O
13.	Given enough time, I would consider every situation from all angles.	O	O	O
14.	To be successful in my work, I find that it is important to avoid hurting other people's feelings.	O	O	O

15. The best way for me to understand a problem is to break it down into its constituent parts.	O	O	O
16. I find that to adopt a careful, analytical approach to making decisions takes too long.	O	O	O
17. I make most progress when I take calculated risks.	O	O	O
18. I find that it is possible to be too organised when performing certain kinds of tasks.	O	O	O
19. I always pay attention to detail before I reach a conclusion.	O	O	O
20. I make many of my decisions on the basis of intuition.	O	O	O
21. My philosophy is that it is better to be safe than risk being sorry.	O	O	O
22. When making a decision, I take my time and thoroughly consider all relevant factors.	O	O	O
23. I get on best with quiet, thoughtful people.	O	O	O
24. I would rather that my life was unpredictable than it followed a regular pattern.	O	O	O
25. Most people regard me as a logical thinker.	O	O	O
26. To fully understand the facts I need a good theory.	O	O	O
27. I work best with people who are spontaneous.	O	O	O
28. I find detailed, methodical work satisfying.	O	O	O
29. My approach to solving a problem is to focus on one part at a time.	O	O	O
30. I am constantly on the lookout for new experiences.	O	O	O
31. In meetings, I have more to say than most.	O	O	O
32. My 'gut feeling' is just as good a basis for decision making as careful analysis.	O	O	O
33. I am the kind of person who casts caution to the wind.	O	O	O
33. I make decisions and get on with things rather than analyse every last detail.	O	O	O
35. I am always prepared to take a gamble.	O	O	O
36. Formal plans are more of a hindrance than a help in my work.	O	O	O
37. I am more at home with ideas rather than facts and figures.	O	O	O
38. I find that 'too much analysis results in paralysis'.	O	O	O

Appendix B

Learning style Preference Questionnaire

Name:
Male / Female
Age:
Previous full time occupation
Qualifications to date (subject and grade)

PGCE Subject:

I am/not available for two short interviews

GCSE:

A LEVEL:

DEGREE:

SECTION A

1. What types of materials do you prefer to use:
A written/text based**OR**
B) diagrams/pictures/ maps?

2. How do you prefer to complete tasks:
A in writing,
B by speaking,
C in diagrams/pictures/maps?

3. In what context do you prefer to complete tasks:
A within groups of students,
B by yourself,
C with a partner?

4. Do you like leading groups:
A YES **B** NO

5. Do you like asking and answering questions
A YES **B** NO

6. What sort of tasks do you prefer:
A **imaginative**, where you are required to identify rules and ideas.
B **testing ideas**, where you are required to use information to test rules and ideas.
C **interpreting**, where you are required to analyse results and information, and draw conclusions?

7. What types of tasks do you prefer:
A **product-based**, where you are required to complete certain fixed tasks producing a piece of work where the emphasis is solely on the final outcome and not on how you complete it.

B **process-based**, where you are required to discuss and develop ideas or use certain strategies where the focus is more on how you complete the task, such as trying out or making up different ways of doing a task?

8. What types of task do you prefer:

A **closed**, where there is one, or a restricted range of correct answers and ways you must complete the task.

B **open**, where there is a wider range of possible correct/acceptable answers and you are allowed to arrive at these in your own way – own choice of format.

9. What type of tasks do you prefer:

A **knowledge/information learning**, where you are required to learn facts and information.

B **skill learning**, where you are required to learn how to use or do something?

10. Which method of teaching do you prefer: (Rank the categories in order of preference: 1 = most liked, 6 = least liked).

		RANK
A	Lecture	
B	Tutorial	
C	Discussion groups	
D	Computer-assisted learning	
E	Peer tutoring	
F	Individual work	
G	Presentation by yourself to the rest of the class	

11. In your own words describe what you believe constitutes good teaching.

12. What are your main concerns about teaching practice?

Appendix C

Teaching Styles Questionnaire

Name of Mentor:
School:
No.on roll:
Girls/Boys/Mixed
State/Independent

Name of PGCE student:
Subject:

Please circle the number which best describes the style of your PGCE student when preparing and teaching in the classroom during his/ her teaching practice with you. (Strongly Agree =1, Strongly Disagree = 5)

	strongly agree			strongly disagree	
1 Planning and organisational skills appear inefficient and disorganised.	1	2	3	4	5
2 The student behaves in an extravert manner both in/out of the classroom.	1	2	3	4	5
3 The student tends to act impulsively rather than cautiously or reflectively when tackling tasks.	1	2	3	4	5
4 The student finds it difficult to conform to rules and procedures.	1	2	3	4	5
5 The student is motivated more by extrinsic rather than intrinsic rewards.	1	2	3	4	5
6 The student seeks and requires a lot of support - is a dependent learner.	1	2	3	4	5
7 The student is very spontaneous - able to 'think on his/her feet'.	1	2	3	4	5
8 The student is not very creative in lessons/plans/tasks/ideas/thinking.	1	2	3	4	5
9 The student sees the 'bigger picture' when planning and teaching and avoids a narrow focus.	1	2	3	4	5
10 The student is very active both in and outside of the classroom.	1	2	3	4	5
11 The student is highly sociable and gregarious.	1	2	3	4	5
12 The student is a highly intuitive decision-maker rather than a rational one.	1	2	3	4	5
13 The student has little concern for precise detail in planning and delivery.	1	2	3	4	5
14 The student is very much an original thinker with his/her own distinct way of doing things - highly individualistic.	1	2	3	4	5
15 The student finds it easy to express his/her emotions.	1	2	3	4	5
16 Collaboration with colleagues is preferred to working on his/her own.	1	2	3	4	5

17 The student is flexible in his/her ideas/approach to planning and teaching.	1	2	3	4	5
18 There is not a strong emphasis on classroom discipline.	1	2	3	4	5
19 The student favours informal classroom approaches over formal ones.	1	2	3	4	5
20 The seating arrangement is very informal and varies according to lesson.	1	2	3	4	5
21 The student sees his/her role more as a facilitator - favours less teacher autonomy.	1	2	3	4	5
22 There are high levels of interaction between teacher-pupil and pupil-pupil in lessons.	1	2	3	4	5
23 The student's main focus in lessons is on skills rather than knowledge.	1	2	3	4	5
24 The student uses a wide variety of techniques/strategies in lessons.	1	2	3	4	5
25 Lessons mainly focus on whole class involvement rather than individual work.	1	2	3	4	5
26 Focus is mainly on discussion rather than lecturing - didactic exposition.	1	2	3	4	5
27 The student has highly developed interpersonal skills.	1	2	3	4	5
28 The student uses personal/idiosyncratic analogies a lot in lessons.	1	2	3	4	5
29 The student does not place a high emphasis on subject knowledge.	1	2	3	4	5
30 In lessons the student mixes freely and closely with the pupils - physically close rather than distant from students.	1	2	3	4	5
31 The student is reluctant to give critical feedback to pupils and does not frequently correct the learner.	1	2	3	4	5
32 The student provides pupils predominantly with facts rather than principles.	1	2	3	4	5
33 There is little structure to lessons – he / she often goes off at tangents.	1	2	3	4	5
34 The student does not ask a lot of questions in lessons.	1	2	3	4	5
35 There is a strong focus on high level tasks in lessons.	1	2	3	4	5
36 Questions asked are mainly open rather than closed ones.	1	2	3	4	5
37 Homeworks are individualised giving children choice rather than one standard format.	1	2	3	4	5
38 The student has a high personal knowledge of the students.	1	2	3	4	5
39 The student is not very pragmatic with planning/setting and marking work.	1	2	3	4	5
40 The student prefers an open-ended approach rather than the 'one correct way' approach.	1	2	3	4	5

41 There is a high use made of children's names in lessons.	1	2	3	4	S
42 The student prefers to operate in a very democratic classroom.	1	2	3	4	S
43 Written tests are not used a lot to assess children's understanding.	1	2	3	4	S
44 Marking of children's work is not very thorough.	1	2	3	4	S
45 The student adopts a realistic approach to teaching rather than an idealistic one.	1	2	3	4	S
46 The student tends to be inconsistent in planning, teaching and assessment.	1	2	3	4	S
47 The student gives a lot of positive feedback/praise to children.	1	2	3	4	S
48 The student tends to have a low self esteem.	1	2	3	4	S
49 The student 's working files/assignments are not very well organised.	1	2	3	4	S
50 The student finds it difficult to evaluate his/her own performance critically.	1	2	3	4	S
51 The student has good vocal delivery in the classroom - a good orator.	1	2	3	4	S
52 Worksheets tend to lack structure.	1	2	3	4	S
53 Worksheets consist mainly of text.	1	2	3	4	S
54 The student values ICT highly.	1	2	3	4	S
55 Presentation within class is highly visual - pictorial.	1	2	3	4	S
56 Little use is made of slides/OHP/ videos.	1	2	3	4	S
57 In lessons there is low use made of verbal tasks.	1	2	3	4	S
58 In lessons high use is made of written tasks.	1	2	3	4	S
59 The student has a good knowledge of subject specific vocabulary.	1	2	3	4	S
60 The student achieved very good academic results whilst at school.	1	2	3	4	S

****

FOR THE ATTENTION OF THE MENTOR

1.Please can you indicate what the predominant teaching style is within your department.

2.Was the form relatively easy to complete or were there problems with it? Please let me know if any points caused confusion or were difficult to complete. Which items? Why?

Thank you for completing the questionnaire. I very much appreciate your help. Please give the completed form to the PGCE student in the envelope provided, who will then return the form to X for my collection.
The first teaching practice form should be completed at the beginning of December and the second one by the 15th of May. If you would like to gain feedback from my research on teaching and learning styles please indicate below.
I would / would not be interested to receive follow-up research on teaching and learning styles.

Appendix D

Approaches to Studying Inventory

Please answer every item quickly by giving your immediate response. Circle the appropriate code number to show your general approaches to studying.
4 = definitely agree (DA)
3 = agree with reservations (AR)
1 = disagree with reservations (DR)
0 = definitely disagree (DD)
2 = only to be used if the item doesn't apply to you or if you find it impossible to give a definite answer.(?)

		DA	AR	DR	DD	?
1.	I find it easy to organise my study time effectively	4	3	1	0	2
2.	I like to be told precisely what to do in essays or other set work.	4	3	1	0	2
3.	It's important for me to do really well in the courses here.	4	3	1	0	2
4.	I usually set out to understand thoroughly the meaning of what I am asked to read.	4	3	1	0	2
5.	When I'm reading I try to memorise important facts which may come in useful later.	4	3	1	0	2
6.	When I'm doing a piece of work, I try to bear in mind exactly what that particular lecturer seems to want.	4	3	1	0	2
7.	My main reason for being here is so that I can learn more about the subjects which really interest me.	4	3	1	0	2
8.	I suppose I'm more interested in the qualifications I'll get than in courses I'm taking	4	3	1	0	2
9.	I'm usually prompt in starting work in the evenings.	4	3	1	0	2
10.	I generally put a lot of effort intro trying to understand things which initially seem difficult.	4	3	1	0	2
11.	Often I find I have to read things without having a chance to really understand them.	4	3	1	0	2
12.	If conditions aren't right for me to study, I generally manage to do something to change them.	4	3	1	0	2
13.	I often find myself questioning things that I hear in lectures or read in books.	4	3	1	0	2
14.	I tend to read very little beyond what's required for completing assignments.	4	3	1	0	2
15.	It is important to me to do things better than my friends, if I possibly can.	4	3	1	0	2
16.	I spend a good deal of my spare time in finding out more about interesting topics which have been discussed in lectures.	4	3	1	0	2
17.	I find academic topics so interesting, I should like to continue with them after I finish this course.	4	3	1	0	2
18.	I find I have to concentrate on memorising a good deal of what we have to learn.	4	3	1	0	2

Appendix E

Summary of results on Cognitive Styles and Learning Styles instruments

Instrument	maximun value	minimum value	mean	median	mode	range	standard deviation
CSA wa ratio (n=55)	2.52	0.67	1.34	1.32	0.93	1.85	.44
CSA vi ratio (n=55)	1.46	0.81	1.08	1.04	1.00*	.65	.16
CSI (n=84)	62	18	42.86	43	43	44	10.27
CSI (analysis) (n=84)	1.9	0.48	1.24	1.19	1.05	1.43	.332
CSI (intuition) (n=84)	2.12	0.41	1.03	1.059	1.12	1.71	.328
ASI (meaning) (n= 82)	24	7	15.81	16	15	17	3.97
ASI (reproducing) (n=82)	21	3	13.34	13	12	18	3.96
ASI (achieving) (n=82)	23	8	16.23	16	15	15	3.483
Mentor questionnaire using 32 items (n =59)	138	73	119.625	122	120	65	13.71

Appendix F

Interview format

1. How did your first teaching practice go?
2. What, if anything, did you take away from the lecture I gave? Was it useful to you?
3. What do you remember about the teaching style in which you were predominantly taught this subject?
4. What style were you most happy with at school?
5. From your observations of staff, which teaching style have you been most impressed by?
6. Do you think there is a preferred method of teaching your subject
7. What were your greatest difficulties in teaching for the first time?
8. How much support have you received from your school mentor, subject mentor and university tutor?
9. Who has been the most useful in helping you with your teaching?
10. Have you received your weekly entitlement form your school mentors?

10b. How often did you discuss subject content and methods/ style of teaching with your subject mentor?

11. Who else in school/college has been very helpful to you?
12. Look at this list of situational factors and ring the ones that you feel have had the greatest influence on your teaching style (see separate sheet).
13. What do you understand by the word learning?
14. What do you understand by the term teaching?

14b. Do you think you teach in the same way as you learn?

15. How would you now describe your own teaching style?
16. What would you like to know more about teaching and learning styles?
17. Did my lecture have any impact on the way in which you teach?
18. Are you able to take risks and try out new ideas? If not, why?
19. Did the pressure of trying to pass the QTS standards affect your teaching style?
20. What questions / issues would you like to raise?

Appendix G

Factors affecting teaching style

HISTORY OF BEING A LEARNER	**TEACHING ENVIRONMENT**
Experiences as a learner	Physical nature of teaching environment
History of tried experiences	Resources available
Exposure to different approaches	Subject related factors
Subject knowledge	Nature of syllabuses
Experiences as a novice teacher	Work load – no. of lessons
Success as a learner	Time of lessons
Subject choice	Class size
Preparation by College	Age of students
	Knowledge of students
SELF : Age / Sex / Race	Ability / range of ability of students- receptiveness
Ability	Gender / Race of students
Confidence	Culture of the School
Extraversion/Introversion	Support from Mentor
Risk – taking	Support from college tutor
Flexibility	Support from other teachers
Spontaneity	Support from peers
Ability to accept criticism	School attitudes towards subject
Ability to deal with stress	Culture of the school
Organisational abilities	Length of working day
Energy	Classroom management skills
Learning preferences	Subject knowledge
Receptiveness to new ideas	Size of school
Inherent ideas about what constitutes good teaching	Extra-curricular demands