Issues of Interaction: A consideration of factors that impact upon children operating, in junior classrooms, as reflective practitioners in the context of group-based practical problem solving activities

Thesis

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Statement of Originality

I wish to argue at this juncture that the work I have developed over the course of the Ed. D programme has an appropriate degree of originality. I have not been able to locate other published texts devoted specifically to the same research question, though I have attempted to build upon the work of, for example, Mercer et al (1999) who have carried out research on children's use of 'exploratory talk', and Kruger's (1993) focus on 'transactional dialogue', concepts that have been of particular relevance to my own operational definitions of 'metacognitive questioning' and 'reflective practitioners'. In this sense, I would hope that the conclusions and recommendations drawn at the end of this thesis will lend further support both to the effective use of collaborative endeavour, as part of classroom teaching and learning strategies, and the associated development of children as independent decision makers, able to use reasoned argument to support the optimised resolution of practical problems.

Foreword

The study detailed in this text focuses on a range of factors that are seen to impact upon junior aged children operating as '**reflective practitioners**' during group-based practical problem solving activities; in simple terms, on the extent to which such pupils develop lines of thought and action that are based on reasoned argument. At the outset of the investigation a focus on teacher-pupil interaction was adopted, as I was initially keen to establish, in particular, an understanding of how teacher questioning might support, or indeed hinder, children operating in this manner. However, over time, classroom based observational work and associated post observation interviews, with teachers and pupils, stimulated an examination of a broader range of issues as shown in Figure 1.1 (see page vi).

The extensions indicated by this model represent an overview of the way in which I have accepted, and tried to elaborate upon, a growing realisation that the development of young children as reflective practitioners can be associated with a combination of interrelated factors (*metacognitive questioning, task structure, the management of group work and the concept of cognitive dissonance*) which are themselves linked to aspects of the institutional macro and micro cultures within which teachers and pupils operate. As such, the study has deepened, as it has attempted to take cognisance of the complexities that are clearly evident in primary classroom environments. Consequently, data collection and analysis has moved appropriately beyond what had initially seemed to be a much more simplistic interfacing of individuals, that is: the role of teacher questioning during teacher-pupil interactions and the ways in which children respond to such interplay, to a position that now affords a more precise focus on factors of relevance to the research question.

As such, it has also led to a realisation of the limited impact that teacher pupil interaction appears to have on young children operating as reflective practitioners. As the findings will indicate (*see Chapter*

4), whilst some evidence is available to illustrate what might be termed 'best practice': teachers' metacognitive questioning promoting reasoned decision making, the study has also shed light on a range of other factors that can equally, in an interrelated fashion, undermine such outcomes. Those that are considered are the nature of task structuring, the effective establishment of ground rules for collaborative endeavour and cognitive dissonance.

Not surprisingly, perhaps, the generation of promising answers to the question of how children might best be supported as reflective practitioners remains, to some extent, elusive; whilst the discovery of new questions to explore have presented themselves for ongoing examination.

Nevertheless, I would wish to think that what could profitably emerge from the data analysed, and the tentative conclusions drawn, is a signpost to classroom teachers suggesting that a personal reflection on the factors that have been identified will support either a shift in or consolidation of their own thinking and a change in or consolidation of their current teaching repertoire (*see Chapter 5: Conclusions and Recommendations*); an objective consideration that will lead them to value the importance of promoting reflective practice as a means of supporting young children as independent thinkers. For, as Howe suggests:

> 'If you cannot increase reflective power in people, you might as well not teach, because reflection is the only thing in the long run that changes anybody.'
>
> (Howe A. 1997 p.12)

Abstract

This thesis sets out to provide an insight into a range of factors which have been observed to impact upon the extent to which junior aged children, engaged in group-based practical problem solving activities, operate as **reflective practitioners** – essentially, as reasoned decision makers. It offers a detailed rationale for both the focus of the research study - an examination of influences on young children as reflective practitioners and the qualitative methodology adopted. It also provides, as part of its data analysis (*centred on verbal interaction between teacher and pupil(s) and amongst pupils themselves*), conclusions and recommendations, suggestions of ways in which teachers might best support young children as reflective practitioners; in effect, by taking cognisance of, and acting upon, both the concerns (*limitations*) and positive aspects (*best practice*) identified and discussed within the text. As a consequence, it is hoped that teachers can develop a classroom culture where all players recognise that both 'action' and 'reflection' are essential and valued components of the effective management of practical problem-solving processes, and that a willingness on the part of pupils to 'think', before they 'do', supports the efficient development of an optimised, end product.

The treatise is organised around an examination of the importance of four key issues: metacognitive questioning, task structuring, the effective management of collaborative endeavour and cognitive dissonance. These are shown to operate in an interrelated and complex manner, thereby highlighting the inherent difficulties in the proficient advancement of problem resolution by young children functioning in the context of group-based activities. In short, the complexities associated with securing the optimised solutions to problems in hand, noted above.

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Lastly, gratitude is extended to all of the schools that have helped me in the field. To the head teachers who kindly agreed to have me on the premises and, most importantly, the classroom teachers and children who were watched and quizzed.

Many thanks.

The Development of the Study over Time

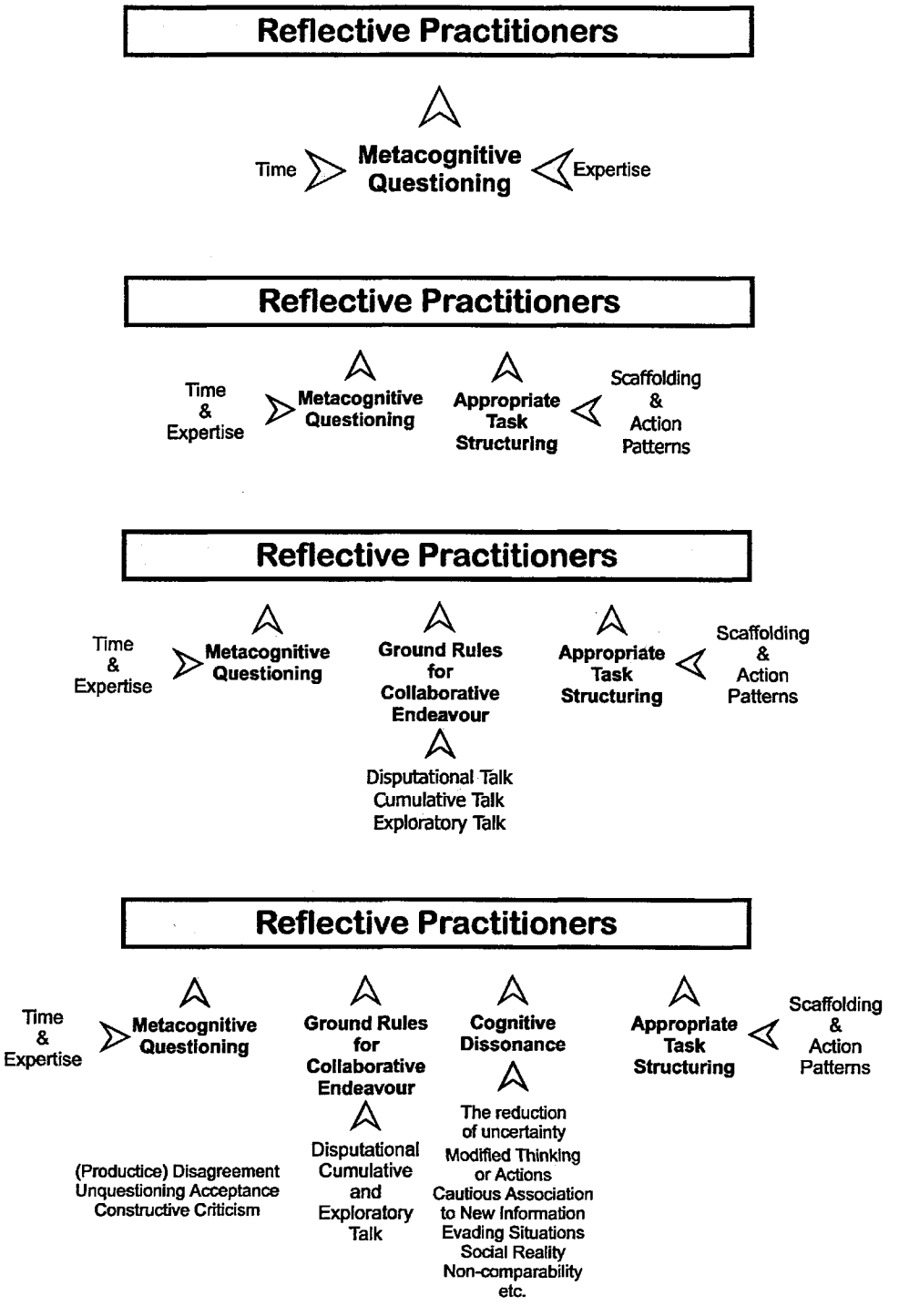

Figure 1.1

Rationale for the study

I would wish to commence this thesis by noting my initial reasons for engaging in the research study, together with an explanation of why I think a better understanding of the ways in which junior aged children, operating in the context of group-based, practical problem solving activities, can be supported as 'reflective practitioners' is important in the context of educational practice.

Firstly, the initial stimuli: where an early association between theory and practice was established. The theoretical prompt came from my reading of Research Report 115: From Thinking Skills to Thinking Classrooms, commissioned by the DfEE and written by Dr. Carol McGuinness (1999). In that text McGuinness noted the importance of developing thinking skills, as part of curriculum provision, including, among other things, the need for schools to be creating dispositions and habits of good thinking, in their pupils. Moreover, she saw the intervention of teachers as a key component in terms of not simply what children learn, but how pupils learn. Not least, teachers modelling good practice. McGuinness also suggested three models for delivering thinking skills including a need for schools to examine opportunities within subject domains. In this context, thinking skills can be seen to be based upon:

- children developing a vocabulary for talking about thinking;
- making thought processes explicit
- reflection
- collaborative learning

This led to further reading and an identification of 'reflective thinking' as a corner stone of education, together with the need for teachers to develop a classroom ethos conducive to such thinking.

The practice link, stems from my work as a member of an education department that involves regular visits into primary classrooms in order:

- to supervise trainee teachers;

- to engage in yearly recent and relevant experiences that provide opportunities for me to take responsibility for Design and Technology projects, usually six to eight afternoon sessions and,

- to work as a team inspector (*though not currently*),

seemed to cast doubt on the extent to which the key aspects of a thinking classroom, espoused by McGuinness, were currently being considered or developed, particularly during practical problem-solving activities which, I believe, offer an excellent vehicle for developing the 'thinking skills' listed above.

It was because of this perceived disparity that I was initially keen to investigate how teacher questioning impacted upon junior aged children as 'reflective practitioners' though, as the study developed, I became far more aware of a complex interweaving of a number of additional key issues, as set out in figure one above.

What has remained constant, however, is my desire to support effective classroom practice by way of either consolidating or changing teaching repertoires as a means of moving pupils forward, not least as independent decision makers disposed to reasoned argument as a key component of effective collaborative endeavour.

For me, primary teachers should see group work as an important strategy in the development of young children and an important aim of the study has been to expound a line of argument that will encourage practitioners to reflect on their current pedagogy and recognise the relevance of ensuring that they provide appropriate opportunities and support, during practical problem solving activities, designed to enhance children's abilities as 'reflective practitioners' as part of a active approach to 'thinking skills' within the context of a 'thinking classroom'.

Having provided my initial reasons for research undertaken I can extended this opening section by developing my rationale for the study by way of examining: the importance attached to reflection as an aspect of the design and make process (*practical problem solving*); the significance of teacher questioning, as an aid to reasoned decision making and the relevance of reflection to the broader notion of 'thinking in education'. It ends by considering what are seen to be key issues: metacognition, metacognitive questioning and reflective practitioners, thereby refining earlier points of reference as a means of underpinning the operational definitions that are then discussed.

It should be noted, at this juncture, that the study is firmly located in the context of group based activities and that subsequent examination of key concepts and concerns will be undertaken within this framework.

Subject Specific Relevance

The newly published National Curriculum for Design and Technology in Wales, ACCAC (2000), sets out a list of what are referred to as 'common requirements'. Within this list, under the sub-heading of 'Problem-Solving Skills', there is an obligation, on the part of teachers, to provide children with opportunities to:

> 'Develop and apply their skills of asking questions, making predictions and coming to informed decisions.' (p.5)

In the National Curriculum for Design and Technology, DfEE and QCA (1999), it was noted that the subject should provide opportunities to promote '*thinking skills*' (p.9) The preceding documents, DfEE (1995) and Welsh Office (1995), indicated that pupils should be taught to, among other things, clarify their ideas, develop a clear idea of what has to be done, suggest alternative methods of proceeding if things go wrong, suggest ways forward and evaluate their designs as these develop. Similarly, The Assessment

of Performance Unit (1991), under the stewardship of Professor Richard Kimbell saw, as one of the main planks of Design and Technology 'capability', the need for teachers to give full consideration to both reflective thinking and active doing, because they are inextricably linked parts of a dynamic, interactive and iterative process. Robert McCormick (1999), discussing the link between 'procedural' and 'conceptual' knowledge, stressed the importance of teachers encouraging what he termed 'qualitative reasoning', as an aid to effective 'designing' and 'problem solving'. For him, practical knowledge is qualitative in nature and is:

> 'Not just to do with how situations are described but how actions are reasoned about.' (p.127).

'*Reasoning*', in the context of this research study, relates particularly to pupil's efficient use of 'procedural and conditional knowledge'. To their understanding and effective use of appropriate strategies (*for designing and making*) as a means of resolving a problem in a proficient manner. For example, choosing to experiment through the direct manipulation of materials as opposed to developing an annotated sketch. As well as, knowing '*when*' to apply such strategies and, as reflective practitioners, recognising the value of offering rationalisations for the judgements that are made and taken. Indeed, the ability of pupils to choose and use suitable strategies at appropriate moments in time and, moreover, to be able to clarify and justify such thoughts and actions, is an essential feature of design and technological capability and needs to be nurtured. To this end, Hunkin (1995, p.21), discussing the concept of metacognition (*see 'Key Issues' pp. 18-27*), argues that pupils' abilities to ask questions of themselves, which help to organise the means by which they attain a particular goal, are crucial to learning how to learn. Moreover, he indicates that students engaged in reflective action will probe themselves or their classmates to determine why they are making the suggestions they are advancing. In respect of Design and Technology activities the crucial matter is that of encouraging pupils to 'optimise'; to work toward what they believe to be the most

competent lines of action, based upon a willingness to stop and 'think' before 'doing'.

Given this 'objective', what I am wishing to assert here is the importance of effective social interaction, as a catalyst for reflective practice. For, as Kimbell et al (1996 p.31) have argued:

> 'Design and Technology not only enhances the thinking and decision-making powers of young people, it also enhances their conscious awareness of those thought processes. They not only learn to think and make decisions, they also know and can see that that is what they are doing.'

Of critical importance here is the development of independence; children who are able to think, and do, for and by themselves. This position has a long and well-established pedigree within the subject field. Indeed, since the late 1970's a number of authors (Alyward 1973, Eggleston 1976, Kimbell 1982), whilst championing design based educational experiences, have referenced, in a variety of ways, the notion of responsible and autonomous decision making as one of the key aspects of the learning associated with children's interaction with the design process. Richard Kimbell (1982), for example, laid stress on the opportunities for 'thinking' afforded by appropriately targeted problem-solving activities. Here, the term 'appropriate' was related to the extent to which problems were manageable from the child's perspective – effectively building on prior experience - yet offering sufficient 'difficulties' to challenge thought. For him, thinking, in the context of designing, requires the externalisation of thought through concrete operations – drawing, modelling and talk. Indeed, reasoned decision-making needs to be expressed in concrete terms, including verbal responses, in order to move ideas forward, rather than them remaining lost in the recesses of the mind. Moreover, he felt that:

'There is no magical point at which children suddenly become capable of thinking for themselves, for this is a quality which develops gradually as a result of continued experience. ' (p.15)

Kimbell also saw the function of the teacher as one of 'scaffolding' (*see Chapter 2: Task Structuring pp. 53-71*) this process, by:

'Steering children towards the goal of independent thought and action along a tortuous path of guided or supported freedom.' (p.16)

I would wish to argue that such steering, toward greater levels of autonomous decision-making, is dependent, in large part, upon teacher-pupil interaction and, in particular, the use of effective questioning strategies, thoughtful task structuring and the establishment of relevant ground rules for collaborative endeavour. In all of this, teachers' verbal interventions are significant and in terms of questioning skills, Kimbell (1982 p.22), quoting Downey and Kelly notes that:

'Judicious questioning serves to orient the child towards phenomena that might otherwise be overlooked or even taken for granted. This kind of questioning is very different from that employed by teachers who merely want to find out whether a child has learnt (or can repeat) what he the teacher has just said.'

These points are mirrored by Ritchie (1995 p.40) who, whilst stressing that the role of the teacher during design and technology activities is multifarious, goes on to indicate the importance of:

'Asking the right questions at the right time, encouraging the child to explore ideas further and clarify existing ideas, making appropriate interventions to challenge existing ideas.'

Such ideas, of course, might be those concerned with the functionality or aesthetics of a product, the suitability and selection of materials available, how to proceed, who should do what or why a

specific option/pathway is deemed appropriate. In all cases, if pupils are to work towards an optimum solution to a given problem, then I would wish to argue that they need to be reflective, to consider their own or others current position and how best they might move forward. That is, to put 'thought', most effectively into 'action'.

Moreover, by encouraging young children to 'think' before they 'do', to 'reason' in an open exchange of dialogue, teachers will also be supporting Mercer's (2003) argument for extending pupils repertoire of language genres enabling them to:

'Use language more effectively as a means of learning, pursuing interests, developing shared understanding and – crucially – reasoning and solving problems together.'

Consequently, two important roles for teachers can be identified:

- the need to encourage pupils to operate as 'reflective practitioners'

and

- a developing awareness of how this aim might best be secured by appropriately changing or consolidating aspects of their personal pedagogy

Certainly, doubts have existed for some time about the nature of classroom practice in the context of problem solving activities. For example, Her Majesty's Inspectorate (cited in Fisher, 1987) expressed concern that children were not being sufficiently challenged nor encouraged to exercise initiative or to work towards their own problem solving solutions as a means of developing inquiring minds and reasoning skills. Given this suggestion, this research study should support a teacher's consideration of how their interaction with children can be effectively utilised to encourage pupils, when working together, to analyse their intentions as a means

of optimising their actions within design based, practical problem-solving activities. For, as Davidson and Sternberg (1998) recognise, intervention that encourages self-reflection has been found to improve problem-solving performance. This is not to suggest, however, that this aim is readily attained. Indeed, if one considers only the aspect of questioning, issues for deliberation quickly arise. David Wood (1992), for example, draws attention to the fact that whilst questioning (*see Chapter 2 pp. 28-42: Questioning*) is a pervasive aspect of classroom practice it can, if inappropriately utilised, be threatening. Moreover, Wood points out that the vast majority of classroom based questioning does not promote, 'deep or searching intellectual activity' (p.205) and that teachers need to think about how they might raise the cognitive demands of their interactions by posing questions which seek analysis, justification and reasoning, such that children become more able to think for themselves. This said, if used effectively, questioning may offer, as Socrates promoted, the possibility of motivating, sustaining and directing the thought processes of pupils, which, in the context of practical problem solving, should support the development of optimal solutions to problems in hand.

Reflective practice, then, can clearly be seen to be an important aspect of practical problem solving, not least in securing optimal resolutions by way of reasoned decision-making. Moreover, teacher questioning can, if appropriately structured, support this aim and the following sub-section elaborates on this issue.

The importance of reflection and associated teacher questioning

Here I will highlight the importance of 'reflection' both in general terms and as a precondition for children, when working collaboratively, attaining a 'shared understanding' of how to make effective and efficient progress when resolving practical problems.

Reflection, a willingness to 'think' before 'doing', is important because it can be seen to underpin proficient problem solving: the seeking of resolutions that are optimised. As a means towards this end, effective teacher questioning, during practical problem solving activities, can support children's development as reflective practitioners, at least in part. So what types of questioning should teachers utilise? The answer, in simple terms at this stage, is questioning that prompts children to use reasoned argument in order to identify, clarify and justify lines of thought and action; to evaluate their own and others current position, thoughts and actions and to plan ahead. (*see Key Issues – Metacognitive Questioning and associated Operational Definitions pp. 19-22*).

But why should questions that support reflective practice be of significance? Raths et al (1986) suggest that the prime concern of teachers should be teaching children 'how to think' and that 'reflective thinking' is, for them, at the core of teaching for thinking interactions (p.171). I would argue, moreover, that encouraging a developing understanding of the relevance of reflection: a willingness to be critical of both oneself and others is vitally important for capable, practical problem solving. As Raths et al confirm, teaching pupils how to think includes 'reflective thinking' which may be linked to the notion of 'suspended judgement' (p.160), the gap between the recognition of a problem and one's response. In short, the importance of pupils' giving themselves, and others, time to review the current position of their progress towards problem resolution as a valuable precondition to the development of optimal solutions; particularly true, as an aspect of the design and make process. Dewey, cited by Max van Manen (1995) noted that, 'reflective thinking' is important not only as a tool for teaching, but also as an aim of education, since it enables us to know what we are about when we act. Moreover, he goes on to acknowledge that whilst the concept of reflection needs to be viewed as 'challenging' and involving such things as perplexity, conjectural anticipation, analysis, deciding on a plan of action or doing something about a desired result, it must be wedded, when viewed as a skill, to appropriate

attitudes. Here then, one also needs to recognise the important part that teachers can play in promoting relevant personal qualities, including a willingness to reflect, as an important aid to making effective design and practical judgements. In part, this signpost provides a useful relationship to those aspects of interaction considered elsewhere in this presentation (*effective task structuring, the management of collaborative endeavour and, more broadly, to the concept of cognitive dissonance - see Chapter 2 pp. 28-85*). Dewey also suggests certain categories of reflection (*retrospective, anticipatory and contemporaneous*) and, of these, the latter, focused upon what he terms 'stop and think action', is of primary concern here. Why? Because this form of reflection would seem to relate most directly to the significance of pupils utilising reasoned thought as a check on their/others current positions and intentions. For, without such consideration optimal resolutions may not be as readily secured. This can be further linked to those aspects of 'thinking skills' referenced by Burden and Nichols (2000 p.300) which relate to pupils' ability to break down and solve problems and to 'think before rushing in'. Fisher (1987) argues that teachers should make use of a range of questioning strategies that can effectively promote children's problem-solving approaches. An essential feature here will be the extent to which children are encouraged to enter into dialogue that provides an opportunity for them to think at a deeper level: to reflect, to consider alternatives and to engage in independent reasoning. In similar vein, Jeni Wilson and Lesley Wing Jan (1996) have suggested that in order for children to become active and responsible learners: willing to make their own decisions, choose appropriate strategies, assess their own work and set their own goals, they need to be encouraged to think about their learning and to become aware of and control their thinking processes. For them, 'reflective processes' are an essential ingredient of effective teaching and learning, providing children with opportunities for analysing and making judgements about the progress of their own work.

Authors advocating the broader notions of 'thinking in education' (*see Reflection and 'Thinking in Education' pp. 15-18*) and 'higher order

thinking skills' further support the importance of 'reflection'. Here, the work of Matthew Lipman (1991), for example, is relevant. In contrasting what he refers to as the standard and reflective paradigms of the educational process he notes that in the latter, students should be expected to be 'thoughtful and reflective, and increasingly reasonable and judicious' (p.14). For him, the reflective paradigm sees education in terms of 'inquiry' and student thinking in terms of participation in a community of inquiry, an important means of developing higher order thinking – a complementary fusion of the critical (*reasoning and critical judgement*) and the creative (*craft, artistry and creative judgement*) aspects of thinking. Indeed, Lipman suggests that if we are to be concerned with education for higher order thinking then curricula and pedagogies should aim to 'educate for judgement and deliberation.' (p.51)

He goes on to cite Resnick (p.69) in defining higher order thinking as involving:

> 'A cluster of elaborative mental activities requiring nuanced judgement and analysis of complex situations according to multiple criteria. Higher order thinking is effortful and depends on self-regulation. The paths of action or correct answers are not fully specified in advance. The thinker's task is to construct meaning and impose structure on situations rather than to expect to find them already apparent.'

It is this notion of self-regulation that has significance here, in terms, that is, of children operating in environments in which they are encouraged to act as reflective practitioners. Indeed, these issues are all crucial to efficient problem solving in the context of Design and Technology activities and will form part of the operational definitions of 'reflective practice' outlined below.

As such, self-regulation is seen to involve not simply self-monitoring but also self-correcting behaviours, requiring autonomy and self-government. Moreover, within classrooms, pupils should be engaged

in independent, imaginative and resourceful thinking to support rationality, judgement and creativity. All of these qualities are essential to a pupil's developing design and technology capability and are readily linked to the notion of 'reflective practice' and the need for teachers to think carefully about the way in which they structure group activity, practical problem solving tasks and their ongoing verbal interactions with pupils, including their use of 'metacognitive questioning'. These concepts are considered in greater detail in the section sub-headed 'Key Issues', to be found below.

At this juncture it is worth noting that Grugeon et al (1998 pp. 80-97) highlighted the following matters as worthy of teachers' consideration when contemplating the nature of talk during group-based activities:

- Are children functioning as a group? Are they collaborating with one another, or do they seem to be working individually?

- Are the children considering one another's ideas carefully?

- Does anyone give a reason for/justify what they say – to what extent is 'rational thinking' part of pupil-pupil interaction?

For these authors:

'Talking with a partner is an opportunity to put half-formed ideas into words. Having to say what you mean, thinking aloud, is a way of making your thoughts clear to yourself: and having to say things to a partner is a way of developing a shared understanding of ideas. If your partner is prepared to accept your initial suggestion, without you having to justify or defend it, you have no stimulus to engage critically with your own thoughts. Also, you have no alternative suggestions to produce the creative friction from which new ideas arise.' (p.85)

These issues provide a useful bridge to other elements of this study, not least the ways in which teachers structure both the tasks that children are to undertake (*see Chapter 2: Task Structuring pp. 53-71*) and the extent to which pupils engage effectively and efficiently as co-collaborators in the resolution of the problems they face, together (*see Chapter 2: Ground Rules for Collaborative Endeavour pp. 43-53*). Moreover, the management of tasks and group activity will be seen, elsewhere in this text, to be linked to the notions of 'disputational', cumulative' and 'exploratory talk' (*see Chapter 2: pp. 46-49*) which, I will attempt to show, are themselves closely aligned to the operational definitions which have come to underpin the study.

Moreover, the 'shared understanding' identified by Grugeon et al is, I would argue, a more likely consequence of collaborative endeavour, when a key aspect of that endeavour involves pupils operating as reflective practitioners. Furthermore, it is a consequence that, for me, underpins practical problem solving which can be seen to be focused and valuable. Focused, that is, on relevant aspects of the task and valuable in the sense that 'thinking' before 'doing ' supports effective problem resolution founded on a recognition of the need to optimise actions through reasoned argument and decision making.

In short, as this sub-section has identified, thoughtful reflection is a key component of proficient practical problem solving. As such, it should be effectively supported by teachers because, in the first place, reasoned thinking is a fundamental component of the development of independent, self-regulatory and more capable learners; and secondly, because 'reflective practice' can be seen to be an integral part of any 'thinking in education' paradigm; paradigms that will also have the development of children as 'autonomous decision makers' as a key focus. I now, therefore, turn to this issue.

Reflection and 'Thinking in Education'

Berardi-Coletta et al (1995 p.222) have recommended that:

'Becoming aware of what one is doing and why, need to be emphasized when problem-solving skills, in any domain, are being trained.'

Whilst I do not see the focus of my research in terms of 'training', per se, I am setting out to assess the extent to which pupils are led to value 'reflective practice', as part of teachers' standard classroom practice, during practical problem solving activities and, in broader terms, the extent to which the case for 'thinking in education' is being assisted. As previously noted, Raths et al (1986 p.171) argue that, 'reflective responses are the core of teaching for thinking interactions.' As such, appropriate teacher-pupil interaction within the context of Design and Technology activities ought to be able to support what are termed, 'infusion approaches' – the development of thinking skills across the curriculum where context can be identified in which particular thinking skills and strategies can be effectively developed (e.g. McGuiness et al 1996 & 1997 Activating Children's Thinking Skills Phase 1 and 2 respectively,) as opposed to specific teaching programmes (e.g. Feuerstein et al's (1980) Instrumental Enrichment, The Somerset Thinking Skills Course by Blagg et al (1988) or Lipman's Philosophy for Children (1985, 1987 and 1991) etc;) Such approaches are seen by McGuiness (1999 p.7) to:

'Both capture a situated view of learning while at the same time keeping general cognitive development in mind.'

That is, an approach to classroom practice across the curriculum where particular thinking skills and strategies can be appropriately developed, that in line with McGuiness and Nisbett (1991), are based on a recognition that:

'To develop capable learners and thinkers we need to rely on more than rote memory, factual knowledge, and the routine application of familiar procedures.' (p.174)

For McGuiness and Nisbet (ibid), the acquisition of thinking and problem solving skills should be seen to be an accepted primary aim of education. Moreover, such thinking, in developing what they refer to as aspects of self-regulation, should help to promote a child's use of metacognitive processes including 'orientation, planning, monitoring, self-testing, reflecting and judging' (p.176); what are referred to as 'good strategy users'. Here, a direct link to the effective use of 'procedural' and 'conditional' knowledge within the design and make process can be readily made.

What is of further importance here is the more direct relationship between thinking skills programmes, of whatever type, and the development of children as autonomous decision makers. As McGuiness, in Gilhooly (1990) notes, most thinking skills programmes seek to develop metacognitive activity to varying degrees and, furthermore, highlight the importance of social interaction relative to cognitive change.

In broader terms, it is also possible to see an important link between 'reflective practice' and the notion of critical thinking. Whilst I do not wish to labour this point the following will help to illustrate the suggested relationship. For example, Garrat et al (2000) cite Ennis in defining critical thinking as, 'reasonably reflective thinking that is focused on deciding what to believe or do' (p.153). In the context of design and technology activities, decisions related to the aspect of 'what to believe' can be seen to be associated with the ways in which a pupil, or pupils, gauge which ideas are considered to be most appropriate to develop; whilst the question of 'what to do' is clearly related to the effective use of procedural and conditional knowledge; namely, to apply their understanding and effective use of appropriate designing and manufacturing strategies: the 'why' and 'how', together with their efficient use of conditional knowledge, knowing 'when' to

apply such strategies. For example, a group may reach a considered agreement on constructing a simple square section framework using card triangles to strengthen each joint. They choose to use PVA glue recognising that they will need to be patient, to allow the glue to dry, but on the basis that this type of glue will give them some latitude for any errors whilst assembling their work. They also acknowledged, in the context of the whole project, the need to construct the framework prior to fixing the required drive mechanism.

In similar fashion, Latham (1992 p.261), stresses that the National Curriculum (*in its 1992 guise*) has, as one of its central beliefs, a notion that 'reflection' is an essential constituent of learning and that:

> 'Reflection is increasingly recognised as a way of supporting sustained, critical thinking, of helping pupils to make explicit to themselves, as well as to others, what they know, understand and can do.'

Correspondingly, Barnes (1992 p.127) notes that:

> 'Reflection, including the reflection that is enabled by talk outside the event, seems to be an essential pre-requisite for critical thinking and the modification of what we believe.'

In summary, the rationale for the study is based upon the importance of junior aged children, during group-based practical problem solving activities, being encouraged to operate as reflective practitioners as a means of:

- Developing their understanding of the need to work collaboratively towards optimal solutions on the basis of reasoned thoughts and actions.
- Developing their understanding of the importance of appraising their own and others' thoughts and actions critically, but constructively.

- Developing them as autonomous decision makers who utilise a range of effective strategies to secure proficient progress.

Moreover, the encouragement, noted above, will come from teachers recognising and acting effectively upon:

- A clear understanding that 'reflective processes' are an essential ingredient of effective teaching and learning that may require a change or consolidation of their current teaching repertoire, including effective questioning, task structuring and the setting of effective ground rules for collaborative endeavour.

Key Issues:

Metacognition, Metacognitive Questioning and Reflective Practitioners

In the previous section a number of references were made to the relationship between 'reflective practice' and 'metacognition'/ 'metacognitive processes'. Not least, that reflection will involve pupils asking critical questions of themselves, or others, as a means of moving proficiently toward agreed goals. Links were also drawn to the important part that teachers can play in terms of encouraging children to explore ideas further and/or to clarify/justify/challenge current thoughts and intentions (see p.5). In this sub-section, therefore, I will extend my consideration of the relationship outlined above, together with identifying the relevance of a teacher employing 'metacognitive questioning' as a part strategy for encouraging children to operate as reflective practitioners. In this way I would hope to offer a refinement of major concepts as a foundation for the operational definitions that are detailed below.

Here, it must be stressed, that from this point forward, 'metacognitive questioning' and 'reflective practice' are to be seen as 'mirror

images', where an encouragement to 'think' before 'doing' is matched by fitting responses from pupils.

An example that could be identified from practice might be where a teacher's prompt for a pupil to consider an alternative means to a particular end, (*using sellotape rather than staples to secure two elements of a developing product*) activates a response that does indeed move that child's (group's) thinking and associated actions forward in a purposeful manner towards an optimum solution.

The operational definitions of these key terms are offered at this stage to form a bridge between the key features identified within them and the associated considerations set out immediately below. The theoretical basis for their development is dealt with in greater detail elsewhere (*see Chapter 2: Action Patterns pp. 65-69 and Chapter 3: Methodology pp. 86-112*).

Metacognitive Questioning

Dominowski (1998) suggests that the encouragement of individuals to provide reasons for their choices and actions often results in improved task performance. Moreover, he suggests that verbalization is most effective when it is centred on the use of what he calls 'metacognitive questioning'. That is, questions that direct problem-solvers to reflect not simply on their intentions but why such intentions form part of the strategies they adopt as a means of securing a resolution to a particular problem. Correspondingly, Gagne and Smith (1962) note that:

'Requiring subjects to verbalise during practice has the effect of making them think of reasons for their moves.'

In similar vein, Mevarech and Kramski (1997), noted that control and regulation are to do with decision making in terms of 'when, how and why to explore a problem, plan a course of action, monitor one's own actions and evaluate one's own progress' (p.368) In their paper they

went on to argue that 'metacognitive questioning' helps pupils to develop forms of control and regulation. They noted three types:

- comprehension questions, that seek to have pupils explain their main lines of thought;

E.g. Why do you think that a sandwich bag will be better than a Balloon as a means of obtaining the type of movement that you want?

- strategic questions, that seek to illicit from students their intended mode of operation;

E.g. What materials and equipment will you need to do the work safely and accurately?

- connection questions, that ask students to relate the current to the past.

E.g. What happened the last time you tried to connect the switch that way and how could you get a better contact?

Metacognitive questioning, then, in the context of this study, can be seen as a form of questioning that encourages children to:

- identify, clarify and justify lines of thought or action, including alternatives – based on reasoned argument that is either self or other-oriented;

For example: *'Why have you decided, as a group, to use PVA rather than the glue gun?'*

- Evaluate in terms of judging one line of thought or action against another, including the monitoring of suggestions or progress involving cross checking, demonstrating aspects of

doubt, a willingness to challenge views etc. based on reasoned argument that is either self or other oriented;

For example: *'Rhiannon has suggested that you use a smaller gear wheel on the input shaft, than the output shaft; but David thinks they should be the same size. What do you think the difference will be if you decided to go along with Rhiannon's suggestion? And why might it be more appropriate?'*

- Plan ahead, based on reasoned argument that is either self or other oriented.

For example: *'You now need to think about finishing the product, so what do you need to do now?'*

In summary a teacher's use of metacognitive questioning is seen to be of significant importance as part of a repertoire of mechanisms that will support effective collaborative endeavour. Moreover, if used regularly and supported by relevant modelling of reasoned decision-making, pupils will hopefully see the relevance of engaging in reflective practice as a means of supporting progress towards optimised solutions, when resolving practical problems.

Pupils are judged to operate as **reflective practitioners** if they are observed to utilise decisions and actions that have stemmed from measured deliberation. That is, they have reflected purposefully on their own or other's current position and, thereafter, demonstrate the metacognitive skills (*see below*) of:

- identifying, clarifying and justifying lines of thought or action, including alternatives – based on reasoned argument that is either self or other-oriented

For example: *'We've decided to use PVA because it doesn't*

set straight away. It takes a bit of time to dry and gives you a chance to change positions of things if you need to.'

- Evaluating in terms of judging one line of thought or action against another, including the monitoring of suggestions or progress involving cross checking, demonstrating aspects of doubt, a willingness to challenge views etc. based on reasoned argument that is either self or other oriented

For example: *'I think that we should use Rhiannon's idea because when you turn the handle to make the smaller gear go round, the bigger one will go slower and that will make the fairground ride work better because it needs to go quite slowly, like the real ones.*

- Planning ahead, based on reasoned argument that is either self or other oriented

For example: *'We need to decide as a group on what we would like to use, say paint or felt-tip pens. Then, once we've agreed, we should make a list so that we don't forget anything.'*

Reference has been made above to children's use of 'metacognitive skills' and I shall now turn briefly to an examination of the concept of metacognition; not least because this concept provides an important foundation for the forms of reasoned thinking outlined in the operational definitions, as detailed – e.g. justifying, evaluating, challenging views etc.

Adey and Shayer (1994 p.67), offered a definition of metacognition as, 'thinking about one's own thinking, becoming conscious of ones own reasoning', whilst Meadows (1993 pp 78-79) citing Brown, suggests that, 'metacognition refers to cognitions about cognitions or

the executive decision making process in which the individual must both carry out cognitive operations and oversees his or her progress'. Here, I would contend that pupils' ability to consciously recognise the value of their own reasoning can best be supported through problem solving activities based on social interaction (*collaborative endeavour*) that is effectively structured and managed. This contention is based on a belief that such activities can foster a willingness and a need to think not simply about what to do, but to offer a rationale for why, how and when to put thought into action. In line with this belief, and the associated operational definitions already outlined, Hacker (1998) notes that, metacognition involves active monitoring and consequent regulation and orchestration of cognitive processes to achieve cognitive goals. And that, monitoring, regulation and orchestration can take the form of checking, planning, selecting, inferring, self-interrogation and introspection, interpretation of ongoing experience or simply making judgements about what one knows or does not know to accomplish a task. Similarly, Clark and Palm, in Gilhooly (1990 p.314) state that, 'metacognition is an awareness and control of one's own thinking processes and problem solving strategies'.

Schraw (1998), offering a more comprehensive position, noted that most researchers have identified two major forms of metacognition. These are 'knowledge of cognition' and 'regulation of cognition'. The first, he suggested, is connected to the notions of declarative, procedural and conditional knowledge, whilst the latter to planning, monitoring and evaluating. Moreover, these two aspects were seen to be closely related and, in the context of a design and technology activity, it is easy to see this link. For example, whilst planning ahead: selecting a particular strategy or skill (*procedural or declarative knowledge*), a pupil could be encouraged to clarify and justify related decisions for its usage at a particular time in the process, (*conditional knowledge*) – the how, when and why to operate in this manner.

For example, a child might suggest that it would be useful to model an idea for a container, three dimensionally, in card, further noting

that if this is done early on in the process it could help the group to identify the means by which other elements can be secured, thus helping to establish a list of components that will be required in due course.

Beyer, cited in Hunkin (1995) defines metacognition in terms of one's knowledge of one's own cognitive processes including the important link to the consideration of alternatives. Livingstone (1997) relates metacognition to planning, monitoring and evaluating progress and re-emphasises the relationship between metacognition and higher order thinking. In line with Mevarech and Kramski (1997) she too highlights Flavell's association between metacognitive strategies and conditional knowledge; the how, when and why to go about things in a particular way/sequence. Lastly, Meadows (1993 p.79) notes that:

'Metacognition, 'involves many basic 'on-line' metacognitive processes, including analysing and defining the character of the problem at hand; reflecting upon one's own knowledge (and/or lack of it) that may be required to solve the problem; devising a plan for attacking the problem; checking and monitoring how the plan helps in the problem solving; revising the plan in the light of this monitoring; checking any solution reached; and, generally, orchestrating cognitive processes in relation to the cognitive contents and objectives involved, in the service of whatever is one's goal.'

Of course, Meadow's view, as with others that have been detailed, is very broad and the focus of my own study is not intended to deal with all the aspects that one might reasonably equate to the notion of metacognition. However, what the definitions considered to date do shed light upon is the importance of reasoned judgements, decision making, monitoring, selection, alternatives, evaluation and planning ahead. These issues, in the context of efficient designing and making, might be referred to more simply in terms of a pupil's ability to recognise and deal effectively with salient problem features. In a paper by Beradi-Coletta et al (1995) an emphasis is placed on forms

of questioning which assist problem solvers to think carefully about salient problem features and what are referred to as critical task components. The authors suggest that:

'Answering a question such as "why did you do that?" invokes a shift in attention from focusing on aspects of the problem itself to a focus on what one is doing to solve the *problem. Solvers must take themselves out of one mode of processing - the problem level - to another - the processing level - and observe themselves as a problem solver.'*

For them, it is 'metacognitive processes' which are central to improved problem solving performance and any interaction to invoke such processes needs to explicitly focus problem solvers on:

- what they were doing/are going to do and why

and

- on the checking of solution moves.

In relation to looking ahead (*what they are going to do*) I argue elsewhere (*see Chapter 2 pp. 58-65*) that pupils also need appropriate support (*scaffolding*) at the outset of a problem solving activity as a means of assisting them to focus on relevant aspects of the task.

All of the above leads to what can be seen as one of the major lines of this enquiry. That is, the need to set out a sound case for the importance of developing aspects of metacognition (*in this study – 'reflective practice'*) as part of normal classroom practice. Indeed, Fisher (1998) argues that metacognitive thinking is a key element in the transfer of learning and that teachers have an important role to play in mediating children's use of metacognitive strategies (meta-teaching). Elsewhere, Fisher (1995) talks of 'metacognitive control', moving from the 'what' and 'how' to the 'why' and 'what for'; and of

the need to engage children in active learning situations where they are aptly challenged through teacher questioning that stimulates levels of cognitive demand that are high.

In the context of collaborative endeavour, however, 'metacognitive control' will need to be based on appropriate levels of agreement. For, as Mercer et al (2000 p.99) have argued:

> 'Control is a matter of constant negotiation as speakers offer contributions which may, if partners are persuaded, determine the subsequent direction of collective thinking.'

For them, one of the key components of appropriate agreement and associated metacognitive control is the use of exploratory talk (see Chapter 2: encouraging appropriate modes of interaction). However, they also recognise that:

> 'Although it is widely accepted that one of the aims of education should be the induction of children into ways of using language for seeking, sharing and constructing knowledge, observational studies of classroom life reveal that induction is rarely carried out in a systematic way.' (p.95)

For them, therefore, opportunities to engage in appropriately structured collaborative endeavour will support children as:

> 'Active, skilled participants in intellectual communities of discourse and practice.' (p.108).

and will help in the development of young children's 'reasoning skills'.

It is the development of these skills that I would hope the findings of this study will aid, by way of helping teachers to reflect on their current practice and, where appropriate, modify it in order to inculcate an ethos in their classrooms in which children feel able to operate as more autonomous and thoughtful decision-makers.

In summary, the operational definitions of metacognitive questioning and children as reflective practitioners are to be seen as mirror images of each other. The former, encouraging children to 'think' before they 'do, as one strategy in relation to the development of young children as reflective practitioners, that is: children willing to engage in metacognitive processes, including a critical appraisal of their own and others current thoughts and actions.

Both these definitions stem from a consideration of the concept of metacognition, which has been shown to be both complex and open to a number of interpretations. In the context of this study, my reading of the term centres on children's use of reasoned judgement as a means of constructively criticising both their own and others current views and intentions. As such, it is about children adopting a thoughtful approach to decision-making that supports an optimum resolution of problems in hand. An approach that seeks a commitment to identifying, clarifying and justifying lines of argument; a willingness to consider alternative ideas or courses of action; a recognition of the significance of considered evaluation and an understanding of the need to plan ahead. In short, a focus upon children thinking about their own and others' ideas and actions in a critical manner. That is, requesting or providing answers to 'why' or 'what for' question? Questions than can be encouraged by effective teacher interaction that, if regularly modelled, will hopefully embed themselves in children's methodology – their own metacognitive processes or 'stop and think' actions.

However, what has also been noted (*more detail to follow*) is the need to associate metacognitive questioning with other, relevant aspects of classroom practice: the establishment of appropriate ground rules for collaborative endeavour and effective task structuring. In this way a foundation has been established for the research study that sets out to examine: **the factors that impact upon children operating, in junior classrooms, as reflective practitioners in the context of group-based, problem solving activities**.

Chapter 2: **Literature Review**

In this chapter I draw upon the work of others as a means of exploring the three key factors identified in the previous section, together with one other: cognitive dissonance. The latter is included to provide a consideration of the complex make up of children asked to interact in group settings because, as Lyle (1997) suggests, their expectations, status, prior achievement and communication skills will all differ and impact upon the notion of 'meaning making' – another link to the notion of 'metacognitive control'. As such, this section will be sub-divided into sections dealing with:

- questioning;
- the importance of establishing effective ground rules for collaborative endeavour;
- task structuring;
- cognitive dissonance.

In order to support lines of thought some use is also made, within this section, of data drawn from the field work undertaken during the research study, though further details are provided in Chapter 3: Methodological Issues pp. 86-112, Chapter 4: Findings pp. 113-165 and Appendix 1, which offers an overview of the groups and teachers who were both observed and interviewed. At this juncture I wish to note that all names are fictitious to maintain the anonymity of the schools, staff and children involved.

Questioning

Questioning, as many authors highlight (Brown, G. and Wragg, E.C. 1993, Dillon, J.T. 1988, Harlen, W. (ed.) 1985, Hunkin, F.P. 1995, Strother, D.B. 1989, Wilen, William W. and Clegg, Ambrose, A. Jnr. 1986, Wilen W. W. 1987, Winne P.H. 1979) is a fundamental constituent of everyday classroom practice and influences the level of student thought and action. As Wilen (1987 p.9) notes,

'In many respects, the primary effectiveness of the teacher lies in his or her ability to stimulate and guide students' thinking and involvement in interaction related to topics, issues and problems.'

Similarly, Harlen (1985), recognises that the purpose of teachers' questions should always be to promote children's activity and thinking. He refers, for example, to 'productive' questions - questions that stimulate productive activity. These include 'what if types' of questioning that may require, amongst other things, the need for predictions in relation to practical outcomes. Closely associated are, 'can you find a way to' questions and 'reasoning questions' that seek some form of explanation. The latter, usually pre-fixed by 'how' and 'why' should, in Harlen's view, be used most thoughtfully as, whilst they do in part seek reflection, pupils may feel that a model answer is required and therefore resist responding. However, Roth (1996 p.711), referring to Harlen's notion of 'productive questions', emphasises the need for questions that call for reflection and analysis and I would argue too, that this would support pupils working toward an 'optimal' or, at the very least, 'considered' solution to a task at hand. Without doubt, as Brown and Wragg (1993 p.3) indicate, the reasons for asking questions, in cognitive and cognate terms are to,

'Stimulate recall, to deepen understanding, to develop imagination and to encourage problem solving.'

Or, as Roth (1996 p. 718) notes,

'For deep learning to occur, teachers need to elicit student explanations, elaborations of previous answers and ideas and predictions.'

Similarly, Latham (1997), in a short paper entitled, 'Asking students the Right Questions', suggests that the appropriateness of teacher questioning is dependent on numerous factors, including the context in which they are asked. Consequently, he believes that teachers

require a 'repertoire of techniques' from which to select the most appropriate. Of these, questioning that is categorised as 'elaborative interrogation', or "Why?" type questions, not aimed at single right answers, are seen to be important in encouraging pupils to both make connections and uncover patterns. Similarly, Lauffer (1994), investigating the extent to which kindergarten children are capable of reflecting on their thinking processes in order to make self-assessments, used, as part of her research methodology, what she refers to as 'exploratory questions'. These included, such questions as: How did you do that? What did you have to do to be able to? Why did you .... ? What makes you able to? What Mercer (1995) refers to as teachers 'inviting elaboration'. The categories of questioning outlined above seem to equate well with my own notion of 'metacognitive questioning' in that they are focused upon encouraging children to identify, justify and clarify metacognitive strategies. A focus, that is, on 'stimulating students thought processes, and not on producing an unalienable truth'. (Latham, ibid pp. 84-85). In short, a willingness to critically monitor the 'present' as a means of supporting the effective and efficient progress of developing lines of thought and action. Lauffer (ibid), moreover, notes that higher order responses were often elicited when questions were simply repeated or rephrased and that over a period of time, the use of exploratory, repetitive and rephrased questions led to children being 'more reflective' (p.330) in terms of providing answers that were 'more thoughtful and therefore more meaningful' (p.331).

For example (*see Appendix 1 School F*):

It should be noted here that Appendix 1 provides an overview of the schools from which data was collected and the use of colour here reflects the mode of data analysis adopted. A justification for both the selection of schools and the method of data analysis is provided in Chapter 3: Methodology.

Teacher Where have we got to then? Can somebody briefly tell me?

Peter	We've been thinking about how big the circuit is and what colours we might use.
Teacher	Why are you worrying about the size of the circuit? (seeking clarification and prompting planning ahead)
Mark	Because it might be too big for the card to hold it. (clarifying and justifying line of thought/action)
Katherine	It could be too heavy (*the circuit*). (monitoring/challenging the suggestion of another)
Teacher	So size and weight are important? (prompting further clarification of developing lines of thought/action)
Katherine	So you have to make sure it's strong card or it won't stand up. (justifying intention and planning ahead)
Teacher	So, if the circuit is too big the card might fall over, so can we do anything else about that? (prompting further clarification of developing lines of thought/action)
Peter	You could put card .... you could fold into four pieces which makes it heavier and you can hide the circuit inside. (identifying and justifying alternative)
Teacher	So you 're doubling the thickness of the card to make it stronger (*correcting heavier*) and putting the circuit inside – that's good.

Here, the teacher can be seen to obtain more meaningful (*focused*) responses in what might be termed an 'incremental manner'. That is, slowly eliciting reasoned argument, including the use of appropriate subject specific knowledge, (*stronger rather than heavier*) which I see as a hallmark of reflective practice, by prompting pupils to think about

key aspects (*size and weight*) and a logical means of moving their design work forward.

William W. Wilen (2001), though discussing questioning in the context of social studies classrooms, notes that whilst teachers should use a range of questioning strategies, including lower order questioning techniques, the objective should be the achievement of 'critical or reflective thought' (p.28) He also talks of the importance of embedding action verbs (*identify, judge, predict etc.*) in higher order questioning to consolidate the relationship between questions asked and the thoughtful responses expected.

In more general terms, Mercer (1995) draws attention to the importance of language as a cultural tool through which individuals can think and learn together. He notes that children formulate and evaluate ideas from an early age, initially through egocentric speech but as they develop, in and through social interaction. Of importance here is an understanding of the fact that:

'Through conversations with parents, teachers and other 'guides' we acquire ways of using language that can reshape our thoughts.' (p.6)

and, in the context of this research, our 'actions' too.

However, much debate (Edwards & Westgate 1994, Harlen 1985, Wilen & Ambrose 1986) surrounds both the nature of questioning and the extent to which certain types support aspects of thinking and achievement. As Mercer (1994) identifies, research has suggested that certain types of teacher question, particularly those requiring factual, convergent responses may actually inhibit pupils' intellectual activity. I would argue further, that in the context of design and technology based activities, an over reliance on the types of inhibitive questions, identified above, will tend to stifle, amongst other things: independence, risk-taking, creativity and, very importantly, opportunities for pupils to think their way around a problem so that, in

collaboration, they can develop their ability to achieve a joint understanding of how to move forward in the most effective and efficient manner. Consequently, in the context of practical problem solving, teachers need to make regular use of questioning that promotes the development of pupils' competence to offer reasoned justifications for their decisions and intended actions. Effective questioning, then, should be seen as a key element in relation to capable practical problem solving and the learning that takes place during associated activities. Indeed, Neville Bennett (1994 p.45) highlights, as an aspect of classroom practice, the importance of teacher questioning. Here, he cites Edwards and Mercer who have argued that:

'It is in the discourse between teacher and pupils that education is done, or fails to be done.'

However, Bennett (Ibid) goes on to stress that research findings (up to 1990) suggest that in many cases children are talked to, rather than with, and that too few questions encourage pupils to work through an idea or problem. For him, teacher questioning should be open-ended, leaving children with problems to solve. They should, he believes, be:

'Encouraged to speculate, hypothesise, predict and test out ideas with one another and with the teacher. The emphasis should be on language being used, not to communicate what is known, but as an instrument of learning.' (p.47)

The issue of 'ineffective questioning' and its probable link to a reduction in independent thought, action and appropriate levels of associated originality, was also raised by Hargie (1983) who argued that a large percentage of teacher questions are of a lower order, simple recall type whilst it is higher order, thought provoking forms which promote greater levels of 'creativity and expressiveness' (p.187).

A simple example, drawn from analysed data, will serve, at this juncture, to illustrate this point (*see Appendix 1: School B*) On this occasion, the class teacher asks a group of children (*who are modelling ideas for a fairground ride*) a closed question, whilst at the same time providing a very heavy prompt in terms of a possible solution.

Teacher Would it not be easier for you to cut that out as one? To shape and fold it .... to score it and bend it? (suggesting the production of a two dimensional net as a means of achieving the required three dimensional form)

The group, in chorused response, agree to this suggestion without either challenging the basis on which the teacher had provided the suggestion or offering and justifying alternative courses of action. As a means of supporting reflective practice the interaction should have been based on a more thought provoking questioning approach. For example:

Teacher If you are going to use card, how might you achieve a strong and well presented 3D model?

Wood (1991) picks up on this theme by noting that research would suggest that many teachers too often use 'closed' questioning rather than encouraging pupils to look into processes of reasoning and the weighing of evidence. It is this type of questioning – discussed elsewhere as forms of 'metacognitive questioning' (*see Chapter 1: Key Issues pp.18-27*) - that forms a significant element of the research study presented here.

An initial model of a teacher promoting some aspects of reflective practice (*in this case the seeking of reasoned argument (justifications) is a very limited feature*) is shown below (*see Appendix 1: School A*) and is based on the observation of a group of children (*four*) at the stage of developing annotated sketches for the

design and manufacture of a monster, powered by simple pneumatics (*inflated/deflated balloon*). This sequence is also reference in Chapter 4 Findings pp. 120-122:

Teacher What are you actually going to use to make the mouth? You need to think about how it's going to open and close? (prompting further clarification)

Claire A balloon. (identifying solution)

Teacher So what's the problem with the mouth you've drawn there? (prompting evaluation of current intentions)?

Samantha It won't open and close. (demonstrating doubt, but not justified)

Teacher Why's that? (prompting evaluation/justification)

Samantha Because it's a circle and it's flat. (clarifying but not justifying in terms of explaining the limitations)

Teacher It's a circle and it's flat. So what do we need if the mouth is going to open and close? What would make it easier? What sort of things could you use? Any ideas? (prompting further clarification but not seeking a justification – i.e. not asking them 'why'?)

Claire I think I know what we could have for teeth.

Teacher We need a mouth first. (scaffolding to keep pupils focused on most relevant aspects of task). So what could we use for the mouth? .... What shape is it going to be? (prompting an idea)

David An egg box. (no justification)

Teacher Yes we could use an egg box. (verifying, but not seeking justification)

Claire Or a little cereal box. (alternative – no justification)

Teacher Or a little cereal box. (verifying, but not seeking justification)

David A Pringle box. (alternative – no justification)

Teacher So, when you draw your designs you're going to need to think about that, yes? So what you're going to do now is to start drawing your design and start telling me how you are going to join things together .... What you are going to use? (prompting planning ahead).

In social constructivist terms the lack of purposeful discourse noted in the first example would seem, at least in part, to work against the view that learning is optimised through talk in co-operative settings. As such, teacher's talk, particularly questioning strategies, requires very thoughtful consideration if the suggested optimisation that is important in Design and Technology activities is to be achieved.

Indeed, the first example can be more readily linked to Mercer's (1995) notion of 'cued elicitation'. For this author, knowledge is shaped primarily as a result of 'people's communicative actions' (p.19) and questioning can be seen to be an important vehicle as a means to this end. In describing a variety of ways in which teachers attempt to guide learning he refers to the notion of 'cued elicitation', seen to be the drawing out of information, in 'learner-centred ways', using strong visual or verbal clues. In essence, asking questions whilst simultaneously providing pointers to the information required, in terms of offering, what the teacher assesses to be, the 'right answer' (*see below*). For Edwards and Mercer (1987), cued-elicitations are viewed as a type of 'initiation - response - evaluative feedback exchange' (*IRF*) mechanism, through which:

'Pupils are neither being drawn out of themselves, in the e-ducare sense, nor simply being taught directly, in the 'transmission' sense. Rather they are being inculcated into what becomes for them a shared discourse with the teacher. As such it falls neatly into the sort of educational process defined by Vygotsky's zone of proximal development, in which pupils' knowledge is aided and 'scaffolded' by the teacher's questions, clues and prompts to achieve insights that the pupils by themselves seem incapable of. It is a device which requires that pupils actively participate in the creation of shared knowledge.' (p.142)

Whilst a place for such questioning can no doubt be argued as supportive of the need for teachers to adopt a wide range of teaching and learning strategies, I would caution that in relation to aspects of designing and making 'right answers' should be seen to equate to rational proposals, emanating from the pupils, that seek to sustain progress towards optimised problem solutions, for which they have argued a sensible case. Moreover, given the lack of subject expertise (*Design and Technology*) that many primary teachers would profess to, it is also necessary to question the extent to which they will be able to operate efficiently as 'experts' in this domain. In this context, it may well be the case that the teacher does not readily have a 'right answer' in hand. Given such circumstances, what seems of greater importance here is a feeling of 'ownership'; teachers open to developing a classroom ethos in which pupils are given the time and space to develop both procedural and conditional knowledge on the basis of utilising reasoned argument for deciding why, how and when to use particular methods and or materials, for and by themselves. Moreover, through such joint action, all participants in verbal interaction should benefit from the development of a common knowledge and skills base that can provide a foundation for future activity. Not least, a shared understanding of the benefits of reflective practice and the associated development of autonomous, reasoned decision-makers. Thus, cued elicitations will only be seen as a form of 'metacognitive questioning' when related visual or verbal clues seek to prompt pupils to 'think' before 'doing'

yet maintain the responsibility for resolving any sub-problems with the child (*group*). As a result, what remains important to the research study, then, is the hope that by encouraging 'reflective practice', in seeking to promote children as critical purveyors of alternatives, evaluators and monitors of their own and others' thoughts and actions and forward planners, they will be more able, through logical judgements, to move toward the optimisation that underpins 'good' design and manufacture.

The following example (*see Appendix 1: School B*), illustrates a teacher encouraging the identification of alternatives, but not the critical purveyance of the same. This 'half way house' position is discussed elsewhere and appears to be a common thread running through the data collected. A thread that would suggest, for a number of reasons, that teachers are not encouraging junior aged children to act as reflective practitioners as effectively as they might.

Stephen	Me and Peter are going to make that.
Teacher	From separate pieces or are you going to make a net. (alternative suggested but choice remains with pupil)

Chorused response of: 'separate pieces'

Teacher	So how are you going to join them together? (seeking clarification)
Jessica	Glue. (solution offered but no justification)
Teacher	You're going to glue card together are you? (intonation here is that of casting doubt on the suggested methodology and thus seeking an alternative)
Anne	We could use sellotape it. (unjustified alternative)

Peter We could use masking tape. (unjustified alternative)

Teacher Masking tape? (again, emphasising doubt and implying the need for a justification)

Jessica No, but we could use the strong masking tape because ..... (line of thought interrupted)

Teacher That's double sided sticky tape .....

The pupils agree on this suggestion.

The argument for developing children as more autonomous decision makers is further championed by Fisher (1987) who argues that teachers should make use of a range of questioning strategies that can effectively promote children's problem-solving approaches. For him, an essential feature of such questioning will be the extent to which children are encouraged to enter into dialogue that provides an opportunity for them to think at a deeper level: to reflect, to consider alternatives and to engage in independent reasoning. Cecil (1995) highlights the important relationship between good questioning and effective teaching and learning. Moreover, she stresses that imagination can only be developed if and when children are provided with opportunities to, among other things, play with ideas, explore their minds, reflect and make reasoned decisions. For her, teachers simply do not ask enough open-ended questions that can facilitate critical and creative thinking. Moreover, what is required, she suggests, is a classroom ethos in which children come to value the importance of asking their own questions; what she refers to as 'self-instruction'. For her, self-instruction can be seen as a means of supporting three metacognitive strategies – self-interrogation, verbal monitoring and thinking aloud. (p.83) In this way, pupils become aware of their own thinking which:

- Aids their definition of problems
- Focuses attention

- Supports plans of action
- Encourages evaluation
- Encourages perseverance
- Supports coping strategies

In relation to the notion of 'reflective practice' this list provides a useful signpost to issues already noted above. Focusing attention in the context of practical problem solving activities ideally means a willingness on the part of a pupil or pupils to critically assess their current position as a means of making effective and efficient progress; where such progress is afforded by judicious modifications (*e.g. a change of materials to improve appearance*) and or the consideration of alternative means (*e.g. using a different manufacturing technique*). Pupils will also need to plan ahead; that is, to make use of organisational strategies that support progress towards optimised problem resolutions. For example, considering any time constraints that may have been applied, choosing the most appropriate material from a range on offer or taking solicitous account of the level of their own current competence with regard to a particular manufacturing technique.

Lastly, in the context of this study, the notion of 'common knowledge' espoused by Edwards and Mercer (1987) also appears to be relevant. For them, joint activity and discourse support the development of a shared understanding or 'mutuality of perspectives' (p.1). It moves classroom practice beyond didactic forms of teaching and instruction to a position in which participants in verbal interaction can share information and experience as a means of building a common knowledge that they see as providing the contextual basis for further communication. Here, I would argue that it is the shared understanding of the need to operate as a 'reflective practitioner' that supports this position. And, it is the shared understanding of the need to act thoughtfully that is a key element of competent practical problem solving. Indeed, what should be seen to be developing when teachers utilise metacognitive questioning and pupils respond by acting as reflective practitioners is what Edwards and Mercer refer

to as a, 'shared frame of reference' (p.157). A frame of reference based on a joint understanding, on the part of the class teacher and pupil(s) that, as noted earlier (see p.1), is not just to do with how situations are described but how actions are reasoned about.

Moreover, it is through this shared frame of reference that pupils are introduced into the conceptual world of the teacher where, in the context of this study, the concept of 'reflective practice' is key.

Essentially, I am arguing that teachers need not be experts, in terms of what would be seen as important subject specific 'declarative knowledge' or associated practical skills, in order to promote a shared understanding of the benefits of 'thinking' before 'doing'. Whilst it is clear from my discussion of the inappropriate use of 'terminology' (*see Chapter 2: pp. 69-71) a*t one does need to accept that a personal feeling of security, based on an appropriate level of awareness, might aid a teacher's ability to interact effectively with pupils, I would contend that what is of greater importance is their willingness to make effective use of 'metacognitive questioning' and, where appropriate, to model reflective practice, as part of their own pedagogy. In short, it is the importance placed on the process of reasoning that will help them to develop a classroom culture in which autonomous decision making, based on a reflective ethos, is valued by all participants engaged in group-based practical problem solving activities (*see also, Establishing effective ground-rules for collaborative endeavour, pp. 43-53*). The extent to which they do so, placed alongside effective task structuring and the judicious management of collaborative endeavour is at the core of this research study. As Judith Watson (1995) suggests (*whilst focusing on teacher talk that encourages reflection*), there is a need to consider the link between teachers' questioning styles and their personal views on the nature of learning. For her, where encouragement for reflection was noted, it coincided with teachers' more positive views of pupils' potential and their ability to think and do for, and by, themselves.

In summary, the role of teacher questioning, as an important aspect of their interaction with pupils, can be seen to have a crucial part to play in developing in children a thoughtful and self-critical approach to practical problem solving. If the design and make process is to be managed proficiently then teachers and children need to value the benefits to be gained from operating as 'reflective practitioners'. As such, teachers need to find the time to prompt children to operate as reasoned decision makers, able, over time, to work with greater levels of autonomy.

However, effective questioning strategies are only part of the more complex environment in which practical problem solving activities take place. Mercer (1995), for example, would argue that whilst teachers should offer a range of opportunities to support the development of the cultural (*communicative*) and psychological (*thinking*) aspects of pupils' language, thereby encouraging individuals to 'involve others in their thoughts' (p.4); underpinning this aspect of effective group collaboration, and the associated reflective practice, is the need for teachers to organise such activities carefully, in order that pupils understand their roles and responsibilities and have a firm foundation from which, I would argue, they can develop intersubjectivity and apposite action patterns, underscoring reasoned decision making (*see Task Structuring pp. 53-71 including: Action Patterns pp. 65-69)*

I should now, therefore, like to turn to the relevance of establishing ground rules for effective collaborative endeavour, as an important foundation for the way in which children approach group-based, practical problem solving tasks, to be followed by a section on task structuring.

The importance of establishing ground rules for collaborative endeavour and encouraging appropriate modes of verbal interaction.

In this section I draw attention to the importance of teachers establishing effective ground rules for collaborative endeavour and encouraging children to recognise and adopt appropriate forms of verbal interaction, as a means of encouraging them, when working as a team, to cooperate in a measured way.

As a useful starting point for this discussion the position of Lovelock and Dawes (2001 p.48), from their investigative base, offers a relevant rationale for deeming this aspect of teacher-pupil interaction to be of significance to this research study:

> 'Many children found group work a difficult experience. Few children were found to have the strategies for pooling their mental resources, or combining their ideas with those of others; for negotiating compromises, or for asking others to justify their suggestions.'

Mercer (1996) draws attention, in his analysis of collaborative talk, to the important part played by teachers in fostering certain kinds of discourse. This, for him, is particularly true in relation to teachers' initial interaction with pupils, prior to problem solving activities commencing. Indeed, citing Galton and Williamson, he notes that:

> 'For successful collaboration to take place, pupils need to be taught how to collaborate so that they have a clear idea of what is expected of them.' (p.362)

Whilst, Mercer et al (1999) may have reservations about the extent to which teacher – pupil interactions generally provide appropriate initial direction for effective collaborative endeavour, they recognise that:

'When teachers make such matters explicit and provide direct guidance, pupils have been found to be enthusiastic and effective at grasping 'educated' ways of using language for sharing and constructing knowledge.' (p.96)

Likewise, Hardman and Beverton (1993), for example, argue that metacognitive awareness of the talk process, by way of analysis and reflection, can be used to aid effective discussion in co-operative group work settings. For them, too, pupils' awareness needs to be developed and as part of this growth teachers need to make them conscious of the different roles that they can play during verbal interaction. They cite, for example, children's knowledge of, 'how to question or challenge' (p.147), together with their growing appreciation of what they call 'discourse markers' – 'well', 'then', 'I think', as an aid to managing such interaction. From the case study material they analyse, a general consensus emerges in which there is evidence to suggest that, 'turn-taking and control of the topic being shared, with participants listening for and negotiating meaning to arrive at a shared understanding' (p.149), are key elements of effective collaborative endeavour.

In similar vein, Lyle (1996), notes that collaborative group work, in a social constructivist sense, enables children to make meaning, supported and challenged by their peers, and to augment both their critical and creative thinking abilities. However, for her, as with other authors (e.g. Baddeley 1992, Cooper 1993, Corden 1995 Gokhale 2002 and Mercer N. 1995 – see below), effective interaction in group settings has to be supported by teachers making the purpose and desired outcome of a task, and the roles that children are to undertake, clear. For Lyle, the roles include those of leadership, negotiation and support of others. Moreover, she notes that:

'Successful educational activity through group work depends on learners (a) sharing the same ideas about what is relevant to the discussion, and (b) having a joint conception of what they are trying to achieve by it.' (p.362)

She also, citing Galton and Williamson, highlights the need for teachers to reduce uncertainty (*see section on Task Structuring pp. 53-71*) as a means of supporting the generation of ideas, by pupils, and a feeling of ownership over those ideas. Indeed, she notes that:

'The educational value of any classroom talk between children, with or without a teacher present, may hinge on how well a teacher has set up activities and the environment for generating and supporting suitable kinds of talk.' (p.19).

Corden (1995), reflecting on the work of the National Oracy Project (1988-92), is certainly of the opinion that getting children to discuss and to understand the potential benefits of collaborative learning and to negotiate and accept the necessity of associated ground rules is an essential pre-requisite of successful group work. Undeniably, for him, pupils need to be very clear about their own responsibilities and the expectations of both their peers and their teacher. Whilst, Baddeley (1992) indicates that, purposeful talk will include the offering and evaluation of ideas, and the ability to reason and explain, noting that:

'Groups work better when the group members fully understand the task and their roles within it.' (p.26).

Mercer (1995), in considering the concepts of 'context' (*pupils responding to their environment and related dialogue from the past and present*) and 'continuity' (*time to consolidate understanding through dialogue*) also stresses the importance of teacher's providing firm foundations for pupils verbal interaction by way of the appropriate setting up of activities, which may include a requirement of eliciting from children key teaching points.

In similar vein Gokhale (2002), from a short comparative study of individual versus group learning, concludes that the latter is more beneficial to the development of critical thinking and problem solving skills, particularly when those involved are encouraged to discuss

'why' they are thinking as they are and to be willing to reconsider/ *reflect upon* (my emphasis) their own judgements. Citing Bruner, this improvement may well be based on the fact that pupils, operating as part of a group, are 'confronted with different interpretations' (p.5). However, an important rider here is that research clearly indicates that 'students who gain most from cooperative work are those who give and receive elaborated explanations from their peers (*see references to 'exploratory, cumulative and disputational talk' and cognitive dissonance, below*)

Returning to the notion of 'measured interaction', I would wish to see this approach linked directly to the key aspects of children acting as reflective practitioners, previously detailed in the operational definitions set out above. Not least, their willingness to clarify and justify lines of thought and action, evaluate their own and others current intentions and plan ahead, on the basis of 'reasoned argument'. But what should the basis for reasoned argument be? A number of authors (Hughes and Westgate 1998, Mercer 1996, Grugeon et al 1998, Mercer et al 1999 and Wegerif et al 1999), would wish to make a connection to the significance of children using 'exploratory talk', talk in which, as Mercer (2000) notes:

'Partners engage critically but constructively with each other's ideas. Relevant information is offered for joint consideration. Proposals may be challenged, but if so reasons are given and alternatives are offered. Agreement is sought as a basis for joint progress. Knowledge is made publicly accountable and reasoning is visible in the talk.'

Moreover, from research evidence, based on whole-class activities aimed at developing children's appreciation of how the collaborative use of language can assist joint activity for reasoning and problem-solving, Mercer (2003) would argue that there are sound reasons for wanting pupils to use exploratory talk because:

'It is a very functional kind of language genre, with speakers following ground rules which help them share knowledge, evaluate evidence and consider options in a reasonable and equitable way. That is, exploratory talk represents a way in which partners involved in problem-solving activity can use language to think collectively to 'interthink' effectively.'

Indeed, for Mercer (2003) such talk is a significant ingredient of what he has termed the 'intermental development zone' (IDZ) or shared understanding of activities. In the context of this study I would view this IDZ as one in which pupils and their teacher maintain a focus on the optimisation of problem-resolution through reasoned decision making.

Furthermore, as Wegerif et al (1999) indicate, 'exploratory talk embodies the kind of reasoning which is valued in a range of 'educated' cultural settings' (p.494). Moreover, when used well, it supports effective joint activity and problem solving endeavour; thus implying, within a dialogical framework (*one in which reason is, 'dynamically evolving in unpredictable ways.' Wegerif, 1999 p.79*), that talk involving pupils in critical but constructive appraisal can be seen to be:

'Reasoning as a social practice.' (p.496)

As Wegerif (1999 p.98) notes:

'In exploratory talk the instant "yes" of acceptance and the instant "no" of self-defence are both suspended and a dialogue between difference is inaugurated.'

In short, 'collective thinking activities' (p.514) have an important part to play in cognitive development and, in the case of my own research, cognitive outcomes (*optimised designing and manufacturing*).

Effective teacher support is also considered, within a limited study of reception classroom discourse, by the authors Hughes and Westgate (1998). Here, they argue, whilst recognising the tentative nature of their recommendations in the context of the inherent complexities associated with the analysis of talk, that teachers need to think carefully about ways in which they encourage both interactional and cognitive aspects of pupils' collaborative endeavour. That is, how appropriate verbal interaction, for example validating contributions to promote participation, reformulating a question to stimulate additional thinking and or the avoidance of the direct evaluations of pupil inputs, can be seen as types of 'enabling strategies' or what are also referred to as 'productive discourse moves'. In line with the citation noted above, Hughes and Westgate suggest that:

> 'Most pupils, even young ones, need guidance and reassurance from their teacher in order to create the circumstances in which exploratory talk (*see below*) can flourish and in which they can be clear about their teacher's expectations.' (p.177)

So how might these circumstances best be achieved? And what is the significance of 'exploratory talk'?

Mercer et al (1999) have devoted a great deal of time to a consideration of how the establishment of suitable ground-rules, as part of a teacher's initial interaction with pupils, prior to their engagement in group based activities, can support the notion of exploratory talk. This issue will be given more attention below, as I endeavour to develop relevant links between the concept of 'exploratory talk' and my own notion of children as 'reflective practitioners'.

However, it is also worth noting that Mercer (2000) has also identified what he terms, 'disputational' (*an unwillingness to take on another point of view or relinquish one's own position)* and 'cumulative' (*the uncritical construction of shared knowledge and understanding*) talk,

suggesting that, together with 'exploratory' talk, these types of verbal interaction can all be seen to be associated with:

> 'The competition of ideas and all (*even dispute*) may have the ultimate aim of creating a broader consensus, a situation in which more people think similarly about some topic or issue than was the case before the dialogue commenced.' (p.104)

I would certainly concur with this view suggesting that, in the case of disagreements, these might also be viewed 'gainfully' provided that what may be seen as an entrenched position is, itself, based upon or retained, on the basis of reasoned argument that affords progress towards an optimised position (*see also Cognitive Dissonance pp. 71-84*).

This view is reinforced by Cooper (1993) who, citing Doise and Mugny, suggests that collective conflict may be more beneficial to cognitive growth than that of individual conflict. Indeed, Orsolini et al (1992 p.34) saw disagreement as a, 'resource to be exploited in conversation, and a learning mechanism to activate'. Moreover, Orsolini and Pontecorvo (1992 p.118), reflecting on a study characterized by instructional aims that assist children's relevant talk and argument, note that the teachers under observation assumed that disagreement motivates children to produce arguments in order to support and make explicit their own point of view. Pontecorvo (1995) went further, suggesting that although arguing is a demanding task, in terms of perspective-taking and reasoning, it is nevertheless frequent among young children and, as such, learning to think can be seen to be strongly related to disagreement. If one can accept, therefore, that disagreement which is based on reasoned argument is to be seen as a purposeful feature of reflective practice, then I would contend that Mercer et al's (1999) category of 'disputational talk' could rightly be sub-divided as either 'non-productive' or 'productive-disagreement'; Where productive-disagreement is judged, in the context of this study, to be based on argument that culminates in the resolution to problems at hand as a consequence

of one or more of the 'combatants' relinquishing their current position – though evidence suggests that pupils, for various reasons, often find this difficult (*see Cognitive Dissonance pp. 71-84 and Chapter 4: Findings pp. 113-165*). In so doing, progress for the group would hinge on the selection of either an alternative standpoint or a compromise position that has been agreed through further discourse. For Wegerif et al (1999) it is, therefore, about children understanding that what is essentially required of them is interaction that is not focused upon individuals 'winning' an argument, per se, but rather on them valuing the acceptance of an appropriately articulated perspective as a way of solving problems together.

However, readily identifying distinctions between 'winning' and 'understanding' may be easier said than done. For, as Wegerif (1999) suggests, talk is inevitably resistant to neat categorisation, an issue that is dealt with in more detail below (*see Chapter 3: Methodology p.107*). Similarly, Lyle (1996), has noted that any attempts to study the verbal interaction associated with group work, deemed an essential element of a social constructivist approach to education, must take heed of the fact that discourse will be shaped by a number of interrelated factors related to the social context in which the interaction takes place. In part, I try to relate to this issue in the section on cognitive dissonance (*see below*).

Nevertheless, one would also hope that the chosen perspective, discussed above, would represent optimised decision-making. This may not, of course, always be the case, but I would argue that if group work is appropriately managed, then it ought to be more evident. Indeed, as Phillips (1992) would contend, teachers should promote 'argumentativeness', by way of encouraging children to 'interrogate tasks' (*asking themselves, 'why are we doing this?' and 'what is the best way forward?'*). However, he goes on to note that teachers need to support this aspect of inquiry by helping pupils to fully appreciate what is to be done in terms of them explaining, persuading, discussing etc; in order that they see the value in giving and exploring the validity of, well–reasoned argument. In short, that

pupils become involved in a decision-making process that is systematic.

At this juncture Mercer's (1995) concept of 'educated discourse', whereby pupils need to make their ideas accountable to specified bodies of knowledge and follow 'ground rules' which are different from those of most casual, everyday conversations, seems pertinent. Here, I am concerned first and foremost with the development of procedural and conditional knowledge (*the how, when and why to use particular strategies*), and a set of appropriate rules that would underpin the notion of optimisation. In this respect, the suggested ground rules offered by Mercer et al (1999) would appear to be appropriately aligned to the encouragement of young children to operate as reflective practitioners. For them collaborative endeavour should be based upon pupils:

- Sharing all relevant information;
- Seeking to reach agreement about what line(s) of thought to follow/action(s) to take;
- Accepting that the group (*rather than individual members*) takes responsibility for decisions and actions and for any successes and failures that ensue;
- Recognising the need to provide reasons to back up assertions, opinions and suggestions;
- Recognising that challenges are accepted;
- Recognising that alternatives should be discussed before a decision is taken;
- Understand that all in the group should be encouraged to speak by the other group members.

In summary, whilst a teacher's metacognitive questioning may support the notion of young children acting as 'reflective practitioners', during group-based practical problem solving activities, such questioning needs to be underpinned by setting up collaborative activities appropriately. That is, by ensuring that a set of ground rules for interaction is established that develop children's understanding of the roles and responsibilities they have as part of a team. By so doing it is hoped that children come to interact in a measured way, seeking to develop a shared understanding of the problem in hand, its resolution through critical thinking and constructive engagement with each other's positions and a valuing, by all members of the group, of reasoned decision-making. It can be argued, then, that it is through the establishment and sustainability of suitable types of talk that group's function at their best and that they do so when they have a clear understanding of the task and their roles as part of a team. In this way, a more systematic approach to the decision-making process should be achievable. In short, as Mercer (1996 p.363) signifies:

'First, partners must have to talk to do the task, so their conversation is not merely an incidental accompaniment. Second, the activity should be designed to encourage cooperation, rather than competition, between partners (*though see the discussion referenced to the work of Kruger, 1993, in the Cognitive Dissonance section below pp. 71-77*). Third, participants must have a good shared understanding of the point of the activity.'

I should now, therefore, like to move on to the importance of effective task structuring, which is associated to the broader notion of 'scaffolding'. Here I shall discuss three interrelated issues:

- support mechanisms that will help young children to focus on relevant aspects of the task in hand ;

- Consideration of the terms situation definition and action patterns in relation to pupils, working as a group, achieving/reaching intersubjectivity;

- The importance of using appropriate terminology.

It is to these issues that I now turn.

Task Structuring

Attention will be drawn here to the importance of aligning ground rules for collaborative endeavour with a task structure that is manageable by what are essentially, 'novices'. In a number of instances, noted during classroom observation, I have felt that too much was being asked of young people at any one moment in time. As a result, groups have been seen to fail to focus collaboratively on the essential requirements of the task in hand. For me, children need to be encouraged, when working as a team, to think about only one, or at least a limited number of key elements. I would argue that such focal points would aid a more collegial approach to the sequential progression of a problem resolution and, hopefully, through critically constructive interaction, would lend weight to children developing as reflective practitioners.

Teachers, therefore, need to give sufficient attention to the way in which group based, practical problem-solving activities are managed, and, in essence, the appropriate setting of effective ground rules for group work, whilst important, has to be buttressed by a structured approach to task setting.

My argument for this 'twin edged sword' approach rests primarily on the need for teachers to consider how the effective management of tasks rests largely on two interrelated aspects:

- the need to break 'global problems' down into manageable, bite sized chunks

and

- the creation of a spirit of collaborative endeavour, through the establishment of suitable ground rules.

Moreover, this consideration should lead to recognition, on the part of teachers, of how these two aspects can assist the development of pupils' procedural and conditional knowledge (*discussed elsewhere*). That is, pupils' growing appreciation of the 'what', 'how', 'why' and 'when' relevant designing and manufacturing strategies (*thoughts and actions*) should be utilised, as a means of moving towards an optimal solution to a problem in hand, and their willingness to use reasoned argument to support associated decision-making. As Mercer (1996 p.365) notes, when appraising his own approach to understanding the quality of talk and collaboration:

'We needed to look at the ways activities were set up by the teacher, and what the teacher expected the children to achieve from doing the work.'

Fisher (1998 p.2) identified an important association between 'reflective practice' and social constructivist theory noting that:

'Vygotsky was one of the first to realise that conscious reflective control and deliberate mastery were essential factors in school learning. He suggested there were two factors in the development of knowledge, first its automatic unconscious acquisition followed by a gradual increase in active conscious control over that knowledge, which essentially marked a separation between cognitive and metacognitive aspects of performance.'

In support of this view Edwards and Mercer (1987 p. 23) citing Bruner, saw 'scaffolding' as the means of aiding a pupil to 'internalise

external knowledge and convert it into a tool for conscious control.' It is the scaffolding of the development of pupils' procedural and conditional knowledge that is critical here. Moreover, where such scaffolding is aided by teachers' use of metacognitive questioning to encourage reflective practice, I would argue that such approaches will assist children's understanding of when, how and why to do things in a particularly ordered sequence as a means of optimising their solutions to practical problems. Indeed, as Edwards and Mercer (1987 p.18) citing Vygotsky, have noted:

'Children solve practical tasks with the help of their speech as well as their eyes and hands.'

Maybin, Mercer and Stierer (1992) extend this issue. If, as they suggest, 'scaffolding' is about more knowledgeable others, 'reducing the scope for failure in the task a learner is attempting' (p.188) then I would argue that teachers metacognitive questioning is a means by which children, if responding in an appropriately reflective manner, can be helped to succeed and develop, particularly in terms of procedural and conditional knowledge. There are also clear links here to the notion of children operating effectively within their zones of proximal development; that is, at points that just exceed their problem solving abilities as individuals in the context of assisted performance. Moreover this would further accord with Maybin et al's view that scaffolding:

'Is not just any assistance which might help a learner accomplish a task. It is help which will enable learners to accomplish a task which they would not have been quite able to manage on their own, and it is help which is intended to bring learners closer to a state of competence which will enable them eventually to complete such a task on their own.' (p.188)

This brings me back to the view that what 'reflective practice' encourages is competence to work towards 'optimal solutions'. In similar vein, Rogoff & Wertsch (1984) note that mental functions,

including thinking, reasoning and problem solving can be aided by collaboration during social interaction. They contend that 'scaffolding', is a concept closely related to that of the 'zone of proximal development', and refers to a process in which more knowledgeable others support children in their mastering of a problem. However, the ability of teachers to provide this guidance needs to be considered alongside teachers' familiarity with and confidence in design and technological activities. In this context Lyle (1996 p. 29) draws attention, based upon her own empirical work, to findings that would suggest that through exploratory talk children's learning can be extended, and that contrary to the view that learning requires the assistance of more knowledgeable others:

> 'It would seem that the Zone of Proximal Development can occur in a situation in which the participants have equal status, and in which all of them are struggling to understand.'

Here, I would wish to contend that 'equal status' and the 'struggle to understand' are centred on all participants (*teachers and pupils*) lacking some relevant declarative, procedural and or conditional knowledge and skills. However, this need not prevent teachers, during verbal interactions, encouraging children to 'reflect', to 'think before doing'. In this sense it is the process of reasoning, rather than the distinctive content of the discussion per se that is to be valued. As such, the notion of 'more knowledgeable other' relates, in the case of teachers perceiving themselves to have limited expertise in the subject domain (*Design and Technology*), to their recognition of the value to be gained from encouraging greater levels of pupil autonomy within their classrooms. In relation to this study this seems to have particular relevance to the notion of 'optimal design' whereby pupils can commence with hazy and only partially reasoned ideas which, in discourse that is appropriately reflective, are re-shaped in order to clarify, for participants, a way forward that can be suitably justified.

Of course, even where levels of expertise/confidence are higher this may not guarantee either effective task structuring or the use of appropriate metacognitive questioning. Rather, this expertise could be used ineffectually by way of offering more in the way of answers, rather than continually challenging pupils to think for and by themselves. What the study hopes to lend weight to, is a growing appreciation by teachers that where they are willing to encourage reflective practice this will result in children operating in a more measured way. For Rogoff and Wertsch (1984), it's about children's notion of how things can best be done going beyond their current internalised position to more closely mirror that of the more expert other. In this case, teachers who value reasoned decision-making.

Thus, whilst I may be questioning the role of some teachers as 'expert' design technologist, I am affording recognition of the capability of all teachers to develop the importance of 'thoughtful action'. This may, in some cases, be bolstered by sound declarative, procedural and conditional knowledge, though this in itself, as argued previously, may not guarantee the use of appropriate teaching and learning strategies.

Finally, and as a cautionary note, Campione et al (1984) highlight the importance of recognising that individual 'zones' will vary from very narrow to broad across subject domains. As such, for teachers to maintain forms of social interaction within a given pupil's 'zone' will be problematic and associated with the perennially difficult notion and reality of differentiation. However, that a teacher provides opportunities for children to think before doing remains a vital element in the development of young children as 'capable' design technologists One hopes, therefore, that tasks are set at an appropriately challenging level and, in any verbal interaction, the pitch of associated questioning is appropriately gauged by teachers, who know their pupils well. It has to be about encouraging pupils to make reasoned decisions. It is to these issues that I now shift.

Encouraging children to focus on relevant aspects of the task in hand

Meadows (1993), reflecting on the work of Voss, notes that dealing with problems involves the gradual build up of both subject-based and procedural knowledge and skills. In relation to the latter, she references the importance of an ability to analyse problems into a sequence of appropriate sub-problems and notes the need to teach such problem-solving strategies in contexts where they are useful. In similar vein, Stephenson (1997) suggests that children need a structure for the way they undertake investigative and problem solving activities; whilst Hennessy and McCormick (1994) argue that teachers will need to plan carefully to provide opportunities for children to be able to engage with and to value sub-processes in order that they begin to build up their own understanding of how such sub-processes might best be used. Fisher (1990) offers a more direct overview, suggesting that it may not always be possible for children to break problems down into manageable steps and that they will sometimes need clues to support their approach to a problem solving task. He also recommends that children need to be:

'Encouraged to verbalise what they are doing, to exercise their linguistic intelligence in monitoring their actions and explain to themselves (*or others*) what they are doing. In gaining more control over intellectually challenging tasks a child is learning how to learn.' (p.121)

However,

'Left to themselves children are not very good at bringing their previous experience to bear on solving related problems. Both structural factors (*the extent to which an appropriate pathway through the problem has been considered*) and psychological factors (*how clearly the problem is expressed and understood*) are important.' (p.129)

For Lyle (1996), collaborative group work needs both to be supported, in terms of developing pupils' cognitive and social skills, and explicitly valued in terms of pupil performance. Not surprisingly, therefore, the role of the teacher, not least in terms of task setting, is seen to be one of the important factors alluded to above. Citing Galton and Williamson, she recognises how important it is for teachers to:

'Reduce uncertainty for children and ensure that they know what they are doing and why in order to increase the chances of full participation, to enable them to generate ideas and to retain ownership of these ideas.' (p.19).

I would argue here, that if children are encouraged to focus on the most relevant aspects of a problem, then this will support their ability to engage in what Mercer et al (1999) have termed 'exploratory talk' (*see above*) and the associated 'reflective practice' that is key to this study. If pupils can be assisted in breaking down a 'global problem' into stages which, for them, are more readily managed, then this should reduce the tendency, noted during field-work, for groups to fragment, with individuals or pairs essentially operating independently of each other. The following example should help to illustrate this matter:

The Year 6 class teacher at School H1 (*see Appendix 1*), where children in groups (*in this case three Y6 girls*) were designing and making a model of a Tudor house, had encouraged the children, during her initial input, to engage with a wide range of issues. She summarised these as follows:

Teacher So what we want is the research, and a picture, and a resources list, and a plan of the cuboids, with their measurements, equipment - and I want the measurement of that equipment, the pieces of wood. And when you say how many you're going to have I want you to add up the prices (*they had been told that*

each piece of timber had a value) and I want you to design a net of the roof and, this is for you to think about on your own, are there any safety issues to think about? We will have a discussion about that at the end of the lesson (*Ongoing reference was left on the blackboard*)

The lack of what I would see as a manageable focus was discussed during the post observational interview (*Appendix 1: H1 30/10/03*):

Question I'd like to come to just how much they can take on board at any one time. You began to say that they should consider a number of aspects – research, a picture, a resources list, plans of the cuboids with measurements and an indication of equipment to be used etc; but how might children's collaborative endeavour be helped by having them focus on a single element of the design, for example the ground floor, rather than setting the problem in global terms?

Teacher It may have helped, in terms of the collaborative work – them discussing a single thing – but what I had in mind was to get from them what they thought was going to be required globally, At the very beginning they were giving me suggestions of what you needed to do, to plan, before they started. So the big global list, as you call it, came from them. I tried to list that on the board, and from my point of view, it was simply a matter of seeing how far they would get from that, perhaps by separating into separate jobs. I might, therefore, have found that in a single lesson they could have done virtually all of it, but I would be learning from it and take them on during the next session.

In reality, the class teacher's intentions were not met, as the observed group tended to work individually on separate elements of

the task. When the children were interviewed, I asked them if it would have helped them if their teacher had encouraged them to concentrate on a single feature of their design - the ground floor of the Tudor house. There was some disagreement here, stemming from an inability on the part of Sophie to see how the second and third storeys of the house would fit naturally (*appropriate proportions maintained*) with any initial structure the group designed; whilst Rachel and Sian were able to identify some benefits from commencing the activity with a more clearly defined focus. As individuals they made the following comments:

Sian — I think it (*a more focused starting point – my interpretation*) would be good, because then we might have finished that and had a little bit more time.

Question — Sophie, about the middle floor not fitting on. Don't you think that had you agreed the ground floor was going to be 15 cm by 10 cm by 12 cm high, that once you had done that design your next floor would .....

Rachel — Be accustomed to it.

Question — A good word Rachel. Because if you made your next floor 50 cm by (*lots of laughs*) ... Yes, exactly, it wouldn't look right. So had you been given less to think about in the beginning, might that have helped you to design all the other bits?

Sophie — Maybe, I'm not sure.

Sian — It would take some pressure off.

Sophie — Maybe, maybe not.

The lack of agreement exhibited here might well stem from the children's lack of familiarity with approaching design and make tasks on the basis of a clearer focus on relevant tasks elements. Sian's

comment - *'it would take some pressure off'* - seems to be revealing however, as it suggests an acceptance of the group's inability to operate as effectively as might have been the case. An acknowledgement that a more concerted effort, as a team, to focus on a single objective at the outset of their work might have offered a more profitable use of the time they were given, leading to a clearer notion of how, for all individuals within the team, the model (*Tudor House*) could have been more adeptly developed.

In similar fashion, evidence from School H2: *4/12/02* (*see Appendix 1*), where a group of four children were designing and making a model of the Globe Theatre, lends weight to the need for teachers to support children's management of problem solving tasks. Support that will help to develop, as part of children's forward planning abilities, an understanding of the requirement to adopt a more sequential approach to problem solving; an approach that places far more emphasis on finding time to analyse a task in order to disassemble the whole into elements that are easier to get to grips with.

Question Last question, it goes back to this idea of having a focus, again. Why do you think that they got so bogged down in fine detail, the business of guardhouses and star shaped windows?

Teacher To them, their finished product seems to be about how it looks rather than how it works.

Question As Richard said, 'if the mechanism doesn't work, it can still be a good model'.

Teacher Yes, so they obviously .... So maybe we need to re-focus them by saying in the initial teaching that it isn't just about how it looks but how the mechanism works and how well it does the job it's supposed to do.

Question So it's about function as well as form?

Teacher Yes ....

Question Well you kept saying to them that if their structure wasn't right, and they said it might wobble and collapse. So they seemed to understand what was important, but they didn't spend any time discussing or thinking about the structure.

Teacher Em?

Question So, perhaps unless you break down the work into chunks that have a clear focus, for example, you work on the structure and once you have something that is operational you can then be as creative as you wish in terms of its appearance .....

Teacher And I think that that would make them realise the importance of why they need to do some things first and other things second. Perhaps the evaluation will be the most important part of the whole exercise.

Question You mean the end-on evaluation?

Teacher Yes, after the making. A focus on the organisation of their work, so that in the next project they can look at what's important, differently.

Question So is it possible that one of the reasons that they weren't structuring themselves, leaving aside the fact that you hadn't asked them to structure their work in a particular way, is that their lack of experience in this area means that they don't have strategies that they fully understand, yet?

Teacher Yes.

In summary, these two relatively short sequences offer some evidence of the need for teachers to 'scaffold' children's problem-solving approaches. I am not suggesting here that this requires the global problem (*the ultimate single objective – e.g. to design and make a fairground ride*) to be made any simpler, but rather to direct pupils to relevant sub-problems; to challenges that allow them to minimise the scope of the decision-making process with which they need to engage (*e.g. if the fairground ride is to be of the merry go round type – what structure will support the moving parts*). In so doing, pupils should come to recognise the need to manage tasks in an appropriately structured and sequential manner, on the basis of selecting suitable strategies that have been jointly agreed through reasoned decision-making. This ability to adopt a narrowed focus should result in a growing acceptance of the benefits to be accrued from essentially limiting the number of task related aspects that need to be considered at any one time. In short, the element of direction offers pupils a working format through which, I would argue, they can more readily reach agreement on what strategies they need to employ at any one moment in the design and make process.

However, this argument assumes that a teacher's perceived view of how children might most effectively break down a global problem and, thereafter, manage associated sub-problems, is readily transmitted to and then assimilated by the pupils. Unfortunately, observational work has indicated that this is, all too often, not the case, (*see Chapter 4: Findings pp. 113-164*) resulting in:

- Pupil uncertainty, in terms of both their engagement with the problem solving process and expected task outcome(s);

- A lack of focus and agreement between members of groups required to work collaboratively;

- Misunderstandings during teacher-pupil interaction reducing the extent to which effective progress is made.

Were teachers' initial inputs to be more securely framed in order to achieve the assimilation referenced above then I would contend that groups would be able to reach 'intersubjectivity', based on the willingness of individuals to give up a currently held position (*situation definition*) in favour of another (*situation redefinition*), as they realign themselves towards an agreed 'action pattern' – a logically structured approach to problems in hand. These terms are dealt with in more detail in the next section.

Action Patterns

Wertsch (1984) has identified limitations in respect of Vygotsky's notion of the 'Zone of Proximal Development' (*ZPD*) particularly in terms of Vygotsky's lack of clarity of what constituted 'problem solving under adult guidance' (p.8) However, given that I would wish to see peer interaction as an integral component of assisted performance, I would suggest that what adults can provide, as part of a supporting mechanism to aid the development of children's procedural and conditional knowledge (*efficient engagement with the design and make process – practical problem solving*), is guidance that promotes a clear understanding, at the outset of a task, of the need for individuals, working as part of a group, to reach joint agreement on how to sequence their approach to goal-directed activities as a means of securing an optimised final product. As such, one would hope that all participants become more capable as a result of developing a willingness to reach agreement on the basis of reasoned decision-making. However, as noted above, this guidance needs to be placed, at any one time, in the context of children focusing on relevant aspects of a global problem, appropriately broken down into manageable sub-units of work. Thereafter, a teacher's role should, I would contend, be linked to three theoretical

constructs identified by Wertsch in his attempt to clarify the concept of the ZPD. These are:

- 'situation definition'
- 'action patterns' and
- 'intersubjectivity'.

With regard to the former, Wertsch argued that within the ZPD adults and children, in the context of collaborative endeavour, might tend to represent objects and events in different ways. Here, the author refers to objects in a concrete sense, for example, the construction of a replica model using a range of interlocking pieces. In the context of the focus for this study (*practical problem solving*) I would argue that the 'objects' referred to by Wertsch need to be viewed as the 'products of reasoned-thinking leading to efficient action'. For teachers, then, there is a need to promote, through careful task structuring and the considered use of metacognitive questioning, a willingness, on the part of pupils to reflect, to think before doing, to come to understand the need for them, when operating collaboratively, to reach a joint understanding of how best to move forward. That is, individuals coming to agree the strategic steps that are required to support efficient problem resolution by way of demonstrating their ability to effectively apply what they currently know and can do. Observational work, as part of this study, has indicated some recognition on the part of pupils of the benefits that might accrue from agreeing on an appropriate, group-based action pattern. However, there has also been an acknowledgement that at times they do not interact effectively with one another in order to secure this position. In post observational interviews there has also been the suggestion that the limited opportunities for creative activities currently afforded within the primary curriculum means that 'action' rather than 'reflection' is valued/prioritised by pupils: 'doing' rather than 'thinking'. Not surprisingly, this position may often be taken at the expense of pupils recognising the important relationship

that should exist between the two as a means of working iteratively towards optimised solutions.

As such, children need tasks to be clearly structured in order to secure a unified perspective on both what the task involves and how they should sequence their approaches to it. Without the former, the latter becomes problematic.

An example from a classroom of Year 6 children (*see Appendix 1: School H1*) will hopefully clarify this position. Here the group were placed in a position of designing a simple mechanism, as the teacher hoped, to act as an efficient lifting device. For the teacher, the object of the session was the development of pupils' understanding of how a simple gear system might be used to both slow the speed of movement and, in this case, increase the output force. However, the pupils seemed to think that the rationale for the activity had more to do with their ability to calculate gear ratios (*mathematical focus*) than the need to apply such knowledge in order to provide evidence of capability – to select the right gears for the job in hand. As a result, situation definitions (*expected outcomes*) were not aligned, either between teacher and pupils or then between the pupils, and the resulting action patterns (*strategy choices and their sequencing*) were inappropriate.

Indeed, Wertsch contends that when, at the outset of problem solving tasks, children come to define the purpose of a task differently from a supportive adult, the consequence will be a variation in perceived 'action patterns', that is, the way in which the development of a solution might be logically and efficiently structured. Such variations may, moreover, differ at a personal level such that individual pupils within a group fail to share an aligned perspective on a best way forward. To avoid the likely consequence of an impasse, scenarios where pupils drift into standoff positions that undermine progress, one or more of the participants will have to give up their current situation definition (*perspective on expected outcomes*), and its associated action pattern (*preferred sequence of events, including*

strategy choices) in favour of a revised and agreed position, hopefully based upon critically constructive dialogue as a means of securing thoughtful decisions. For Wertsch, it is this relinquishing of an existing situation definition, and its associated action pattern, in favour of a new one (*situation redefinition*) that is a fundamental quality of movement within the zone of proximal development; a 'qualitative transformation' (p.11) that, as I understand it, augments pupil's cognitive development.

In this way pupils hopefully come to recognise the relative appropriateness of their thinking and associated lines of action, as does the teacher as facilitator of 'reflective practice', through the medium of communication. Indeed, I would argue that it is the role of communication during teacher-pupil interaction that in effect causes each, as an aspect of verbal reasoning, to evaluate the outcome of their own and others intentions. Participants (*teacher and pupils*) in such interaction may begin at different or comparatively similar starting points, but what is important to the development of an optimal solution is that, where necessary, modifications to currently held positions, on the basis of reasoned judgement, secure intersubjectivity; that is, functioning on what Vygotsky termed the interpsychological plane needs to be supported by all participants in the context of social interaction such that they come to both share the same situation definition and know this to be the case. For, as Wertsch notes (p.13):

'Intersubjectivity is often created through the use of language.'

However, as discussed below (*see Cognitive Dissonance pp. 71-84*), pupils' readiness to engage in this type of interactive exchange may well be adversely affected by factors that reduce their willingness to reach a shared understanding that would be of benefit to the group as a whole.

In summary, when a clear framework of interaction is established, through effective task structuring, a framework in which teacher and

pupils are clear about expected outcomes, then I would contend that children should be more readily positioned to use elements of reflective practice to secure jointly agreed action patterns supportive of efficient problem resolution. Moreover, it should support the ability of children to ultimately retain ownership of related tasks and secure progress, albeit with the type of guidance referenced above, through joint agreement on strategy usage based on reasoned decision-making. Lastly, such interaction can also be linked to the notion of 'contingent teaching'. Roy Corden (1992) draws out the connection between a teacher's willingness to operate contingently and a teacher's ability to use interactional dialogue appropriately. Of the many ways in which a teacher can interact Corden notes that in prompting children to 'clarify' their own understanding a teacher is 'scaffolding' their learning. In the context of pupils' design and technology experiences such scaffolding should, therefore, support pupils' developing knowledge and understanding of related procedural and conditional knowledge. Furthermore, as Wood (1991 p.108) contends:

> 'contingent control helps to ensure that the demands placed on the child are likely neither to be too complex, producing defeat, nor too simple, generating boredom or distraction'

In essence, what is being suggested here is that when teachers and children interact in the ways outlined above, new schemata, or versions of progress, can be developed as a result of the shared interaction. If one assumes that children will be approaching problem-solving activities with a degree of doubt about how best to move forward efficiently then any encouragement to 'think' before 'doing' must, I would argue, be beneficial. Indeed, as Wood (1991 p.106) notes:

> 'Without help in organizing their attention and activity, children may be overwhelmed by uncertainty.'

The importance of using appropriate terminology

Finally, in this section, I would like to briefly turn to a consideration of how the misuse of subject specific terminology can adversely affect the way in which a task is structured and, thereby, undermine the effectiveness of both collaborative endeavour and the associated use of reasoned decision-making. This inappropriate usage, noted on more than one occasion during data collection, seems to be related to teachers' current limited levels of subject specific knowledge and skills and is, for me, an important issue in terms of children establishing agreement, as a team, about the way in which they approach their work. That is, how they agree an action pattern (*as discussed above*) that supports efficient progress. When terminology is used in such a way that the teachers perception of expected outcome (*situation definition*) is not fully appreciated by the children, leading to different perspectives being held within a group (*a lack of intersubjectivity*), then what tends to happen is group fragmentation, undermining collaborative endeavour. An example of this phenomenon is provided in Chapter 4: Findings, where I discuss the ways in which a teacher's use of the term 'plan', rather than 'design', leads to some members of a group interpreting the desired activity outcome as writing a list of materials (*'planning' seen in terms of organisational requirements*), whilst others interpret is as a need to develop additional ideas (*'planning' seen as drawing*). Whilst this might move their work forward there is a danger that a lack of interplay between pairs of pupils (*as was the outcome in the case in question*) may well result in a divergence of pathways resulting, in simple terms, in the list of materials being agreed by Pair A not taking cognisance of the new ideas being developed by Pair B. Correspondingly, the new ideas of Pair B may not be based on a sufficient acceptance of the materials list now being formatted by Pair A.

For now, I would simply wish to argue that the accurate use of subject specific vocabulary, as an element of teacher-pupil interaction, is yet another variable that requires consideration if

teachers are striving to promote young children as reflective practitioners. For example, if the aim is to encourage pupils to be critically constructive, to challenge their own and others current positions, then they need to commence verbal interaction on the basis of a clear understanding of what is expected of them in terms of focusing on relevant aspects of the task in hand. This, again, is linked to the significance of appropriate task setting as an aid to scaffolding pupils' management of group-based, practical problem solving activities.

Cognitive dissonance

Lyle (1997) sees pupil-pupil talk as a key element of problem solving as it provides opportunities for pupils to negotiate meaning whilst receiving both encouragement and objections from their peers. However, she questions the extent to which such advantages are actually accrued during classroom practice, not least because of the complex make up of children asked to interact in group settings. She notes, that among other things, their expectations, status, prior achievement and communication skills will all differ and impact upon the notion of 'meaning making'. Not surprisingly, therefore, the same author (1996) also noted that any attempts to study the verbal interaction associated with group work, deemed an essential element of a social constructivist approach to education, must take heed of the fact that discourse will be shaped by a number of interrelated factors related to the social context in which the interaction takes place (*see Chapter 2: Establishing Ground Rules etc. pp. 43-53*).

This section attempts to shed light on some of the possible factors at play and is focused on the work of Festinger (1957). However, before I consider the relevance of Festinger's concept of 'cognitive dissonance' further, I would like to refer to the work of Kruger (1993) who identifies some useful aspects of social interaction that are, for me, closely aligned both to Festinger's work and the notions of

'exploratory talk' and 'productive disagreement' discussed previously (*see Chapter 2: Establishing Ground Rules etc. pp. 46-49)*

In a paper on dyadic interaction, focused on socio-moral reasoning, Kruger (ibid) identifies, from research findings, that the discussion of ideas that pupils eventually reject (*'tearing apart solutions that pupils find inferior' p.178*) appears to have a much more significant impact on cognitive outcome than any dialogue related to accepted solutions. For Wegerif et al (1999) this appears to be seen essentially in terms of interaction that is not focused upon individuals 'winning' an argument but rather on understanding or solving problems together.

As such, what leads to problem resolution can be regarded as incorporating aspects of both socio-cognitive conflict (*a Piagetian position*) and cooperation (*a social determinist position*). This link supports the view expressed in, for example, Mercer (1996 p.370) where he argues that, 'exploratory talk', by incorporating both conflict and the open sharing of ideas represents the more visible pursuit of rational consensus through conversation.' As Wegerif (1999 p.92) suggests:

'Meaning requires at least two 'voices' or perspectives.'

An example drawn from School H2: 6/11/02 might help to illustrate this position and Kruger's references to the importance of children being in conflict with each other's ideas, but not necessarily with each other:

Question If Richard's idea was a better one than yours and he gave a reason, how easy would it be for you to give up your idea?

Craig Quite easy, because it would be a better idea, so it would be easier to do.

Question But what if Richard said, not cardboard Milo, plastic. But he didn't give you a reason? Would you just give up your idea?

Craig No.

Question Why?

Craig I'd ask him to say a bit more. Because if he chose plastic, that would make the paint fall off, because it can't dry into it.

Here, Craig is indicating a willingness to express conflicting views, but nevertheless open to changing his own position providing new ideas can be readily accommodated into any personal changes in thinking that he would have to undertake. As such, ideas would be contested, though not in the context of any conflict at a personal level. In Festinger's (1957) terms Craig is exhibiting a willingness to modify his thinking as a means of reducing uncertainty (*dissonance*) (*see below*)

Moreover, Kruger also argues that conflict and cooperation, as central elements of cognitive development, are not as far apart as some would contest and have more to do with semantics than practical outcomes. He notes that:

'In no study does simple agreement or disagreement relate to outcome. In all studies success is predicted by engaged discussion of the issues, including explanation, clarification or revision of ideas.' (p.166).

These are all key elements that have been incorporated into my own operational definition for 'reflective practitioners'. For Kruger, in 'tearing apart' ideas, aspects of conflict and co-operation are both visible. The latter, illustrated via the co-construction of understanding, the rationalising of inferiority (*why is this idea not appropriate*),

demonstrates the importance of pupils being in conflict with each other's ideas, but not necessarily with each other. This subtle but significant issue was evident in some feedback from pupils during post observational interviews. In one example (*drawn from School H1 30/10/03*) decisions seemed to be based, in part, on what might be referenced as a ritual ganging up – two pupils playing off a third.

Question Georgia, how easy is it for you to give up your ideas, in favour of Stephanie or Hannah's ideas?

Sian It's quite hard because sometimes I have better ideas than they have, but we have a vote and they always vote against me.

Sophie We can be quite cruel to each other (*said with a giggle*).

Question So Georgia, if you think that your idea is best, how would you try and convince them that your idea was best?

Sian I'd give a reason why it's better than theirs.

Question You're not just saying that because you think that I think it's important?

Chorused response of no!

Question So why do you two (*Rachel and Sophie*) tend to vote against her.

Sophie I don't know really. It's just that sometimes we have different opinions. But sometimes it's me and Georgia voting against Hannah and sometimes its Hannah and Georgia voting against me. It changes.

Rachel But for some reason it's mostly me and Stephanie

against Georgia.

Indeed, Kruger suggests that:

'The importance of reasoned dialogue in all studies clarifies the common ground of the two theoretical positions.' (p.166).

For him, what is crucial in collaborative settings is an opportunity for individuals to critically engage with and integrate multiple perspectives. That is, a willingness to enter into what he terms, 'transactive dialogue', as a means of securing successful cognitive outcomes. As Wegerif et al (1999) note, Kruger has found that:

'The groups who do best are those which consider alternatives before deciding.' (p.497)

His transaction coding has had implications for my own study as he identifies within them the relationship between critical appraisals that are 'self-oriented' and those which are 'other- oriented' I list these below for clarification:

Transaction statements:

Defined as spontaneously produced critiques, refinements, extensions or significant paraphrases of ideas where:

- Operations on a partner's ideas are labelled 'other-oriented'
- Clarification of one's own ideas are labelled 'self-oriented'

Transactive questions:

Defined as spontaneously produced requests for clarification, justification or elaboration where:

- Requests to the partner are labelled 'other-oriented'

- Requests for evaluative feedback on one's own ideas are labelled 'self-oriented'

Transactive responses:

Defined as clarifications, justifications or elaborations of ideas given in answer to transactive questions, where:

- Responses here can be either 'other or self-oriented'

The following, drawn from the transcription of a visit to School F: 30/1/02 (*see Appendix 1*) will hopefully help to exemplify these aspects:

Peter — What would you do to hide it (the circuit board) Caroline? (other-oriented transactive question: seeking clarification)

Caroline — Well I would fold it four times to make the card and hide it inside those two bits. To help me not to have a problem I drew a diagram of it in my book (self-oriented transactive response: offering elaboration).

Katherine — I would put a (*inaudible but I think sticker*) on the back of it, it's for my Mum and Dad (self-oriented transaction statement: refinement/extension).

Whilst Kruger's work was related specifically to dyadic dialogue it seems to me to be justifiably relevant in terms of the small group work that has formed the nexus of this study. As such, this work was influential in the development of the operational definitions of 'metacognitive questioning': classroom teachers prompting children to reflect upon their own/others current position/intentions; and 'reflective practitioners': children using reasoned argument to critically judge their own/others current position/intentions (*see Chapter 1: Key Issues pp. 18-27*). This willingness to operate at what

may be termed an intra-objective and inter-objective level are seen to be important in the context of this study for, as Kruger's (p.179) concludes:

'Collaborative learning is learning from analysis of the other's perspective, and from the other's analysis of one's own perspective, and from a new synthesis of those analyses. It is both dissection and creation.'

However, the idealised 'critically constructive' position suggested by this viewpoint has not always been readily enacted during the practice that can be observed within classrooms. For example, whilst Lyle (1997) clearly sees pupil-pupil talk as a key element of problem solving she nevertheless questions the extent to which such advantages are actually accrued during classroom practice, not least because of the complex make up of children asked to interact in group settings. She notes, that among other things, their expectations, status, prior achievement and communication skills will all differ and impact upon the notion of 'meaning making'. It is in relation to some of these factors, and others, that Festinger's work is seen to be relevant.

Festinger's theory of cognitive dissonance, in essence, suggests that where individuals are confronted, psychologically, with aspects of uncertainty (*my term*), they will be moved to diminish this status as a means of securing a more consonant (*harmonious*) state of mind. This might exhibit itself as a change in behaviour (*actions or feelings*), in modified thinking or in a cautious association to new information and or new opinions; including actively evading situations and information that might cause the concerns that have activated the dissonance (*uncertainty*) to increase. For Festinger, the reduction of dissonance is a basic human function and may be observed in many contexts.

'Where an opinion must be formed or a decision taken, some dissonance is almost unavoidably created between the cognition of

the action taken and those opinions or knowledges which tend to point in a different direction.' (p.5)

In the context of group based practical problem solving activities, whilst some evidence from my own study suggests that pupils can identify the benefits of engaging in reflective practice, and demonstrate a willingness to engage critically with their own or others' intentions, the perception of a variation in degrees of expertise (*knowledge and or skills*), within the group, may prevent peer interaction on the basis of such interfacing revealing personal limitations, at least in relative terms; quintessentially, pupils actively evading situations and information that might cause them to feel uncertain/exposed/undervalued etc.

It can be argued that dissonance almost always exists within decision-making processes requiring reflection upon two or more alternatives. If this is the case, then the reluctance of pupils to give up a current line of thought or action, including their design ideas, may often be a function of their wish to reduce cognitive dissonance (*uncertainty in their own thinking*) rather than a wish to engage in conflict based upon overtly personalised disagreement.

Such dissonance could simply be related to the notion of 'status' and children's desire to be seen as having a notable impact on the way in which a product develops. This was recognised by the class teacher at school E: 12/12/01 who noted that:

Teacher It's a difficult thing (*giving up idea*). When you're creating something, when you're going to have something on show for others to see, then children want quite a big stake in it and it is difficult for them to give up even little things. And the only way around this is to bring them back (*as a team*) more often than you think.

Festinger also argues that the extent to which individuals might feel dissonant is a reflection of the value placed on the viewpoint currently held; yet made uncertain by the introduction of a differing perspective. However, he recognises the importance of what he terms the establishment of 'social reality' (p.21). Put simply, gaining the support of others. Of course, in any group situation dissonance for individuals may either be increased or decreased as a result of social interaction and, where opinions differ, these are a potential source of dissonance. However:

> 'One of the most effective ways of eliminating dissonance is to discard one set of cognitive elements (*viewpoints*) in favour of another, something which can sometimes only be accomplished if one can find others who agree with the cognitions (*lines of thought/action*) one wishes to retain and maintain. Processes of social communication and social influence are, hence, inextricably interwoven with processes of creation and reduction of dissonance.' (p.177)

This is certainly relevant to this study because in the process of moving toward an optimal design, decisions will need to be taken that may require the rejection of other lines of thought or action, themselves attractive to those who hold them, including persuading others to join your own cause. As such, a link can be drawn between Festinger's work and Wertsch's (1984) concept of situation redefinition (*as discussed above*)

Consequently, acceptance or rejection (*two sides of the same decision making coin*) of an idea will result in either the 'accumulation' or 'reduction' of dissonance for one or more parties involved in the interaction. This could lead to simple agreement: e.g. admitting that your position was wrong or changing an opinion so that it corresponds more closely with the opinions of others. Such compliance may be enacted because some reward is valued – moving the work on speedily to a resolution or consolidating a friendship. If not based on any reasoned argument, then such

changes in levels of dissonance may fall into Mercer's (1996) category of 'cumulative talk'. Indeed, some evidence has suggested that pupils may see entering into critically constructive discussion as dangerous for the general well being of the group. In this sense, pupils may perceive the reward for limiting dissonance as greater concordance within the group, though not necessarily to the benefit of optimising progress. A comment from a pupil at School H2: 6/11/02 affords some recognition of this possibility. Asked why the group had not engaged in a great deal of interaction during a session in which they were at the initial designing phase (*including manipulating samples of materials*), the following response was provided:

Craig We're busy getting the work done and also I don't think that we should challenge one another because then we'll just end up getting into a fight or something.

Alternatively, it could be a simple reluctance to engage: e.g. believing that you have no personal responsibility for any decisions being made; or pupils holding on to a viewpoint which they see as appropriate and recognising that in not giving succour to other opinions their own position, whilst not being utilised, remains in some way intact – personal dissonance is not increased, at least in the short term.

Then again, accumulation or reduction of dissonance could be based on forceful opposition to or outright rejection of a viewpoint, or an attempt by one pupil to make another seem somehow, non-comparable (*thoughts and or actions deemed less worthy*). If either of these positions were not based on any reasoned argument, they might fall into Mercer's (1996) category of 'disputational talk'. In the first instance, a pupil may feel that if their case is made strongly enough, then this will either invoke change in others, or, at the very least, leave them feeling more justified with the position they are holding. Moreover, if a pupil can persuade others to hold a similar position then this minimises the relative amount of dissonance

created by, for example, a single member of the group who holds a different point of view. In the second case, non-comparability might be based on one pupil derogating the position of another. For example, if one pupil suggests that they would like to include a particular graphic element within a product – a logo, another might undermine the value of the suggestion by simply saying, 'you're no good at drawing'. A pupil might also attempt to exert influence on others in order to persuade them to accept a viewpoint. Here, one would hope that relevant clarifications and justifications are included in the dialogue (*exploratory talk/reflective practice*) to support the change suggested. Of course, resistance to such change will be greatest from those individuals for whom such change will generate increases in personal dissonance that may be judged excessive. For Festinger:

> 'All those elements that, considered alone, would lead to action other than the one taken are dissonant with the cognitive elements corresponding to the action taken.' (p.36)

Festinger also recognises that the perceived relevance of an individual degree of expertness within a group plays a role in determining the value placed on any viewpoint they hold, and the extent to which this might increase or decrease dissonance. During some observations, witnessed as part of data collection, pupils have been noted to discuss their belief in a person's worth as a means of satisfying them that progress is being made in a satisfactory way. As such, this would suggest that the need for any further interaction could be seen to lead, unnecessarily, to dissonance that might be avoided by simply assuming all is well.

Again, evidence from school H2: 6/11/02 provides an example:

Craig We (*Richard and I*) could discuss what we think is better and see if she agrees (*Natalie*), but if she doesn't then we could find a way that we all agree on. But Natalie is good at sketching so I thought that it wouldn't

matter what she did, because I thought that she would do something that was good.

Question So you had faith in her?

Craig and Richard Yes.

Furthermore, in a group situation the chosen line of thought/action may simply be a reflection of the relative attractiveness of one idea, in relation to others and, as such, decisions may not necessarily lead to an optimal position. One would hope, however, that the interaction taking place is, in the context of this study, reflective: pupils are engaged in a critical but constructive evaluation of alternatives (*'exploratory talk'*), resulting in decisions based on reasoned argument that is focused on resolving conflicting ideas and not, as Festinger notes, 'an opposition of forces acting on the person' (p.40). As a result of such 'reflective practice' pupils may be able to reach what Festinger calls 'cognitive overlap', where aspects of differing ideas are co-joined as a means of reaching the same end result. This overlap might also motivate pupils to draw on information (*seek out cognitive elements*) that would consolidate the joint position. This should not be seen as compromising the position of either player, but rather of actively drawing upon the positive aspects of each individual proposition together with a recognition of the benefits that can be accrued from a co-joining of the suggested lines of thought/action. An example might be that one pupil is arguing for masking tape as a fixing method, another for staples. If the first pupil were to suggest that they use both, staples for strength and the masking tape because it can be over-painted and will also hide the staples from view, their thinking becomes co-joined (*overlaps*).

Finally, it is also worth noting that Festinger has indicated that social agreement will be easiest to obtain where most individuals have the same dissonance between cognitions that can be reduced in the same manner (p.192). For me, this 'same dissonance' seems to

manifest itself regularly in a stated need to move on from 'thinking' to 'doing', to be active rather than reflective. If there is a jointly held desire to be making rather than designing, then this, in part, may be why children have often failed to be reflective (*engage in exploratory talk*) during the designing phase – they simply want to *'get on with it'* and an increase in dissonance, however supportive of an optimised resolution to their problem, will simply delay their move toward practical activity.

From school H1: 30/10/02:

Question If you know what you are thinking up here, in your head, why don't you say it more often?

Rachel I really don't know.

Question Is it because you really want to get on with it? Do you like the practical bits more than the designing bits?

A chorused response of yes.

Question So do you think that sometimes in Design and Technology, that because you are keen to get going, that you ignore having five minutes to agree some important things at the outset?

A chorused yes.

Whilst I appreciate that the questioning may have been somewhat leading in nature, the views expressed by the three girls in this group mirrored many other responses from children who clearly enjoy practical, creative tasks and seem to wish to separate such work from any intellectual activity if this is perceived to thwart the progress of the product being developed. As such, the iteration between reflection and action noted elsewhere has tendency to be underplayed.

In summary, Festinger's theory of cognitive dissonance sheds some further light on why pupils might, when operating in groups, fail to interact in ways that support the utilisation of reflective practice as a means of optimising their progress when attempting to resolve practical problems. Individuals may not, for example, wish to engage in the clarification of a current line of thought, for to do so would lead to an increase in personal levels of uncertainty. In this context positions may become entrenched. At other times, friendships may lead to a collective view that will be held by weight of numbers within a group, even though the preferred line of thought or action is not, in reality, secure. Alternatively, simple agreement (*cumulative talk*) may be reached to obtain the reward of moving quickly from reflection to action; from thinking to doing.

Drawing the threads together

The sections above have drawn attention to the fact that if a teacher's initial input to a whole class is not as focused as it might be then children, working essentially in an independent (*of the teacher*) and collaborative manner, may fail to work in an efficiently structured way in order to move their practical problem solving towards an agreed optimisation. Indeed, given Fisher's (1991) stress on the importance of teacher communication being located in terms of a clear pattern or framework, one can begin to see how any disturbances in the setting of such frameworks (*setting ground rules for effective collaborative endeavour, focusing children on relevant aspects of a task structuring and using appropriate terminology*) can hamper children's associated patterns of interaction and lines of thought and action. Where appropriate frameworks are established Rogoff (1991) has suggested that teachers can help them to extend their current knowledge and skills to a higher level. Indeed, if the development of associated knowledge and skills is seen to involve the discovery of what is best paid attention to, borne in mind and acted upon, in an appropriate goal achieving sequence, then the suggestion here is that teachers will be helping to enhance, in

particular, the 'what', 'how', 'why' and 'when' aspects alluded to above. Kimbell et al (1996 p.43) sum this up nicely when they note that:

'One of the more obvious objects of education is to develop the ability of pupils to manage themselves; to bring them to the point where they not only understand what it means to take responsibility for their actions but, moreover, they have expertise in doing so.'

However, it is also necessary to acknowledge that even where teachers can be seen to provide appropriate frameworks and also make effective use of metacognitive questioning, the extent to which children subsequently engage in reasoned decision making may remain limited by other factors, some of which I have attempted to draw attention to under the heading of 'cognitive dissonance'. Indeed, as Mercer (1995) notes, whilst some would argue strongly for the need to provide children with well structured opportunities to talk together, not least as a means of encouraging pupils to construct effective arguments and through which pupils 'reason together', research on group based activity has shed light on the possibility of inter-pupil discussion being, fragmentary, superficial and educationally unproductive. Moreover, as noted previously (Lyle 1997), the extent to which pupils engage effectively in 'meaning making', in reaching reasoned and agreed positions on how best to proceed, will be influenced by a wide range of factors – status and expectations being but two of these.

It is perhaps little wonder that reaching any definitive position in relation to: **a consideration of factors that impact upon children operating, in junior classrooms, as reflective practitioners in the context of group-based, problem solving activities**' has proved to be both interesting and challenging.

Chapter 3: **Methodology**

In this section a rationale is provided for the use of a qualitative methodology that is based on a consideration of a range of possible modes of enquiry and their suitability for the evidence base required to support my investigation of the research question. A clear indication is also provided of the research instruments employed, together with an acceptance of the difficulties aligned with any approach to the study of 'talk'.

Overview

In line with Goetz and LeCompte (1984) the research approach that has been adopted for this study can usefully be termed as: 'educational ethnography', as it has drawn from a relevant literature research and an associated investigative process focusing on a particular form of human behaviour, namely teacher-pupil / pupil-pupil interactions. The outcome of associated investigative work has been the analysis of raw data resulting from the retrospective transcriptions of observed classroom activities, followed up by semi-structured interviews with participating pupils and their teachers. However, herein lies a problem of terminology and categorisation. I might equally refer to the work as a form of phenomenology, defined by Wragg (1994, p.54) in terms of:

> 'Making notes about classroom events and interviewing teachers and pupils to see what constructs and interpretations emerge when they talk about the classroom.'

Not surprisingly, sharp dividing lines between methodologies do not appear to be readily obtainable; rather, the study undertaken points to an overlapping of aims and approaches and a degree of subjectivity in relation to the placing of my chosen modus operandi into any specific research faction. In this context, a good deal of the literature considered below is to do with research methodology in the broadest sense; particularly, the development of a rationale for

choosing an essentially ethnographic, qualitative and interpretive approach rather than a method centred on the collection and analysis of largely quantitative data. This is not to suggest that I have not wished to take on board views that see each of these approaches as having inherent strengths and weaknesses. Nor the consequent recognition of the possibility of incorporating aspects of both methods into the approach selected, at least at the outset of this study. Rather, following the consideration of a range of views, as detailed below, I decided in favour of a qualitative approach, for which a justification is provided in due course. I will also deal elsewhere in this section with the notions of validity, reliability, triangulation and reflexivity.

Mercer (2001) provides strong links to the approach that has been adopted when considering 'Socio-cultural discourse analysis'. For him, this methodology, along with others, has its strengths and weaknesses. Its strength can be related to its sensitivity towards culture, context and the ways talk enables educational activity to progress, minute by minute, as a finely co-ordinated process of interaction; whereas, its most obvious weakness is seen to relate to, the instinctive nature of the analytical measures involved. As such, this approach is seen by Mercer (1996) to differ from 'lingustic' styles in that it is less concerned with the organizational structure of spoken language, and more with its content, function and the ways shared understanding is developed, in social context, over time. As with aspects of ethnography and conversation analysis, reports of such research are usually illustrated, as is the case with my own study, by selected extracts of transcribed talk, to which the analyst provides a commentary.

Of course, such commentaries – in the context of this study, analytical on transcript notation (*see Appendices 2-5*), offer a very personalised reading of data and thus the interpretive nature of the analysis undertaken and presented in support of my lines of argument are freely acknowledged here. I shall also concede the relatively restricted database, and the impact this limitation has on

the conclusions and associated recommendations outlined in Chapter 5. Furthermore, there is also a conscious recognition of the need to invite a close scrutiny of my work, such that others may draw from it as they wish. This said, other authors have also drawn my attention to the fact that the problems identified above are problems common to the investigation of 'talk' in general – whatever methodological approach is utilised. As Hughes and Westgate (1998) note, in relation to their own methodological approach (*coding using Barnes and Todd categories*):

> 'In spite of some inevitably subjective interpretation underlying choices of particular code-categories at particular junctures we hold the view that the system can be cumulatively revealing and no more open to error than categories that purport to be objective.' (p.177)

Returning to Goetz and LeCompte (1984), they note that it is impossible, in any social setting, to record all that takes place as the interactive stream is too complex. Rather, they suggest that there is a need to record events that are significant in respect of the chosen topic. To this end my focus has been on the relationship between verbalised thought and action; particularly, how young children as reflective practitioners, promoted by effective teacher interaction (*task setting, group work management and metacognitive questioning*) are prompted to engage in reasoned decision-making. These authors also shed light on the distinction between participant and non-participant observation; categorising the latter, in its purest form, as requiring the observer to be hidden from the observed. My own fieldwork has been consistently based on a very high degree of non-participation; having always avoided any temptation to join in the activities being recorded (*either physically or verbally*). This strategy was adopted to minimise what Anderson and Arsenault (2001, 2nd edn.) refer to as the *Hawthorne Effect*, where the observer's presence results in the modified behaviour of the observed. However, given that I have always been visible to both the pupils and their teacher during observations and have also set the initial

questions for the semi-structured interview sessions, I am aware that I may well have had an effect, if not always immediately tangible at the time of those interactions, on the associated data that was recorded. However, as Brown and Dowling (1998 p.47) would argue, 'whatever form of observation one adopts, there are a range of possible observer effects that will have a bearing on what happens'. I did not wish to adopt a line of argument that might suggest that I could operate either, in a positivistic sense, in a totally objective manner; nor be hidden from the action, not least because of associated ethical issues. Rather, I am open to the possibility of not only influencing performance but of bringing to the analysis of the data collected an interpretive framework that may be skewed by my working in familiar settings; familiar in the sense of the subject area and my own views on relevant pedagogy.

Accordingly, I would wish to categorise my approach as that of a 'partial-participant observer', very closely aligned to Anderson and Arsenault's (ibid) concept of the 'direct observer' but cognisant of having a degree of impact on proceedings. Beyond the observational and interview work I regularly withdrew myself from the environments in which data was collected whilst data was analysed, prior to returning to seek corroboration of findings via respondent validation.

What has been of consistent importance is my open recognition of the fact that I may have impacted upon the research process at any one of the stages involved; either during the collection of data, or in its interpretation and subsequent findings, conclusions and recommendations.

For example, it is worth noting at this juncture that some of the questioning located in the transcripts of the semi-structured interviews can be seen to be rather 'leading' in its nature. I am willing to acknowledge this phenomenon and to accept that this may have led to responses that were skewed by my position. However, I am also disposed to defend the tactic as a mechanism for encouraging

responses where either teachers or pupils seemed reticent to engage actively in the discussions taking place. Of course, the extent to which results are distorted is not easy to gauge because the evidence obtained cannot be judged against a response freely given. So, what does all this mean for the notion of 'objectivity'? Perhaps, as Eisner (1993) suggests, it is about being as objective as one can be; an acknowledgement that whilst we cannot have an undistorted view of reality (*ontological objectivity*) researchers ought to aim for methods that aspire to eliminate bias (*procedural objectivity*). In this sense leading questions might be seen to work against the latter, but in prompting respondents to offer a view this helps to advance the generation of additional data that can at least be analysed by the researcher, presented as part of the study's evidence base and remain open to thorough scrutiny by the reader. In all of this individuals will bring something of themselves to bear on that which is offered for consideration, how that consideration is conducted and the resulting views that emerge. Citing Toulmin, Eisner (ibid) noted that:

> 'All of our scientific explanations and critical readings start from, embody and imply some interpretive standpoint, conceptual framework, or theoretical perspective. The relevance and adequacy of our explanations can never be demonstrated with Platonic rigor or geometrical necessity.'

These concerns, as noted below, can also be levelled at quantitative approaches, more detail to follow. For now, all I can hope to offer is a research study based on a belief that what I have done has been developed thoughtfully, ethically and on the basis of presenting the associated findings in an honest manner open to the examination of my peers.

So, why the ethnographic, qualitative and interpretive approach? It is to this question that I now turn my attention.

A very straightforward, if somewhat simple response to this question is because the approach seemed eminently suitable, it 'fitted the bill'. Indeed, Arsenault and Anderson's (2001 p.119) definition provides an excellent framework for the work that has been undertaken:

'Qualitative research is a form of enquiry that explores phenomena (*young children as reflective practitioners*) in their natural settings (*classrooms*) and uses multi-methods (*observation of teachers, observation of pupils working in groups, semi-structured interviews)* to interpret, understand and bring meaning to them.'

For Hammersley and Atkinson (1983) ethnography is viewed as a basic form of social research, and is associated to 'participant observation', the two terms being seen as equivalent. They compare and contrast the methodological underpinnings of 'positivism' (*quantitative*) and 'naturalism' (*qualitative*) but note from the outset that neither term is readily defined and nor does research, in reality, fall neatly into either of these camps. Moreover, they conclude that, 'neither provides an adequate framework for social research' (p.25). Central to the former is scientific methodology, often experimental, and the analysis of quantitative data. Conversely, 'naturalism' presupposes that the, 'social world cannot be understood in terms of causal relationships' (p.7) and that researchers must attempt to see the world in the same way as those who are being observed; resulting in what they refer to as 'cultural description' (p.9) Both methods have their flaws, in terms of validity and reliability and both attempt, by varying means, to eliminate the effects of the researcher on the data collected and considered. For Hammersley and Atkinson the latter is futile, as each and every researcher begins a study as part of the social context they are viewing and should accept the necessity of understanding the bearing their position may have on outcomes. For them, researchers must recognise the 'reflexive' nature of their position and work systematically and rigorously with the knowledge available to them. Moreover, all knowledge should be seen as a construction on the basis of available evidence and, therefore, imperfect. Here, reflexivity can be seen to support both the

'common sense' basis of qualitative research and the scientific foundations of quantitative methodologies. Most importantly these methods should not be viewed as incompatible; whilst ethnography, has the value of developing theory, of challenging preconceptions and of being flexible in response to the evidence accrued during research interactions, it also has it's limitations, particularly the time consuming nature of the transcription and analysis of teacher-pupil interaction, the limited number of samples that will be targeted and the associated problem of not being able to generalise from a relatively limited evidence base. It should, therefore, be seen as one method among many and from a perspective of giving credence to the utilisation of a range of methods that can bring greater understanding to the social world. In broad terms then, an argument can be made to support the use of a mixed approach to any research study where quantitative and qualitative research instruments (*see next sub-section*) are employed in an attempt to draw upon the strengths, whilst seeking to eliminate the weaknesses, of either methodology. Given this line of argument, why has a solely qualitative line of attack been chosen in relation to this investigation?

A number of responses are worth consideration here. Firstly, the creative nature of design and technology activity and the associated possibility of children pursuing a range of solutions seem to militate against any pre-coding system. For example, pupils will often move very tangentially when developing ideas and in directions that are some way removed from teachers' pre-conceptions. In this context, attempting to limit observational data to the logging of pre-determined utterances might well impede reflection on important aspects of interaction that I could not have imagined in advance. Hammersley (1993), referring to the Flanders system (*Flanders Interaction Analysis categories: FIAC*) of pre-coded observational structures, suggests that it implies a theory of instruction whereas, in reality, teacher-pupil interaction often involves pupils asking difficult questions that may prompt the direction of interchange. Moreover, the 'meanings' of such questions may well be of significance and such meanings cannot be determined in advance of their utterance

within specific contexts. For Hammersley, therefore, pre-coding systems such as Flanders FIAC are more suited to 'transmission' forms of teaching and in the context of this research are, therefore, deemed inappropriate.

However, whist Croll (1998) recognises that quantitative analysis may be seen to offer only a partial, constrained and inflexible view of classrooms; he also notes that any research will be, to some degree, 'partial' and theory-laden (p.162). For him, any view of ethnographic, qualitative research as full, is as misleading as any generalized view of systematic work as incomplete. Whilst numbers, it maybe argued, cannot meaningfully reflect social reality (p.163), in determining such numbers the observer must make what Croll refers to as a 'binary judgement'. Did the event take place or not? Was it one category or not? At least, he suggests, the system is a highly organised and self-conscious form. In ethnographic work such binary judgements are also present. However, I would argue that in avoiding predetermined coding one has more time, working retrospectively, to make judgements about the nature of dialogic elements that would, in a pre-coded environment, have to be made instantaneously. However, this is not to ignore the fact that in any observation (*empirical*) setting it can be argued that the consideration of all variables is never achievable and any interpretation will also, to a degree, be partial.

In similar vein, Hargie (1983), also notes, citing Ober, that ethnographic researchers should reject completely the systematic observers' insistence on knowing precisely what to look for before, preferring instead a 'catch–what-you-can' approach; to, 'tell it like it is' (pp. 215-216). However, he warns against attempting to assign the label of 'objectivity' to any form of ethnographic research as all observers will bring with them preconceptions that will pre-empt a degree of 'selectivity'. For him, what is important is the maintenance of an appropriate balance between a set of what might be called working guidelines and a set of preconceived ideas that may inappropriately dictate a prior research focus (p.216). These views

are reinforced by Delamont (1992 pp. 18-20) who refers to the 'zooming in' aspect of ethnographic research. Here, a researcher will start with a wide angle of vision before progressively focusing in, on the basis of on-going data and its analysis, on what she/he sees to be the most salient features related to the research focus in question. In the context of this study clear associations to this viewpoint can be readily established: I have moved from an initial vision of effective reflective practice as a consequence of appropriate teacher questioning to one, based on observation and data analysis that has drawn me to consider other significant aspects such as task structuring, the management of group-based activities and the complexities of pupil-pupil interactions.

As such, ethnographic research clearly separates itself from the a priori reductionism intrinsic to the prearranged coding systems of more methodical forms of investigation. Furthermore, for Delamont, the strength of an ethnographic approach lies in its ability to focus on the meanings that behaviour entails and, thereby, to offer explanations that take account of the subjective processes that inform the thoughts and actions of teachers and pupils.

Again, my own work has been closely related to this view, in that the operational definitions and the associated system that they inspired to support data analysis have developed, over time, in response to my own changing perspectives on how best to assess the extent to which teachers are supporting the notion of young children as reflective practitioners. To what extent I have 'arrived' remains open to question, but the ethnographic approach has certainly aided the development of this research study; from a somewhat undisciplined foundation to a point at which I believe myself to be more attuned with the key aspects of classroom practice, in the context of young children's practical problem solving, through collaborative endeavour.

So, a wholly qualitative approach can be seen in the first instance to be warranted on the basis of the creative, unpredictable nature of practical problem solving and the consequent need, therefore, to

have time to analyse verbal interactions retrospectively as a means of gaining greater insights than might be possible from the instantaneous recording of a quantitative approach.

Secondly, I also aimed to consider the effect that teacher – pupil interaction, in particular teacher questioning, has upon pupil's management of practical problem-solving tasks. In short, how pupils' thought and action are interlinked during practical problem solving activities. In this context McIntyre and Macleod (1993) have drawn attention to the problems related to what they refer to as 'defined units of behaviour' (p.15). For them, a focus on such categories limits the opportunities to reflect upon continuous phenomena. As such, in attempting to collect data that might well offer a means of capturing a pre-conceived notion of 'commonplace features' one runs the risk of eliminating the 'unexpected'. Given that the design and make process is an iterative one, following no pre-determined linear format and with out pre-determined outcomes, I felt that this study warranted as flexible an approach as possible and one that would allow for the unanticipated; that is, for the impulsive output of creative, collaborative endeavour. Hence, my selection of an approach based on the retrospective analysis of data collected in as natural a setting as possible. As Silverman (1993 p.39) citing Atkinson notes, a distinct disadvantage of pre-coding is the rigidity it places on work in the field and its preponderance to deflect attention away from non-categorised events. Nevertheless, as V.J. Furlong & A D Edwards (1992 p.54) suggest:

> 'Although the ethnographer is committed to having as open a mind as possible during his period of observation, it is inevitable that he will begin his work with some preconceptions and some foreshadowed problems which will lead him to pay attention to certain incidents and ignore others.'

Of course, I have held certain views about what I might have found and have attempted to be cautious in terms of ways in which I might have over enthusiastically ascribed types of interaction to particular

forms of reflective practice. However, the associated findings and the conclusions and recommendations developed have been based upon an analysis of transcribed dialogue that has been made available for scrutiny and comment on the part of both participants in the research proceedings and, of course, the current reader. In respect of the latter what is provided is selective in nature and this will need to be borne in mind by those who may well wish to form alternative interpretations. As Bryman, cited in Silverman (1993 p.148) suggests, this will allow the reader, 'to formulate his or her own hunches about the perspectives of the people who have been studied.'

The issues raised above can clearly be linked to the questions of validity and reliability (*see also Research Instruments pp. 98-108*). Anderson and Arsenault (2001) reference reliability, in qualitative research terms, as the ability of different researchers reaching the same conclusions given the same situations. They raise the problem of 'personal impressions' (p.12) and this does appear to be problematic as there must, to some extent, be a degree of pre-determination underpinning the work of any individual. Moreover, following fieldwork, the interpretive nature of any associated analysis of data must to some extent be subjective and, for that reason, one might argue that no two interpretations can ever be the same. However, in this study, reliability is also supported by the transparency of the account I have provided so that at least, theoretically, another researcher could go through the same process.

In terms of validity, Anderson and Arsenault (ibid) refer to the: 'extent to which what we measure reflects what we expected to measure' (p.13). In qualitative terms: the extent to which the stated interpretations are in fact true. As noted previously, I have tried to operate on the basis of being as objective as possible, yet cognisant of an inability to achieve an undistorted view of reality. In short, the ongoing question here has been: to what extent can that which I perceive to be a true reflection be confirmed by another individual who will perceive both the evidence and my interpretation of it from

their own unique point of view? The answer, is that I can only offer a guarantee of the authenticity of transcription in relation to internal validity and suggest that any generalisation offered be recognised as limited by the nature of the relatively restricted research undertaken and the personalised interpretations of data analysis offered.

As Anderson and Arsenault (ibid p.119) note:

'The researcher's perspective also influences what might be found.'

For example, a researcher with an avowed feminist perspective will not view a situation through the same lens as a phenomenologist, ethnographer or constructivist, yet their methodological approaches and techniques may be similar. They might be extraordinarily skilled, yet they could end up with differing interpretations.

In simple terms, in adopting a qualitative approach I am aware of being attached to certain preconditions that will have some impact on the shaping and informing of my opinions, attitudes and ways of looking at phenomena and interpreting the data that has been collected (*see Chapter 4: Findings pp. 113-165*).

In this section I have argued that there are problems in neatly pigeon-holing the adopted research methodology under any one methodological banner and that in broad terms it is perhaps best seen as an essentially ethnographic, qualitative and interpretive approach. I have been what I have termed a partial participant observer collecting data on the basis of observing teacher-pupil and pupil-pupil interactions in junior classrooms during the designing and making phases of design and technology activities. I have acknowledged the fact that I would not have been able to record everything that happened during observational sessions and, that in predetermining aspects to be considered important, the research, to some degree, will be partial and theory laden. However, in offering elements of the detailed transcripts of observational work for scrutiny in this text (*albeit selected elements*) and engaging pupils and

teachers in post observational stimulated recall interviews, I have hoped to secure both a reliable and valid approach. Valid, in Craft's (2000 2nd edn) terms, on the basis that I have made use of more than one data collection method (*triangulation*), have allowed participants to share their own perspectives (*respondent validation*) and have consistently been aware of and responded to the extent to which I may have impacted upon the process (*reflexivity*).

Research Instruments

This section addresses two interrelated aspects of the study. Firstly it provides detail on the data collection methods that have been employed, including references to the work of others in support of my own chosen approach, followed by a description and some consideration of the data analysis techniques used.

Prior to my considering these issues I would like to offer a brief rationale for the selection of the schools that have supported the investigation, as detailed in Appendix 1. In short, each was chosen on the basis of what can be termed 'opportunistic sampling'. Schools D, E and H all fall, geographically, into an area for which I have responsibility in relation to my position as a Senior Lecturer within the School of Education at the University at which I teach; schools A, B and the class H2 provided access through ex-students; schools F and G are the nearest primary schools to my place of work and are often engaged in University/School based links whilst at school C, I took advantage of a request to support the development of design and technology work in a Year 5/6 class. As such, I was well known to most of the respective head teachers, though not in all cases to the staff that were observed. There were, however, no direct links to the children, who I met for the first time on the pre-observation visits. The choice was further supported by long standing relationships between all of the institutions and the University, each being what are termed 'partnership schools'. It should also be noted that these schools provided a good range, in terms of urban/rural locations, and

in respect of teachers – some of whom had very limited design and technology training to those (*schools A and B*) who had been recently trained with the subject as a specialism.

I would now like to turn briefly to some general issues before a consideration of data collection methods.

In the early stages of the study I decided to limit the observations to be undertaken to teacher-pupil interactions in top junior classrooms during the designing phase of a design and technology activity, feeling that it might prove difficult to obtain useful transcriptions in the context of the hustle and bustle of predominantly practical activity. Top junior aged children were selected as the focus group on the assumption that at this stage of development they should be exhibiting higher levels of autonomous working and should thus readily respond to any stimulus that promoted 'reflective practice', as defined in the operational definitions considered previously. However, limited access to classrooms meant that I had to take advantage of any opportunities afforded me and this included involvement in one lower junior classroom as well as observation of some practical (*making*) sessions (*see Appendix 1*).

Data collection has been by way of observational work and semi-structured post observational interviews. The use of these two data collection methods and sources of evidence supports the notion of triangulation. Edwards and Westgate (1994) define triangulation as researcher / observed consultation with a view to establishing a shared perspective. The concept is seen to have its roots in phenomenology – reality is seen as residing not in any would be objective account separable from the participants but rather in their respective perceptions. (p.76) Whilst Wragg (1994) guards against what may be the subjective or fantasised perceptions of respondent validators recall, whose accounts may be significantly at odds with actuality, I would contend that the involvement of participants, on the basis of the availability of detailed transcriptions during interviews (*see p. 103*), has been a key aspect of the study; key, in terms of

providing perspectives that did not always match my own, thereby causing me to engage in worthwhile personal reflection. The need to draw on the views of others is also supported by Delamont (1992) who, in the context of viewing 'ethnography' in relation particularly to observational work in a single or limited number of classroom settings, believes that researchers must value the position of those observed and thereby take account of how they understand their world. This can be related to the concept of 'reflexivity': recognising that there is no way to view the social world from a position of isolation. Indeed, what Delamont highlights is the need for 'honesty' and 'reflexivity' - a willingness to provide a truthful account of the research setting and to involve the observed.

I now wish to offer a little more detail on each of the research instruments used:

For observational purposes I asked classroom teachers to select groups of four children, in some cases three were observed due to absence, and, after some initial work (*Schools A, B and C)* sought a rationale for the selections that were made (*Schools D – H see Appendix 1*). The motivation for this method was largely based on the fact that time availability was at a premium. Given this context I decided not to opt for selecting groups at random but to place my faith in the teacher's greater knowledge of the pupils to be observed and their familiarity with the current position of groups, vis a vis the design and make process. However, this said, it is also worth noting that on more than one occasion teacher perceptions were not wholly met by the practice that was recorded. This decision can be seen to have led, in most cases, to the selection of children that the teacher thought would work well together and would engage in dialogue, during activities and in the follow up interviews (*see Appendix 1*). I appreciate that the resulting sample may not, therefore, offer as full a representation of classroom interactions as might have been the case. However, the majority of groups selected were of mixed ability and gender and this did mirror the general management of groups in

terms of teachers' standard practice for design and technology activities.

In the case of all participating schools I made a preliminary visit to introduce myself to both the teacher and the children. This visit included the children becoming familiar with the recording equipment to be used (*audio – video*) and the nature of the observation to be undertaken. All groups were also informed of the role I would take during recordings, I sat at a distance and did not engage with the pupils or teacher. In respect of the former, the sight of such equipment was nothing new and I did not feel at any time during observational work that the children were affected to any significant extent by the presence of the technology on view. Of course, occasionally individuals played to the camera, but this was never for any length of time and did not deflect them in any major sense from the task in hand. This opinion is supported by Lyle (1996 p.15), who points out that, in the context of her own research undertakings, any effects of using of a tape recorder as a research instrument were minimal because children were used to such recording equipment.

During the observation sessions, these lasted between 30 and 45 minutes – depending on the length of the teaching sessions, break times etc., the children sat at a table with a microphone located at the centre and with a video camera, on a tripod, appropriately positioned to record their interactions. The tape recorder was placed close to the video camera so that I could control each piece of equipment without interfering with the progress of the pupils work.

Video recording was undertaken to provide a back up to the audio data. It often allowed me, retrospectively, to identify and or clarify speakers and to reflect, where necessary, on such things as spatial arrangements, use of equipment, key activities (*e.g. sketching*). Consequentially, the transcriptions were very accurate records of the interactions observed. (*see Appendix 3*).

It must be noted at this juncture that for the majority of observation sessions the group to be recorded were placed in a position within, or just outside the classroom that was conducive to the collection of data, based on the use of audio and video equipment. Backing for this procedure seems to be available in references to the observational work conducted by Mercer et al (1999, p.102), where video recordings were made in relatively quiet areas within normal classroom environments using an auxiliary high-quality microphone; I assume as a means of securing better recording quality. It was a concern for quality audio that also caused me to operate in the manner chosen. Not least because early trials had highlighted the problems I would otherwise face with the non-specialised technology at my disposal. This decision, of course, must be acknowledged as one that caused pupils to be operating in circumstances that were a little different to normal routines. However, in terms of teacher-pupil interactions the change was minimal as, in all cases, the class teacher normally rotated around the working groups and in this sense there was no reduction in the amount of time given to the children being observed. This said, the same children were not as actively involved with other pupils as they might have been or, in some situations, as readily able to be proactive by way of calling attention to the teacher, as work progressed. These issues, undoubtedly, also bear upon the extent to which the data may have been influenced by the methods adopted and I can do no more than make them transparent to the reader.

As the study developed, and I became more sharply focused on initial teacher inputs, I added the audio recording of the class teacher's introductory discussion with the whole class to the methods employed (*see Appendix 2*). This data has been used to examine questions related to task structuring and the establishment of effective ground rules for collaborative endeavour.

Post-observational interviews (*see Appendices 4 and 5*) were conducted on the basis of interviewing the children, as a group, first, followed by an interview with the teacher. My rationale here, was a

simple one: I felt that the children would be more forthcoming if discussions were free from teacher influence and what they had to say, where I deemed it to be pertinent, could then be fed back to the teacher in question. This was often useful as a starting point for sub-questions posed to the class teacher, not least where their perceptions differed from those of one or more of the pupils.

Prior to the interviews commencing all participants were provided with a copy of the relevant transcript of the previous observational session; though the transcripts given to the pupils did not contain an indication of the questions to be posed, as I felt that this could be distracting. However, this approach aligns with Mason's (2002) argument for making interviews as 'contextual' as possible; where people's individual and collective understandings, supported here by the availability of the transcripts, are explored on the basis of relevant specifics, both for interviewer and interviewee. As such, the groups became a 'focus' for a particular set of issues that could be managed with sufficient flexibility to allow the way in which pupils dealt with them to be, where appropriate, a catalyst for further enquiry.

The teacher version was a copy of my own working document as this provided her/him with clear evidence of the process and an opportunity to raise issues as required. These transcripts proved to be very useful as a stimulus for discussion, particularly in terms of allowing pupils and staff the chance of re-visiting aspects of the observational session when necessary.

The interviews were carried out as soon after data collection as possible. On occasion this led to a two-week gap between observation and recall. Not ideal, but a consequence of busy schools, teacher illness and my own workload schedule. Again, I have to recognise the impact that this may have had, particularly on the retention of relevant issues by the pupils. However, as noted above, in all cases teachers and pupils were provided with copies of the relevant transcribed dialogue and this was supportive to all

parties, both as a memory jogger and reference point during discussions.

The interviews were of the semi-structured type allowing me to ask chiefly open-ended questions, identified during data analysis (*see pp. 106-108*), and to provide opportunities for respondents to offer inputs based upon their own perceived areas of interest. In the case of the pupils I always attempted to reach a balance between sharing questions amongst the group and capitalising on the feedback that individuals were keen to offer. Whilst I recognise that the group-based approach may have meant that the way in which some individuals interacted was affected by the presence of their peers, the time limitations did not permit an adoption of an individual interview method. Whilst each pupil may have offered franker responses in a one to one situation I judged that they would operate in a more relaxed manner alongside the rest of their group.

Last, but not least, individual interviews would also have required non-contact between respondents during the interview process – an organisational requirement that would have required further support from staff within the institutions in question. This did not seem appropriate in busy schools that were already being very accommodating.

Each session was audio-recorded with full transcripts produced and analysed as soon as possible after the event. Such sessions were often over thirty minutes in duration, with some of that time taken up in discussion that had developed as a result of the more fluid style. This seemed particularly important in terms of the children involved given the guidance on interviewing children offered, by example, from the Open University (2001 p.173):

'Open-ended questions often work best. Decide what questions you would like to ask in advance, but don't stick too rigidly to them once the child really gets going. Making the child feel that you are

listening and responding to his or her answers is more important than sticking rigidly to your schedule.'

The questions that were asked, either to pupils or teachers, were colour coded green (*see also Data Analysis pp. 106-108*) on relevant analysed transcriptions and remained visible to the class teacher, but not to the pupils. In the case of the latter, as noted previously, I felt that the children might be easily deflected from the flow of the interview session if, as they tended to do, they read ahead and wanted to be answering questions out of sequence. However, during all the stimulated recall sessions, the lines of enquiry identified at the time of data analysis were pursued and, moreover, respondents were provided with opportunities to raise additional issues, or further develop lines of interest. This allowed me to capitalise on content that I deemed relevant to the study. This position is supported by Silverman (1993) who, citing Burgess, has argued that open-ended interviews allow respondents to access their unique view of the world, to be proactive in verbal exchanges, not least because:

'No fixed sequence of questions is suitable to all respondents.' (p.95)

The resulting mixture of open ended and limited preset questioning provides an effective response to the concerns of those such as Hammersley who, cited in Silverman (1993), argues that:

'It is naïve to assume that open-ended or non-directive interviewing is not in itself a form of social control which shapes what people say.' (p.95)

Of course, it is possible to argue that in drawing attention to certain features of an interaction, whilst being less enthused by others, will almost certainly affect the nature of the topics to be discussed and the resulting flow of dialogue as well as contributing to a somewhat slanted analysis of events. I can only argue here that the same must also be true when deciding upon both the nature and order of

questions to be utilised in a more structured approach. Each has strengths and inherent weaknesses.

Data Analysis

The analysis of data based on the observation of group work, and the associated teacher-pupil/pupil-pupil interactions, has been largely centred on the development of the simple system of categorising forms of recorded dialogue rising from the operational definitions of 'metacognitive questioning' and young children as 'reflective practitioners', set out above (*see Chapter 1: Key Issues pp. 18-27*). However, in addition, the scrutiny of initial teacher inputs, both audio recorded and documented by way of limited field notes, for example during the twin sessions managed by the same class teacher in School G, have also added to my consideration of relevant links to task structuring, the organisation of group-based activities and cognitive dissonance. Indeed, I would argue that what has emerged from the critical examination of data, drawn from the range of settings outlined in Appendix 1, is the development of a more focused recognition of those elements deemed, in the context of this study, to impact significantly on young children operating as reflective practitioners. In short, the rigorous examination of transcripts has led to and, thereafter, sought to exploit, a cross-referencing of categories of action that have been seen to lend weight to my answering the research question posed.

At this point I wish to note Mercer's (1996) recognition of the inherent difficulties of aligning transcribed text, with chosen word/phrase types; in his case, 'lingustic categories'. For example, in Mercer (2000 p.102), his categories of 'disputational', 'cumulative' and 'exploratory' talk are seen to be:

'Idealizations, models of ways of using language which may rarely be found in any pure form.'

This issue is reiterated by Wegerif (1999 p.97) who notes that:

> 'Disputational, cumulative and exploratory are not meant to be descriptive categories into which all observed speech can be neatly and separately coded .....we suggest that the typology offers a useful frame of reference for understanding how talk (*which is inevitably resistant to neat categorisation*) is used by children to 'think together' in class.'

For me too, such alignment has been far from neat and easy. However, as I have discussed elsewhere, my own interpretations, for they are no more than a personalised view, are exposed here to further scrutiny and debate – reflexivity in action.

Moreover, given that the operational definitions have changed over the time of the study so too have my interpretations of associated interactions. This is seen as a strength of the qualitative approach adopted not least because it has allowed for a refinement of analysis as theory and practice have more successfully merged. The analysis itself has been managed on what might be termed an 'instantaneous basis'; by this, I mean that the colour coding system adopted to aid the process was added to transcriptions as they evolved (*see Appendices 2-5*). Interpretation was ongoing. As audio recordings were transcribed I identified what I deemed to be relevant aspects of metacognitive questioning (*red*) and or reflective practice (*blue*). Where this prompted questions to be asked during post observational interviews, these were also noted (*green*). I found this to be a more insightful means of analysing the data than attempting to transcribe the whole recording with analysis carried out retrospectively.

The colour coding also helped greatly in extracting pertinent elements of the data from the volumes of paper that were created. I would like to think that this systematic line of attack has lent weight to the notion of procedural objectivity though I recognise that, along with

Craft (2000, 2nd edn), because others may wish to interpret the data differently, no guarantee of inter-judge reliability can be provided.

In the same manner, the analysis of transcripts, as they unfolded, also allowed for issues to be identified in relation to the other aspects of this study: task structuring, ground-rules for collaborative endeavour and, in a less direct sense, cognitive dissonance. Any associated questions were also colour coded green and referenced for consideration by pupils, the teacher or, in some cases, both parties.

In terms of the transcripts themselves I have not attempted to provide any fine detail with regard to, for example, the inclusion of time lapses between interactions, intonation, facial expression etc. Rather, in line with Mercer (1996) I have maintained a focus on the content of the verbal interactions with only limited information about other aspects (*e.g. giggle, chorused response, inaudible*) where these have been seen to be essential to the:

> 'Comprehensibility of the speech and the presentation of the analysis.' (p.366)

Ethical Issues

The ethical rights of the participants involved in this school based research (*see Appendix 1*) have been consistently borne in mind in terms of both the initial approach to the institutions that were prepared to support my avenues of study and throughout my engagement with associated pupils and staff. As Bell (1999) suggests, those who are willing to cooperate need to know what the aim of the study is, exactly what is required of them, how much of their time is required and how the results that are obtained will be used. These points are reiterated by Dockrell (1988) who indicates that since the 1970's there has been an increased awareness of ethical issues in research that move beyond purely technical aspects,

which he argues remain of significant importance, to those that might be referred to as 'propriety standards' and relate more directly to participants in research undertakings. He too notes that participants must 'understand fully what is being asked of them' and suggest that researchers must not 'minimize or exaggerate the demands that are to be made in terms of time, effort or stress on subjects'. (p.62)

In this respect the position of participants was made clear from the outset and the demands on their time were kept to what was agreed by all to be a manageable level. Moreover, the provision of transcripts, in advance of the post-observational interviews, made the process of data collection and analysis open to all and allowed, by way of respondent validation, for errors to be modified: for example, naming the wrong child and, in addition, discussion of relevant issues, prompted by participants, to be pursued.

Furthermore, researchers should always be cognisant of concerns related to the notion of authority and the way(s) in which the researcher is perceived by those, in this study, that are being observed/interviewed. Given these provisos the involvement of schools was always based on the following structure:

1 Initial telephone contact to head teacher with an outline of the study provided.

2 An agreed date reached for a meeting to discuss (*with head and class teacher*) the study and associated arrangements in greater depth.

3 An initial meeting with head teacher where the aims of the study were discussed in some detail. At this meeting a request was always made that such detail was not relayed to participating classroom teachers. Rather, heads were asked to say that the focus of the study was simply an enquiry into teacher-pupil and pupil-pupil interactions during practical problem solving activities.

There is an obvious underlying dilemma here in terms of achieving an appropriate balance between providing information to participants and maintaining an objective approach to the research. Namely, that to provide too much information in the early stages could jeopardise the validity and reliability of the data gathered from observational and interview work. For example, it seemed to be inappropriate to indicate that the study, in part, aims to inform classroom practice by guiding teachers in the greater use of metacognitive questioning as this may well have prompted teachers, during observations, to modify their teaching style. Even if this modification had been based on a sketchy understanding of what metacognitive questioning is, the change, however marginal, would have to some degree undermined the anticipation of portraying and analysing a teacher's 'normal' mode of interaction. Consequently, a compromise position seemed preferable: providing the head teacher with a detailed account of the research focus whilst presenting participants with only sufficient information to allay any fears they might have and, in the case of the teacher, to encourage a recognition of the value of the research (*see below*). It is also relevant to note that:

- teachers were provided with opportunities, during the final post observational interview, at a participating school, to quiz me further about the specific nature of the research and, as a result, where such requests were made, clarification was provided. For example, an explanation of the foci on metacognitive questioning, task structuring and the management of effective collaborative endeavour;

- during post observational interviews with teachers I also provided, where this came naturally into discussion, an indication of why questions related to specific interaction between pupils were being asked. This led to references in respect of my interest in the concept of 'cognitive dissonance and, at times, to further anecdotal and useful evidence from the teacher concerned.

I would also wish to note here that if any of the teachers had indicated concerns about the content of the transcripts supplied, or a desire to remove themselves from the research process, then either the associated data would not have been used and or a request for a termination of proceedings would have been immediately honoured.

4 A meeting with the class teacher(s) in participating schools to provide an outline of the research study and to note that follow up interview sessions would be carried out on the basis of all participants being in receipt of a full transcription of the data previously collected. Time was also devoted, in this session, to encouraging the classroom teachers to recognise the value of the research study in terms of their own classroom practice.

The focus here was on their developing an understanding that the data collected, analysed and discussed would prove useful to them in terms of a personal reflection on their own current management of practical problem solving.

5 Head teachers were also notified of my willingness to provide them with a copy of any relevant sections of the draft dissertation to allow them to comment, as required, on elements drawn from my involvement with the school, prior to such information being published for wider reading.

6 Assurance was also given, early on, that in the final version of the dissertation the school and individual participants would not be named (*see Appendix 1*).

In this respect, Dockrell (1988) also draws attention to the importance of confidentiality and the need to reach agreement on just what may or may not be disclosed by way of publication. Most importantly, perhaps, Dockrell notes that whatever agreements are reached participants must have access to textual material prior to its dissemination to a wider audience.

7 Follow up letters were sent to head teachers detailing relevant aspects of the meetings previously held and confirming the dates for observational and interview work agreed.

8 A second, preliminary visit (*see Appendix 1*) was then arranged at which I met participating pupils. This allowed them to be informed of the nature of the work I would be carrying out, to become familiar with the recording equipment and to ask any questions.

Although consent was not obtained directly from the children participating in the observational/post-observation interview sessions, had any pupil indicated dissent this would have been respected immediately, allowing the pupil, on the basis of informing the class teacher of the circumstances, to leave the relevant group-based situation.

With these points in mind I would now wish to turn to some initial thoughts about these issues and offer an outline of my intended approach.

The rationale for this structure was related to a wish to reduce any associated anxieties that may have otherwise developed on the part of participants. It also allowed me to discuss with the teachers involved the benefits that they might accrue from assisting me in the venture; most significantly in terms of their own personal reflection on classroom practice and the opportunity that would be afforded them to step back and consider the possible strengths and weaknesses of the teaching and learning strategies they employ in the context of practical problem solving activities.

In this chapter I aim to provide further evidence to support my current position in relation to what I would now wish to present as the results of my investigation. These are outlined below as areas of discovery, important in their own right, but which need to be seen, in the context of the study undertaken, as interrelated factors impacting upon junior aged children operating, during group-based, practical problem solving activities, as reflective practitioners.

In essence, four categories have been identified (*metacognitive questioning, task structuring, effective management of collaborative endeavour and cognitive dissonance*) that together appear to determine the extent to which young children work successfully together in order to move towards optimal resolutions to problems in hand. Consideration of these categories seeks to illuminate both best practice and the reasons underlying the limited evidence of children acting as efficient reflective practitioners, noted during the research process. By way of an overview, interpretive summaries of these four categories are provided towards the end of this section as a prelude to an identification of three key findings (see pp. 164-165)

At this juncture it seems useful to note that whilst examples of best practice were found, evidence of young children operating effectively as reflective practitioners has not been seen to be a key feature of collaborative endeavour in the context of practical problem solving activities. Not surprisingly, therefore, what has emerged from the study is an indication that **the role of the teacher is both central to the aim of promoting young children as reflective practitioners and complex**. It cannot be based, as was originally imagined, on effective metacognitive questioning alone. Rather, it requires the development of a classroom ethos conducive to pupils as 'reasoned decision makers' that is based upon a pedagogical approach that, in addition to effective questioning, recognises the significance of clear task structuring and the effective management of collaborative

endeavour. Moreover, an acknowledgement will also be needed of the fact that, even when conditions seem appropriate, the ability of young children to negotiate meaning, to reach a shared understanding of how best to proceed, may be limited, not least, as Lyle (1997) suggests, by the complex make up of children asked to interact in group settings.

I will now turn to an exploration of how these interconnected issues can support and or undermine children operating as reflective practitioners/reasoned decision makers.

1: Meta cognitive Questioning & Reflective Practitioners – best practice

As indicated above, evidence drawn from those groups of children and their teachers that participated in the study did not suggest that it is common practice for teachers to utilise metacognitive questioning or for young children to operate as reflective practitioners during practical problem solving activities. However, examples of what might be termed 'best practice' were noted on occasion and in these contexts evidence could be found to illustrate how effective metacognitive questioning supports the notion of optimisation discussed previously.

It should be noted here that any evaluation of the examples of 'best practice', provided below, should be made on the basis of assessing the dialogue between teacher and pupils as a whole, rather than in terms of the individual constituents. It is only by doing this that the reader will come to see how teacher questioning, which may begin at a relatively low cognitive level, requiring essentially an answer that draws upon a child's procedural knowledge (*how are you going to do this?*), leads to the 'metacognitive' plane: by way of further probing that encourages children to, for example, monitor one another's suggestions and or justify an alternative course of action (see Chapter 1 pp. 20-22)

Some examples will demonstrate this position and those provided make use of the analytical tool of colour coding relevant aspects of transcribed dialogue: red – aspects of metacognitive questioning, blue – aspects of reflective practice:

School A: 15/11/00

Teacher How are you going to attach this ..... this body bit to the head box? (seeking clarification of intentions and promoting planning ahead)

Samantha Em ..... we can use those string things and you can join them on. (part clarifying solution and planning ahead)

David How? (monitoring others suggestion – seeking clarification/justification)

Teacher But if you think of the end of the tube though ... would that be easy? (promoting evaluation of intentions)

Samantha No ... (challenging but not offering reasoned argument)

Teacher How else could you do it? (seeking alternative promoting planning ahead)

Samantha Em ...

David Ah ...

Teacher Think of the legs that you saw in there. (prompting them to relate current work to prior experiences)

Claire Ah ... you could cut little bits ... and then spread those out and then you could stick the head on top. (justifying alternative)

I would wish to argue here that Claire's alternative ought to be valued as a justified line of thought / intended action. Of course, she could have extended her input by suggesting, perhaps, that in cutting strips into the top of the cardboard tube and bending them she would be creating a larger gluing surface area and, consequently, a stronger joint when assembling the pieces. However, what she is clearly demonstrating is recognition of having seen this method used successfully elsewhere and, in empirical terms, going with what she currently thinks will work better than the "*string things*" offered by Samantha. In this sense the group, prompted to do so by the teacher's verbal interaction, have arrived at what I would consider to be an optimised solution for an element of the work they were developing.

The same group of children also reached a further justified position when considering how to fix the sponge ears of their monster to the cardboard box head:

Claire	Sponge, the ears are going to be sponge.
Teacher	Sponge ... now where have you got sponge from? Was that on the list of things we had to use to make it?
Kate	No, but I've got some sponge at home .. some's mine and some's my sisters.
Teacher	So you're going to use that are you? Lovely ... And how are you planning on attaching your sponge to your box? (seeking solution and promoting planning ahead)
David	You'll have to glue it. (suggestion but not justified)
Samantha	Could glue it .....

Teacher Well it's quite light weight ... do you think it will stay on? I suppose it is quite light, do you think that will work? (promoting evaluation and seeking justification)

Kate We could sellotape it on. (alternative, but not justified)

Teacher Or you could sellotape it on. (verifying but leaving choice with pupils)

The teacher could have asked them to justify a choice here (*evaluating one line of thought or action against another*) by prompting them to weigh up the advantages and disadvantages of each method. However, the children did engage in further discussion leading to a justified outcome, at least in terms of using sellotape:

Claire Yes ..... you could get some sponge and put it on to the box and then sellotape it ..... with a few bits of sellotape.
(clarifying intentions but not justifying)

Samantha You could have round bits going up there .... I was thinking of a cardboard box ....

Teacher What's the problem with sellotape if you're going to use paint? (prompting evaluation)

Samantha Oh! ..... paint won't go on the sellotape. (identifying weaknesses – monitoring intentions)

David You can't paint over it. (monitoring others suggestion)

Claire But you could put the sellotape on first and then paint it ... and don't paint over the sellotape .... (offering solution and planning ahead)

David But ... but it ... (*some confusion here*)

Samantha Or you can paint it first, and when the paint's dry you can put the sellotape over it. (justified alternative)

Teacher What a clever idea! What a clever idea, paint the body before you add the wings and the ears. (verifying)That would work as the selloptape's see through .. that's a great idea Samantha. O.K. so are you going to write some of that on there for me , on how you're going to attach it. (prompting planning ahead – list of materials tools etc.)

School B: 4/12/00

Teacher What's the first thing you are going to do, next? You need to move on now ... what's the first thing you're going to do? (encouraging planning ahead)

Stephen Make a base. (clarifying the group's intentions).

Teacher The base. Right, what about the base?

Peter We have to make the shape of it. (further clarification)

Stephen So, we need one, two, three, four pieces of ..... we need ....

Peter One, two, three, four ....

Stephen No, we need three pieces the same size ... and one small piece and then we've got the front open for the pulley to run free. (challenging his own and other's position before clarifying and justifying alternative)

Teacher You've got to start moving on now.

Again, time is an issue here and the need to move on undermines, to some degree, the extent to which additional interaction might lead to further clarification for all members of the group (*in this case the two girls were not actively involved in this discussion*).

Stephen Me and Peter will do the base while you (*Anne and Jessica*) do the cotton reel, the handle and the dowel, all the pulleys and attach the yoghurt pot with the string. (planning ahead)

Teacher Sounds like a good plan to me, now lets move on with it.

In this extract, the group reached a sound position in terms of construction details and Stephen took responsibility for assigning tasks to various members of the team. These proposals did not lead to any disagreements and thus provided a clear focus for the next phase of the work. The teacher's prompt for the children to think carefully about the base of their fairground ride also led to Stephen providing a rationale (*justification*) for the very sensible idea he was offering.

In the final example, the exchange between Samantha, David and Claire also provides a link to Mercer's (2000) concept of 'exploratory talk', as information can be seen as being offered for joint consideration and engaged with in a critical but constructive manner. The group are seeking to achieve 'joint progress' and, moreover:

'Knowledge is made publicly accountable and reasoning is visible in the talk.' (p.98)

2: Reflective Practitioners – not quite there;

Whilst the 'best practice' detailed above was evident on occasions, interaction generally fell short of this position. A good example of this

can be drawn from School A: 15/11/00. Here, the teacher can be seen to use metacognitive questioning as a means of encouraging the children to clarify their ideas, to consider alternative means and to plan ahead. What is not evident however, and this was often the case, is an extension of the verbal interaction in order to prompt pupils to justify the intentions that they identify. In essence, what is missing is the critically constructive element that would move the discussions towards more clearly defined examples of 'exploratory talk' and the 'measured deliberation' identified in the operational definition of reflective practice set out in the Key Issues section of Chapter 1.

Claire — I know what we could have for the mouth, we could have sponge and paint it red and then we ..... (identifying and clarifying an idea – self oriented)

David — We could cut it. (clarifying but not justifying – other oriented).

Teacher — Why don't you bring your chair round here, yes (*talking to Samantha who is a little detached*).

Kate — I was thinking that for the mouth a circle with sponge and then we paint it red, then we put some ..... like teeth with cardboard... with em!... (further clarification but no justification)

Teacher — What are you actually going to use to make the mouth work? How are you going to make the hinge of your jaw? (seeking further clarification and promoting planning)

Claire — Paula did a round mouth but we're supposed to do like ..... get a normal mouth. But she did a round one and ..... (monitoring the work of other)

Teacher Well she's not here today, so what are you actually going to use to make the mouth? You need to think about that and how it's going to open and close. (promoting further clarification)

Claire A balloon. (identifying solution)

At this point in proceedings the teacher had an excellent opportunity to seek from the pupil a justification for the use of a balloon powered mechanism, particularly since the use of syringes (*an alternative means*) had been discussed during an earlier whole class session. Unfortunately, the opportunity was missed and the pupils' attention is drawn back to the current design, as sketched on A3 paper.

Teacher So what's the problem with the mouth you've drawn there? (prompting evaluation of current intentions)

Samantha It won't open and close. (demonstrating doubt, but not justified)

Teacher Why's that? (prompting evaluation/justification)

Samantha Because it's a circle and it's flat. (clarification but not justifying in terms of explaining the limitations)

Teacher It's a circle and it's flat. So what do we need if the mouth is going to open and close? What would make it easier to make it open and close? What sort of things could you use? Any ideas? (promoting further clarification but not seeking a justification - i.e. not asking them 'why')

There is also an indication here that the teacher is undervaluing the earlier suggestion of a balloon. This was probably a result of a focus on the children using syringes, but does not show an appreciation of Claire building on previous knowledge and skills.

Long pause here (some 6 seconds) as children ponder on this question

Claire I think I know what we could have for the teeth .....

Teacher We need a mouth first. (scaffolding to keep pupils focused on most relevant aspects of task). So what could we use for the mouth? .... What shape is it going to be? (prompting an idea)

David An egg box.

Teacher Yes we could use an egg box. (verifying, but not seeking justification)

Kate Or a little cereal box. (alternative but no justification)

Teacher Or a little cereal box. (verifying, but not seeking justification)

It can also be noted here, and was the case elsewhere, that teachers did not take the opportunity to model reflective practice (*see Chapter 5: Conclusions, Recommendations and Looking to the Future pp. 166-176*). For example, this teacher could have responded to Claire's suggestion of an egg box by noting:

Teacher Yes an egg box, because it has a hinged lid and this could be lifted easily because it isn't very heavy.

Such modelling was not seen to be a strength of teacher-pupil interactions and it is to the limitations noted during the study, and their possible cause, that I now turn.

3: Reflective Practitioners – inconsistencies

At the outset of this section I feel that it is important to note that many of the children interviewed indicated a sound understanding of the benefits that might be accrued from operating as reflective practitioners. Not least the advantages that could be aligned to securing justifications for current intentions. For example:

School F: 4/2/02

Question How important do you think it is to ask one another questions, to share ideas and to be cross checking one another?

Mark I think that it is very important because if you share ideas .... Em .... Because someone might have put something down (*on a sketch*) and it might not work, so it's important to share that so you could tell them that it won't work.

Similarly, from School H1: 30/10/02

Question How important do you think it is, if you have a disagreement, to justify, to explain your own idea?

Sophie Very important, because it could be better than other people's ideas and sometimes you don't understand what other people are saying.

Question So, Sian, if you think that your idea is best, how would you try and convince them that your idea was best?

Sian I'd give a reason why it's better than theirs.

However, as with inconsistencies between teachers' views and actual approaches, the value of reflection expounded by children was

rarely put into practice. In this context, it should be borne in mind that regardless of how well teachers might be seen to utilise effective interaction, as a basis for young children operating in a reasoned/considered manner, the way in which the children function in partnership will be governed, in part, by personal perceptions about the needs and ways to reduce their own levels of uncertainty within a group structure. For example, an unwillingness to give up an idea, in favour of alternatives held by others, was often seen to be a block to children moving work forward in the most effective manner, thus limiting the extent to which groups can optimise their approaches to problem resolution. Elsewhere, failure to operate effectively as a group appeared to have something to do with the classroom culture in which they operate. As such, I would suggest that for efficient and effective problem solving to flourish the classroom culture in which children function needs to be based upon a shared understanding (*teacher and pupils*) that operating as independent thinkers and doers is valued; that is, a climate in which children feel secure to take risks and make decisions, in which they recognise the learning to be accrued from challenging viewpoints, identifying and justifying alternatives etc.; and where their associated opinions and ideas are seen to be of worth.

Here, clear links can once again be drawn to the notion of cognitive dissonance and, moreover, its associated relationship to Mercer's (2000 p.173) concepts of 'cumulative' and 'disputational talk' The former is based upon a building of uncritical, non-competitive and constructive relations that aim to keep individual differences or perceptions of judgement to a minimum; whereas the latter may involve a perception of peers as a threat to personal positions and generate dialogue and actions intended to maintain individuality and thus keep identities and, in this context ideas, separate. Either way, interaction is unlikely to result in the optimisation of progress and the willingness to act reflectively, will certainly be undermined.

In relation to cumulative talk, for example, data analysis has indicated that on occasions pupils seem to have an intuitive

understanding of what others are thinking or may be intending to do, as though lines of thought or action are transmitted without the need for dialogue. It may be, therefore, that a belief in one's own or other's subject-based ability is sufficient to negate the perceived necessity for more formalised and critically constructive interaction whilst at the same time reducing the likelihood of identifying or extending any related levels of uncertainty (*dissonance*).

For example, School H2: 4/12/02

Question	Richard, do you think it's important to justify ideas?
Richard	Yes, because when your friends know what you're doing .... like I could discuss something with Craig and then ask Natalie later because I don't want to interrupt her while she's thinking ... doing the sketch.
Question	But what if she's thinking the wrong things?
Craig	We've got to see what she's doing because she might be doing things we don't want her to be doing.
Question	So how would you get her to justify?
Craig	Ask her to rub it out?
Question	Well she could rub it out if you thought that it was wrong, but how would you argue your point of view with Natalie?
Craig	We could discuss about what we think is better and see if she agrees. But if she doesn't then we could find a way that we all agree on. But Natalie is good at sketching so I thought that it wouldn't matter what she did, because I thought that she would do something that was good.

Question So you had faith in her?

Craig and Richard Yes.

Occurrences of 'disputational talk' were noted regularly during observational sessions and the following example provides a very good example of a group failing to secure a shared understanding (*negotiated meaning*) when interaction is effectively centred on the maintenance of individual positions and the separation of ideas.

For example, School E: 28/11/01

Julian Well that's too long. (evaluating the actions of another and identifying error, but without justification)

Michelle Oh, that's a side then. (clarifying but no justification)

Julian Too short ! (*meaning for the side piece suggested*) (clarifying but no justification)

Michelle Who measured this?

Julian It's too short for there and too short for there. (demonstrating aspect of doubt, but no justification)

Michelle Who measured two hundred and forty six? Who measured two hundred and forty six for there? (cross-checking)

Julian Me.

Christopher Julian.

Julian Why? (negative challenge to the question posed)

Michelle That's centimetres you're on about though? (monitoring

previous measurements but not in a reasoned manner)

Julian — But you've got to start from the beginning though haven't you, from the arrow. *(referencing a measurement already drawn on their paper model)* (evaluating current line of action and offering justification)

Michelle — Well I make that two hundred and twenty nine. (no agreement reached on method and no justification of current position)

Julian — Well sorry! (*dismissive reply*)

Christopher — Well it's still too short. (disagreement maintained but still not based on any reasoned discussion)

They return to practical work for a short while

Julian — The measurement is 296. (no justification offered or cross checking carried out)

Michelle — I know why you measured it wrong (*from the paper model*), the lines wonky. (evaluating other's line of action)

Some giggling at this

Christopher — We need another two hundred and ninety. (alternative suggestion but no justification/cross-checking)

Here, a group of four able pupils had the relatively simple task of cutting square section timber (1cm x 1cm) into appropriate lengths for a framework, already drawn onto a piece of A3 paper. Rather than operating as a team, agreeing dimensions, organising who

would do what, cutting single pieces and using these as a template etc., they operated in every sense as individuals. Indeed, even when errors were identified they failed to reach agreement on the correct sizes for individual components and continued throughout the thirty-minute observation session to work in isolation. Not surprisingly, little was accomplished.

In the post-observation interview the following points were made:

Question How do you think that you might have worked better as a team?

Christopher Try not to argue as much, we argued a lot of the time.

Question Why were you arguing?

Michelle We disagreed on the lengths.

Question Why do you think that you disagreed so much on what sizes to cut?

Christopher Some of us were doing it from the clear plastic bit at the end (*of the ruler*) and some of us were doing it from the 0, so it made a difference.

Question But no one said to any one else that that was a problem! So how might chatting to one another have helped?

Christopher Well because we all assumed that everyone else knew what they were going to do so we all just got on with our own stuff.

Julian We should have sat down for five minutes and talked about what we were going to do, each of us.

Question Do you mean right at the beginning or .....?

Julian Right at the beginning, just say .... agree on the lengths, what it's going to look like and then go off and do the stuff ... we didn't do much of that .... we just went off and .... (*input ends*)

I then discussed, generally, the problem of saying things out loud but with out addressing specific issues to one another.

Question Do you think it might be useful to have a team leader who is responsible for that sort of checking?

Christopher Maybe or maybe not .... if the team leader got too bossy it might make it worse.

Question So how do you think you might have responded to your teacher's request to agree?

Christopher Before we started we'd had a chat about it and we thought about what we'd all be doing, but then some of us changed our mind half way through once we'd started doing what we were going to do. So, we had agreed previously, but then we changed our minds and that wasn't so good.

In cognitive dissonance terms (*see Chapter 2 pp. 71-84*) I would suggest that this episode is an example of pupils holding fast to individual positions as a mechanism to actively evade a situation that would cause, for some of the group, a loss of status. I would contend that each must have recognised that only one measurement can be correct but that to cross check this, as a group, though a sensible strategy, would expose two of the team, and possibly all three engaged in the dispute, as adopting the wrong sizes. Furthermore, this might then lead to a perception of being undervalued as part of the group. Perhaps, in this situation, none of the pupils was willing to lose face for the benefit of moving the work on more swiftly and

efficiently. Whilst no outright rejections of suggestions can be noted, neither is there any tacit, cumulative, agreement. Each seems to be working to avoid any increase in personal dissonance and this was clearly not supportive of optimised progress.

Elsewhere, evidence has also shed some light on the fact that pupils may engage more constructively when talking in environments that they perceive to be more conducive to reaching agreement than that of the classroom. Not least, as a means of avoiding additional discussions with their class teacher that they feel may lead to both greater levels of uncertainty and, perhaps, an undermining of personal status resulting form having to respond to teacher based questions in the presence of ones peers. In school H1: 16/10/02 and 30/10/02 (*see Appendix 1*), for example, Sian, a year 6 pupil, informed me that agreement on ways forward, between herself and her peers (Rachel and Sophie), which had not been noticed by me as part of their observed interaction, had been reached during playground discussion rather than in the lesson. Whilst this lends some weight to the class teacher's feedback that would suggest that pupils are more ready to make use of what Mercer et al (1999) would call 'exploratory talk' when liasing in an environment beyond that of the classroom, it also begs the question of why this should be so? Conceivably, children recognise that the uncertainties that will arise from their being seen to engage critically with one another may also prompt further levels of uncertainty from teachers who may wish to extend the discussion by way of seeking further 'reasoning'. Indeed, it may be that the element of risk-taking/decision-making required as an aid to constructive criticism is more freely expressed when pupils feel less inhibited by the culture of the classroom in which the search for right and or extended answers may be prevalent at a sub-conscious, yet impressionable level. Some evidence is available to support this position:

Question Natalie, your teacher came to speak with you once during your work last week and asked you about how you were getting on. Do you think it would help you to

operate better as a team if she interacted with you more often? Or would you sooner be left to sort these things out for yourself?

Natalie Probably easier to try and sort it out for yourself.

Question Why?

Natalie If your teacher is with you it's not really your .....

Craig Ideas.

Natalie Yeah, she's telling you what to do?

Question Do you think she is telling you what to do, or do you think that she should question you in such a way to try and get answers from you?

Richard Yes.

Question Is that what normally happens?

Richard Teachers normally tell you what to do but if you want to work as a team you might as well be left alone. Otherwise the teacher is making .... like telling you to be quiet and only to listen to one person ....

Craig Yeah, if we get told by the teacher all the time we won't learn from our mistakes.

Question So you won't learn from your mistakes. So, when your teacher did come to speak to you, I thought that you tended to explain things in more detail to her than you do to one another. Why is that, why do you explain things more carefully to a teacher than to your friends?

Richard Well otherwise she asks you loads more questions.

An interesting indication here of what appears to be a willingness to extend responses to a teacher as a means of reducing further workload, rather than seeing this mode of operation as an approach that should be cultivated across interactions generally. In the same post observation session these pupils also drew attention to a further variable impacting upon the inconsistencies discussed here: namely pupils' intuitive belief in one another's ability.

Furthermore, this feedback, obtained during the post observational interview, also sheds additional light on discrepancies between teacher's valuing 'reasoning' and not actively encouraging it as part of their normal classroom practice:

Question How important is it for children to justify their viewpoint, and for you as teacher to model the type of responses that you would want to receive from them?

Teacher I agree it's important, and I think I did at times ask them to say what the problems might be in terms of responses received – a type of justification, asking them to think things through a step further. However, I wasn't saying, what are the good points for suggesting that, and I should perhaps have been doing both so that they are thinking of ways to solve problems and giving reasons for doing so. A fuller justification.

Question So what might be the problems for you as a teacher in finding the time to encourage this type of reflective thinking, to elaborate, justify, give reasons; or for you to model this type of response?

Teacher Well, interestingly, it is important to try to get children to argue their point of view and I've always found that if you listen to them in the playground, that they are very good at justifying themselves naturally. It's only in the

lesson that they seem reticent. They are used to justifying themselves (she goes on to describes a number of playground instances) but not in the classroom.

4: Reflective Practitioners – teacher limitations;

From the outset of the research study it became apparent that teachers seemed to recognise both the value to be gained from children operating as 'reflective practitioners' and the roles that they might take in supporting this position. However, there also seemed to be two major reasons undermining their fullest support of the concept; particularly the extent to which they encouraged pupils to justify their current lines of thought or action. These were, 'lack of time' and 'lack of confidence' in Design and Technology. The former seems readily linked to the pressures currently faced by primary classroom teachers as they try to manage the weighty requirements of covering curriculum areas outside of English and Mathematics, in limited time frames. The impact of the associated Literacy and Numeracy strategies has meant that all other subjects are effectively squeezed into half the school day, this leading to QCA (2002) and Estyn (1999) suggesting that subjects such as Design and Technology receive only 4% of curriculum time. Essentially, this appears to result in teachers trying to do their best but having to move work on at a pace that does not always allow for the time needed to engage with groups of children in a mode congruent with the notion of reflective practice. Views obtained from teachers during post-observational interviews have often alluded to this issue and I offer a sample to support this line of thought:

The following extract from School D: 11/12/01 provides an illustration of the problems faced by class teachers when attempting to manage the requirements of twelve curriculum subjects (*National Curriculum in Wales*). In many ways the teacher's responses highlight the gap between theory and practice. For, whilst she makes assertions about

questioning strategies at the outset of her feedback, these were not always mirrored in the observed sessions recorded in her classroom. Furthermore, even when she did interact in ways that supported the children as reflective practitioners they did not, in the context of practical activity, respond accordingly. In general, though there was a clear acceptance of the importance of encouraging 'reflection', this is set against the difficulties of pursuing this concept during group work activities and within the current constraints of a curriculum that can be seen to be undermining the notion of 'breadth'. The transcript begins at a point mid-way through a discussion about how the class teacher might encourage her pupils to act as reflective practitioners:

Teacher I always ask them open-ended questions. How have you done that? How could you improve that? Explain to me what is going to happen here? Questions that make them put into words what is in their minds and helps to clarify it for me and hopefully for them. And for other children to listen to what they are saying and to also encourage them to .... It's hard to think of ways to get them to work in a more unified way though?

Question I'm just thinking that given that you have a busy classroom and limited time for D & T how easy is it for you to model the language that you might want the children to adopt?

Teacher Individually it is not easy, though I do try to have a point at some time .... I mean if they were in a class situation I'd ask everyone to stop, ask a question and encourage others to chip in. And at the end they present ideas for group discussion. But it doesn't really go on at small group levels.

I then asked the teacher to think about the fact that the children I observed in her classroom had noted a need to 'get things finished in the time available'. A desire to get on and 'do'. I therefore went on to

ask her how she might be able to interact with them to encourage the reflection I was wishing to distinguish:

Teacher — You may need to say stop, talk and then continue (*practical work*).

Question — Yes, perhaps one strategy might be to say, we've had ten minutes, so all tools down I want five minutes discussion to consider who's doing what and why?

Teacher — In other subjects we tend to do that, if you find that children are getting things muddled or wrong you do stop everyone .... Even if people are doing good work you want them to share it so others can get ideas .... Children are used to that style of work, having a break and listening to discuss what's being produced. So they could do that in D&T but I probably don't use that method (*see levels of confidence below*). I probably do my input, set them off using their ideas, bring them back, see what their ideas are, discuss them to see how they might improve them, set them off again and evaluate afterwards.

Question — In the transcript I've identified many instances of you doing these things with individual children, so why don't they take time out in D & T if they are used to doing it in other subject areas? Do the children just get engrossed in practical activities that they .....

Teacher — Is it because they don't often do practical activity? Especially when they get to year six, when a lot of their work is focused on types of tests. Even in Maths it's only on certain days of the week, or with low ability groups that we do physical work, concrete activities. Most of the time it's all paper and pencil work, it's rare that they get stuck into something!

I concluded by referencing a comment that Christopher at school E: 12/12/01 had made about only half listening, when asked how important it is to stop and think before doing:

'when your working (*practical session*) if someone is trying to tell something to you, you blank them out and concentrate on sawing or something and if someone is telling you something important, then you only kind of half listen. But if you're sitting down in a group, then you can all focus on everyone else.'

Given that this type of pupil feedback illustrates a common thread within my data – that in the context of practical work, critically constructive interaction is often of less concern to individuals than is progress, I invited the class teacher at school D to indicate how she might get pupils to appreciate that taking time out to talk might help them to get on quicker in the long run (*to work more efficiently*). Her response was revealing:

Teacher It's a big time factor, trying to get everything done (*curriculum coverage*). What would be nice would be to have small groups working on D & T projects in a more relaxed manner. Children working on carousel activities and then they would have more time. But there is literacy in the morning then Maths after break and it's all pushed into the afternoon (*the rest of the curriculum*).

The same teacher also answered the following questions:

Question How difficult is it for you to allow pupils to maintain ownership of a problem?

Teacher Very hard, because at the end of the day you want them to have some success in what they are doing, and if you know that the time is running out, you feel that you have to give them something so that they have

a finished product or have some success at the end of the day.

Question Is it just about them getting a nice finished product or is it about your concerns that you can cover the curriculum areas in the time allowed?

Teacher It's possibly a bit of both, but more for them. To be honest, I can look back afterwards to see what curriculum areas we haven't covered. But in this particular activity (*designing and making moving cards*) I think that it's important for children to see something at the end of it.

Here, the class teacher is clearly trying to balance the requirements of curriculum coverage with a wish to see children succeed, in terms of the completion of the product. However, I would argue that in so doing, the importance of coming to informed decisions, based on reasoned argument is likely to be underplayed as part of the iterative process discussed elsewhere (*see Chapter 1: Subject Specific Relevance pp. 4-9, Chapter 2: Action Patterns pp. 65-69 and Chapter 3: Overview pp. 86-98*)

A further example comes from School H2: 6/11/02

Question But how easy is it for you to do that (*ask metacognitive questions or model reflective practice*), given the time you have for D & T, on the curriculum?

Teacher It's not easy. It's a problem to get the children to reach the standards that you'd like them to reach, in the time that you've got. But in English and P.E., which were my major and minor subjects (*at University*), I would encourage them to say 'why'. As part of English planning, for oracy, I encourage groups to list key words that they think are important for group work; like

'motivation', 'co-operation' etc. This is often followed up by oral presentations. I tend to do this sort of thing automatically in Drama, I'm more relaxed. But I didn't do it naturally here. I also think that if you were to video the end of the project, then there would be lots of 'why' and 'how' questions. I hadn't realised that evaluation is going on all the time.

This is not to suggest, however, that this class teacher, or others who have participated have not recognised the value of encouraging children to operate as reflective practitioners. Rather, there is the secondary issue of classroom culture and the current focus on individualism within curriculum delivery methods. A second extract from my conversation with the class teacher at School D: 11/12/01 demonstrates this well:

Question How do you think that you might modify your inputs, particularly your questioning style, to encourage children to work more efficiently as a team?

Teacher They need to be encouraged to listen to each other a little bit more and to stop and review what they are doing and perhaps reflect on where they started, where they've got to now and actually get each other to see what the others are doing within the group.

Question If you are suggesting the need to give greater emphasis on stopping and thinking before doing, how quickly do you think that they can assimilate that in terms of responsibilities as part of group work?

Teacher It's hard for them to work co-operatively because most of the work that they do is as an individual. They're assessed as individuals, and not praised as co-operative groups. So perhaps if there should be more emphasis on praising them for producing co-operative

work, and perhaps listening skills so that they are listening to what the other children are doing. So that they could tell me .... If I asked Jane to tell me what Robert is doing here, she probably couldn't have done really. Perhaps rewarding that ability to look, listen and understand.

Returning to the issue of time, two additional examples, drawn from post-observational interviews, exemplify this limitation further:

School F: 6/2/02

Question How easy do you think it is, in normal classroom practice, to try and encourage children to be reflective? To think before they do? Given the current pressures of the primary curriculum and the limited time available for design and technology as a subject.

Teacher Well time is of the essence, but not just in D & T. In Science as well when you try to get them to work through things, investigations, before they actually do them. So you try and build this time into what you're doing, but there is a certain amount of pressure to get on and do.

Question Are they used to working as independently as they were in this context?

Teacher They do work in groups, possibly of a few more, six or seven .... Though in twosomes within a slightly bigger group ....

Question And would they be given a set of rules, responsibilities for working in groups? Or are they left very much to mange the group situation by themselves?

Teacher They'll be given some constraints and told what they've got to do. But to a certain extent you try and let them

create things.

The issue of ground rules is discussed further below.

School G: 4/2/02

Question How easy is it, given the demands of the current National Curriculum for you to get children to act reflectively. For you to give them enough time to think?

Teacher It's immensely difficult. I try to have a design and make activity every term but to actually get the children to work to produce, to realise their designs and to evaluate them inside of a term is extremely difficult, without giving focused activities, using jigs and doing a lot of decision making for them. And we tend to lose a lot of time on the design process. Its going back to what we were saying earlier, it's trying to slow them down, make them use their imagination and apply some experience to that imagination.

The second issue here is that of lack of confidence in the subject area and how this might impact upon children's developing ability to act as reflective practitioners. Two sub-issues have arisen here, the first relates to the 'inappropriate use of technical vocabulary' which can be seen to have a direct impact on task structuring and, ultimately, collaborative endeavour. The second is connected to the inconsistencies that exist between a teacher's approach to collaborative endeavour in subjects with which they see themselves to be confident and those, such as Design and Technology, where they feel less secure.

In relation to the inappropriate use of language, a common thread that can be seen to run through some of the data collected is associated to the way in which teachers misuse the term 'plan'. In the National Curriculum for Design and Technology, planning relates to children's organisational abilities, the need for them to think ahead

and to consider what materials, tools and techniques they should employ at the manufacturing stage of the design and make process. However, teachers will often use this term as a request for children to 'design' to draw a 'plan' (*sketch*). Unfortunately, if the teacher's perception of outcome is not clarified the children may approach associated group-based activities from a position that is not based on an intersubjective view of the requirements of the task. As such, action patterns (*see Chapter 2 pp. 65-69*) may vary leading to a lack of focus that undermines them operating in as reasoned a manner as they might. The following example typifies this issue:

School H2: 30/10/02

Question First question, at the beginning (*of whole class discussion*) you said, tell me what were you planning, what were you designing, what were your plans about? And then you asked Richard. Now this relates to a question asked of your Year 6 colleague, what is the distinction for you between planning and designing? I'm not sure that the children are absolutely sure?

Teacher Right. Em ..... I've interchanged them and I do usually try to use the term design.

Question So how might the way you interchange the terms impact upon the way in which they operate and what they are focused on?

Teacher It's tough that .... And I think I would prefer to use the word design as it would help them to focus on the fact that they were being asked to finish off their designs in order to make. Perhaps planning is more about discussion .... I don't know .... It's tricky that one.

Question It is, because you think that they can have distinct areas of designing, in terms of them coming up with

ideas as opposed to planning about how they intend to go about their making? Or do you think that the two areas are so closely related that ....

Teacher They are, but for me design is more about the final product, you have your design and can now make it .... I haven't really thought about this before .... I wasn't aware of the fact that I'd used those terms in that way.

Question Well, for example, when they are doing a design sketch and are annotating it to say card or square section timber, that is a form of planning, because they are beginning to think about materials and perhaps techniques. So they are closely aligned, but you may need to start thinking carefully about how you make use of such terminology?

Teacher Yes

However, whilst the inappropriate use of technical vocabulary might be seen to adversely affect children's response to a task and undermine their approach to effective collaborative endeavour, I have argued elsewhere (*see Chapter 2: Questioning pp. 28-42 and The importance of using appropriate terminology pp. 70-71*) that teachers need not be 'experts' in terms of declarative knowledge or practical skills in order to develop reasoned decision-making by encouraging children to operate as reflective practitioners. Moreover, I have already provided evidence of teachers engaging in relevant interaction in order to support this aim (*albeit limited*).

The second issue here is that of teacher confidence and differing approaches to collaborative endeavour across subject boundaries. Limited evidence (*my focus on this facet of the investigation came somewhat late in the day and remains open to further examination*) suggests that where teachers do feel a lack of confidence in the subject domain this may prevent them from adopting strategies, used

elsewhere in the curriculum, which would more ably support reflective practice whilst children are engaged in practical problem solving tasks. Of significance here is the limited evidence of teachers establishing effective ground rules for collaborative endeavour during Design and Technology work, even though this might well be done in other curriculum areas – in the context of this study, for example, during English and Drama (*School H2*) and Mathematics (*School D*) where the class teachers felt a greater sense of 'expertise'. This must be seen as an important omission given the work of Mercer et al (1999) and others (*Wegerif et al, 1999*) who have noted the importance of establishing appropriate ground rules for collaborative endeavour as a means of establishing a framework in which children will hopefully cooperate effectively as a team. However, evidence from the data I collected in the field provides limited examples of teachers using pre-group work interaction to establish how teams of children might work most effectively together. Not surprisingly, therefore, teams often failed to agree upon a collective approach to the work in hand, resulting in an inefficient use of time and resources, both human and physical. Indeed, all too often pupils seemed to lack a focus for organising themselves in to an effective unit. This for me, seems to impede children operating as reflective practitioners because without a firmly established understanding of the ways in which groups work best they will probably not recognise the value in, for example, airing and sharing views and or recognising that alternatives should be discussed before a decision is taken (*see Chapter 2: Establishing ground rules for effective collaborative endeavour pp. 43-53*).

There is also an indication of teachers assuming, I would suggest unwisely, that knowledge and skills learned in one situation will transfer readily to new contexts. These issues are clearly demonstrated in the following extract:

School H2: 4/12/02

Question O.K. So, why was it that on this occasion, you didn't

reference specifically how they might operate as a team? And is this something that you normally do or not?

Teacher We actually do a lot of group work, a tremendous amount.

Question Collaborative group work?

Teacher Yes. I do a lot of drama where they have to discuss how they intend to present their scene, and even in dance and P.E. we do a lot of problem solving work where they work as a group. I've done a lot of inputs in the past about how to work as a team, how we listen to each others ideas, how we share ideas.

Question But this was their first D&T project (*of the academic year*)?

Teacher Yes, and I think that I possibly, wrongly, assumed that they would transfer other group work skills into this activity.

Question So what ground rules would you normally give them to support collaborative endeavour?

Teacher Listen to each other's ideas, don't all talk at the same time, value each other's ideas and be willing to recognise that your own idea is not always the best. I often say that I love working in a group because you can pinch other people's fantastic ideas, add them to your own fantastic ideas and come out with an even better one (*alluding to optimisation here*). The noise level is usually high during group work, so I always say we need to listen as well as talk. I also tell them to make sure that everyone is included. I've some members of the class that will quite happily sit there

and don't get involved in a group very well, and also some who will try and dominate. I tried to give you a mix of those.

Question If you look at the list on the script I've given you, you'll see that you've mentioned quite a few of the ground rules shown there (*from Mercer et al 1999*). What's more, the group told me that they do have rules for group work, but that they hadn't used them well on this occasion.

The class teacher then went on, at some length, to explain that the class had also recently been engaged in Outdoor Education activities and that on their return to school each group had done an oral presentation on how group work is relevant both outside and within the classroom.

Question Why do you think then, that in D&T, some of these rules that they might operate with quite readily in an English or Drama activities seem to disappear?

Teacher Well, we always say that we have to work towards a goal, that we are all trying to get to the same point and it's necessary to work together.

Question And in fairness, they did seem keen to move the work forward, though not always through discussion, as a whole group - lots of gesturing and positive activity etc. I got the feeling that they were keen to help one another, but they didn't always do that as effectively as they might have done. So why do you think this was the case? They worked often in pairs but didn't, as a group of four, air and share ideas.

Teacher I'm wondering whether had I given you four girls, that this might have led to a different scenario. That they

might have felt .... There might be a gender issue here.

Question Though Craig and Teresa often worked together.

Teacher Well that's personalities .... Why in D & T? .... Well maybe they do feel strongly about their own ideas, about what they would like to construct, and maybe they would like it (*the final product*) to be more their way. So, if they are working in a pair, then possibly there are less ideas for them to have to contend with.

Question Fewer pathways of communication. OK. What do you think it has to do with the outcome of D & T being practical? That they want to get on to the cutting and sticking and ....

Teacher Yes, and they want to be in control of that as much as they can be. So maybe they are trying to get control of the design in order that they can also be in control of what they do when they're making.

This is a further interesting viewpoint, that children's focus on 'product', rather than process, might be leading them to see the priority in any discussion and decision making as the extent to which their own idea will be brought to fruition, irrespective of it's relative value *('getting things done' has been dealt with previously)*. The class teacher's comments about paired work producing "less ideas for them to contend with" might also be usefully linked to Festinger's (1957) views about dissonance reduction (*see Chapter 2: Cognitive Dissonance pp. 71-84*).

Question OK, let's move on. How easy would it be for you to regularly, in the context of your classroom, discuss those seven ground rules (*Mercer et al 1999*)?

Teacher Well I do that, on a weekly basis. I try to get at least

one group based activity in a week. But, I'm becoming aware of the fact that they won't, within each subject, take what they've learned about group work as a whole; so I may need to give them a reminder. And let them feedback to me about how they should work as a group.

Question So recap and reinforce the ground rules?

Teacher Yes.

Question They did say that they felt that it would have helped to have had the rules reinforced, and three of the four gave an example of a rule that they thought was important.

In the same interview the class teacher also associated her subject insecurity with the noted absence of her modelling reflective practice for the benefit of her pupils:

Question When you interacted with the group, you tended to extend their responses – they'd say, I'm going to use glue' and you would say, 'so you're going to use glue to stick these two pieces together'. But you never asked them to say why? So, how important do you think it is for you as teacher to model the sorts of activities that you want them to engage in? Because they never, not once, did any of them challenge one another.

Teacher It's insecurity with the subject. In drama I would often say to them, why have you chosen to do it this way, or why have you decided to take on that character. It would come naturally to me. And they would offer a response.

Question So how might you get them to start asking the 'why'

question? To start operating in a more critical but constructive manner?

Teacher By probing, by asking them to say why?

Question But what if you model responses? What if they hear you say, 'well yes, I agree, because I'd stick it with sellotape because. And you go on to give a reason, to justify a line of thought?

Teacher Yes, I see that.

We then went on to discuss the notions of 'expert' and 'novice' and I suggested that pupils and teachers can learn about the process elements of D & T by modelling reflective practice for each other. The class teacher responded by saying:

Teacher Absolutely. I've never done a project (*D&T*) of this type before. Design and Technology on teaching practice was sandwich making, and that's nothing like designing and making a structure. I want to do this subject well, but it's a learning curve.

A further reason for the lack of ground rules for collaborative endeavour during practical problem solving activities was provided by the class teacher at school H1: 30/10/02. Here, the limited use of group work and a failure to see ground rules as a useful precursor to effective collaborative endeavour is identified:

Question Last question. Research has indicated, that collaborative endeavour can be supported by referring to a set of ground rules (*Mercer et al's 1999, as set out as part of the transcript given to the class teacher*) on a regular basis. Now during the introductory session you did invoke four such rules and some of them meshed with these (*Mercer et al's*). So, the question is, how

often might you encourage these ground rules and do you apply the same rules in different curriculum areas? Do you have a consistent approach to the way in which children are encouraged to work purposefully as a group?

Teacher That's a good question and really it's down to how frequently they actually work as a group .... and ..... well Science and Technology is about it.

Question So is group work limited?

Teacher It is limited. You also have to have a focus for the lesson, and if your focus is how well they work as a group .... then these (*Mercer et al's 1999 ground rules*) would be the sorts of things, the ways that they should collaborate, would be stressed and worked on. But generally the focus is something else; for example, that they should be thinking ahead before they start to make. So these (*ground rules*) have not, necessarily, been stressed enough, because my main focus has not been how well they work as a group. Here, the main focus was how well they could think ahead, to fire up ideas.

Question But the two aren't mutually exclusive. In order to think ahead effectively ....

Teacher Yes, exactly. They need to be able to inspire each other, discussing together.

Whilst the teacher at school H2 did try to develop ground rules for collaborative endeavour, at the outset of the children's second practical session, and recognised the need to structure problem solving tasks thoughtfully (*see below*), it has to be noted that the observed group did not, as a consequence, operate effectively as a

team. As discussed above, that might be seen to have had something to do with the children's unfamiliarity with group based Design and Technology activities and an inability to transfer skills learned in one situation, to a new context. However, I would also wish to contend that more generally, pupils limited functioning as reflective practitioners results, in part, from the failure of teachers to structure practical problem solving tasks appropriately (*see also Chapter 2: Task* Structuring pp. 53-71). This is an important limitation for, as I have argued elsewhere, without appropriate scaffolding groups may fragment because of their failure to recognise how they might best organise themselves to tackle key issues – the most relevant aspects of the task in hand.

From school H1, comes this very relevant passage:

Question How much do you think they can take on board at any one time. You began to say (*during initial whole class discussion*) that they should consider a number of aspects – research, a picture, a resources list, plans of the cuboids with measurements and an indication of equipment to be used etc; but how might children's collaborative endeavour be helped by having them focus on a single element of the design, for example the ground floor, rather than setting the problem in global terms?

Teacher It may have helped, in terms of the collaborative work – them discussing a single thing – but what I had in mind was to get from them what they thought was going to be required globally. At the very beginning they were giving me suggestions of what you needed to do, to plan, before they started. So the big global list, as you call it, came from them. I tried to list that on the board, and from my point of view, it was a simply a matter of seeing how far they would get from that, perhaps by separating into separate jobs. I might, therefore, have

found that in a single lesson they could have done virtually all of it, but I would be learning from it and take them on during the next session.

In reality, the children did split into separate jobs, but not on the basis of any agreed structure (*action pattern*). Consequently, whilst each made some headway with their own task, this did not lead to a clear understanding, as a group, of how the final product (*Tudor House*) would look or, more importantly, how they could best begin its construction (*overall shape, size, detail etc.*). In this instance, rather than asking the children to think 'globally' I believe that better use of the limited time available could have been secured had they been asked to think about one aspect, as suggested: namely, agreeing how the ground floor of the building was to be designed and made and, thereafter, using this starting point as the basis for further developments. This argument is based on personal experience and would support a more thoughtful approach from pupils: e.g. maintaining appropriate proportions between the various sections of the construction, developing relevant skills progressively etc. As noted during my interview with the children, particularly Sian (*see also Chapter 2: Relevant aspects of the task in hand pp. 58-65*)

Question What would agreeing help you to do?

Rachel It would help us to know exactly what it was going to be like and be able to picture it a bit more, so that it wouldn't be that individual.

Question So it would help all three of you to be able to picture it better, rather than having your own pictures, which you sometimes seemed to have last week. Is that fair?

Sophie And you could also get on with it quicker, if we discussed it.

Question So you could save some time as well! OK, last

question. Do you think it would have been easier if your class teacher had said to you, we know that Tudor houses had two or three storeys, but this afternoon I only want you to think about the ground floor?

Sophie Not sure, because she didn't know either that there were three storeys to begin with until we did another History lesson, with a video.

Question But whether you have two or three storeys, do you think it would have helped you to agree and design a better house if your class teacher had said, this afternoon let's just concentrate on getting the ground floor designed and worry about what goes on top later? Sian?

Sian I think it would be good, because then we might have finished that and had a little bit more time.

Question Sophie, about the middle floor not fitting on. Don't you think that had you agreed the ground floor was going to be 15 cm by 10 cm by 12 cm high, that once you had done that design your next floor would .....

Rachel Be accustomed to it.

Question A good word Rachel. Because if you made your next floor 50 cm by (*lots of laughs*) ... Yes, exactly, it wouldn't look right. So had you been given less to think about in the beginning, might that have helped you to design all the other bits?

Sophie Maybe, I'm not sure.

Sian It would take some pressure off.

Another very good example of this issue can be drawn from observations and interview data collected at school G on the 31/1/02 and 4/2/02. Here, the class teacher's activity management led to a common problem in the way in which two groups of pupils approached the same piece of work, the designing of a pizza. Not least, the extent to which their perception of the task focus affected their ability to agree on appropriate strategies for effective progress. On this occasion the same class teacher provided an initial input to two Year 5 groups, one before afternoon break, the other immediately afterwards. In the first input a clear reference was made to the children (*working in pairs within a group of four*) having to divide their pizza into halves. In the second input this distinction was omitted, but did not seem to affect the children's interactions significantly (*see below*). However, in the case of both groups the teacher failed to impress upon the participants the need for them to treat each quarter of the pizza as their own: that is, that each segment could be designed on the basis of individual preferences. This seemed to lead the children to a position in which they focused on the mathematical aspects of fractions and in particular, on the concept of equality – the quarters had to be the same. This lead to disagreements over the ingredients to be used in the individual segments of the designs that were developing, resulting in limited progress and a failure to produce a prototype (*model of the pizza using cardboard and various types of coloured paper, card discs etc.*) that were based on reasoned decision-making. The following extract throws further light on this situation:

Question The difference between your inputs for Group A (*pre break time*) and B was that with Group B you didn't stress the business of dividing the base before they began. Nor did you, for either group, stress that designs for each segment were to be based on individual preferences. So, the question is, how important do you think it is, to efficient designing and making, for you to provide pupils with a clear plan of action about how they should be going about their work prior to them

commencing the task? And, what problems do you think might arise if the way that they see themselves moving forward is different to your expectations of how they might move forward?

Teacher I think initially that that was a slip on my part, the fact that I had done it once and then went into the second lesson .... and you never ever seem to get two lessons that are exactly with the same input or with exactly the same responses. Having done it once without those specific notes, perhaps it was a lack of planning on my part not to itemise what I wanted covered, I just omitted it (*dividing the pizza and individualised segments*).

Question I'm going to tell you in a moment what they said, but how do you think that they responded to my saying, was it a problem for you not to be told to divide it (*the pizza base*) at the outset?

There is a long pause here while the teacher gives this some thought.

Teacher I would have hoped that they would have said that it's not a problem because we should have realised that ourselves.

Question Almost, they hinted, all four of them, that they hadn't given it any thought, but Chloe's response was, 'well, OK, we didn't think about it but once we had sprinkled all those cheese bits over the base we wouldn't have been able to see them (*the fold lines*) anyway'. So they could see the advantage of doing it (*dividing the base*) but at the same time they said that it wouldn't have made their job any easier. However, there was a problem in both groups, and this I'm going to try and link to maths. The first group you told about dividing,

the second group had said it (*not dividing*) wasn't a problem, but in both groups there was disagreement because there were two people who had the same preferences, for example, cheese and tomato topping. What happened, as the designing went on, was that the children forgot that they could still think in quarters (*as individualised segments*) For example, Paul and Elinor (*Group A*), who both wanted the same topping, disagreed because Paul started putting what he wanted, in terms of amounts of ingredients, across the half of the pizza rather than just his quarter. This led to Elinor saying there were too many tomatoes, with Katrina supporting her and Paul continuing to go his own way. The same happened with Carl and Kirsty (*Group B*), because they stopped thinking of their half as two quarters and failed to recognise that they could have operated on these in terms of their own preferences. They were arguing about the half! So, I'm wondering, because some of them were hinting at the need for equality, whether ....

Teacher They'd forgotten about their own preferences.

Question Yes, and they began to think, mathematically, that quarters have to be equal. Now Kirsty (*Group B*) used the term equal, but was referring to equal size. However, what I'm suggesting is that they moved the term 'equality' into the same amount of ingredients. So, how might they be encouraged to forget their maths and keep a focus on their individual ideas?

Teacher It might mean going back to thinking about how the pizza is going to turn out, so that they then focus on their own space.

Question So how would you encourage them to maintain an

appropriate focus: that they have come up with an individual design?

Teacher Em .... I don't really know .... perhaps had I been here they might have arranged things in a different way and appreciated that and then been able to apply the two quarters in that way to the half. I'm not certain.

For me, this lack of certainty seems to derive from the complexities of monitoring the progress of a number of groups engage in practical problem solving activities, simultaneously. In some classrooms this has amounted to teachers trying to support up to nine groups (*of four*). Elsewhere, some teachers also feel that they are faced with the dichotomy of pupil independence versus teacher control. At school E, for example, the following was noted:

Question What other things do you think that you might have been able to do to get them to work more efficiently as a team?

Teacher It's always a fine balance between wanting them to negotiate particular roles or coming in and suggesting – well why don't you two look at measurements ... the others decide upon what sort of decoration you want and then come back and show the others. So you can either ... I didn't want to split them as such ... there is a desire within me for them to negotiate those roles. It's very easy to come in and say you do this, and on the odd occasion with certain groups you have to tell some children, because of ability wise or the way groups work – you think ... you have to step in and say it would definitely be a good idea if you two went and did this or did that, and then come back and see how you move on, in order to get them to some level of working together. With those in there (*the observed*

group) I didn't see that as totally necessary when I started – I obviously noticed that I needed to come back and say are we doing this or that, but I'd still want to shy away from saying why don't you do this and you do that. I'll intervene and help them physically with certain things, if they've got the ideas, but I wanted them to try and come to the point where they would say why don't you two do this and you two do that, because I've prompted them enough to negotiate ... but underlining that must be the desire for them to come back to each other and say are we doing this right, do we need this or need that?

Unfortunately, whilst the teacher's desire for the children to take responsibility for task management was well founded their response to the implied offer was not well matched. Once again, I would argue that without an accompanying level of prescription, by way of focusing children on relevant aspects of the task, children will be left to consider too many options at any one time. In this case, one session devoted to the construction of a simple framework ended with little progress achieved because the four members of the observed group failed to agree on associated key measurements that had not been identified as a focal point for their initial deliberations, even though the class teacher recognised the significance of this aspect of the work:

Question In a nutshell though, the one thing that these four did not do, at any stage, was to reach an agreement on what measurements to use for pieces that were being cut by all four of them. Why?

Teacher It was the one thing I wanted them to consider first, because I'm at pains to emphasise that the thing must look right.

From the children, came the following comments:

Question	How do you think that you might have worked better as a team?
Christopher	Try not to argue as much, we argued a lot of the time.
Question	Why were you arguing?
Michelle	We disagreed on the lengths. (*of square-section timber*)
Question	Why do you think that you disagreed so much on what sizes to cut?
Christopher	Some of us were doing it from the clear plastic bit at the end of the rule and some of us were doing it from the 0 so it made a difference.
Question	But no one said to any one else that that was a problem! So how might chatting to one another have helped?
Christopher	Well because we all assumed that everyone else knew what they were going to do so we all just got on with our own stuff.
Julian	We should have sat down for five minutes and talked about what we were going to do, each of us.
Question	Do you mean right at the beginning? Or ....
Julian	Right at the beginning, just say .... agree on the lengths, what it's going to look like and then go

off and do the stuff ... we didn't do much of that .... we just went off and did our own thing.

Given the problems noted above the establishment of a clear task structure, supporting intersubjectivity and agreed action patterns seems all the more relevant.

However, even where the importance of task structuring is identified pupils may still not operate in line with the focus determined by the teacher. At school H2, for example, the following comments were recorded:

Question — You set up the session by telling them that all they needed to think about was essentially the stage and Heavens (*an area above the stage where a winch mechanism raised and lowered actors to the stage*) elements of the Globe Theatre and the structure they would need to join these two parts together. So, why do you think that it's important to break down D & T projects into manageable chunks?

Teacher — Because I want them to achieve a final product, and if you give them too much to think about in the group they will go round and round in circles and won't be able to achieve what they want to achieve. They might try to plan (*design*) the whole of the Globe, with the Galleries, with the overall shape of the Globe, and they might have sat down and drawn a very nice picture of what they thought the actual Globe looked like, without having enough thought about constructing it (*the Stage, Heavens and working machine*).

In reality, what the teacher had hoped to avoid, within the group situation, was what was actually recorded during my observation of children at work. Even given her focus on ground rules for collaborative endeavour, and a sound task structure the children still failed to work effectively as a team, though once again they recognise the value that should be gained from doing so:

Question When you first began to work, Natalie started sketching and you two (*Craig and Richard*) began to work with pieces of material and to discuss ideas. But you weren't all talking together. What might have been a better way to start?

Craig To discuss what we need to do so that we can split up the things to do. (*an agreed action pattern*)

Richard I thought discuss first too.

Question Why?

Richard Because then we would all know what we were doing .... Rather than us just like .... Well I thought I knew what we were doing.

Natalie I think that we should well .... discuss it first, because we'd all know what we were doing and we would find it easier to do stuff.

Later on during the same interview sequence:

Question Your teacher asked that before you started discussing some of the other details you should think about how the model was going to stand up and work. So, the question is, do you think that you need as a group to discuss the order in which things are going to be done, because you were discussing detail before you even

had a theatre (*structure*) that was standing up, strong, and ready to have detail added to it? How do you think that you might have gone about the work in a more structured way?

Craig — We should have discussed how it was going to be built and then ..... after that we could have .... We could have done the detail last.

Richard — I think that .... we should have .... discussed the detail at the start .... because then you know what to do .... Like if you know what you want on the floor (*of the 'heavens'*) then you can put that on (*I assume the sketch*) at the beginning. You'd already have it drawn on.

Question — So you think that it is important to consider detail before you get too far with the making?

Richard — I think that it's important on some things but not others.

Question — So was it more important here to discuss detail before discussing the structure – how the two boxes were going to be held apart? Or do you think it was more important to discuss the background and the spikes (*roof details*).

Richard — Perhaps we should have discussed it in the middle .... If you discussed it in the middle then you would know what to do and would have time to write it in (*on the sketch*).

Question — So, do you think that you need to be thinking about the whole thing?

Richard — Yes.

Question Natalie?

Natalie I think we should discuss how big we should have the wood first, and then discuss the heavens and guardhouses (*two-dimensional detail to be added to the model*) after we've done that.

Question So do you think that you should have got the structure sorted out first?

Natalie Yes.

It is this failure to agree a way forward that seems to lead to fragmentation within groups, thereby undermining both reflection and its support of optimisation. The question remains, why might this failure continue to exist, even where teachers are asking metacognitive questions, setting ground rules for collaborative endeavour and structuring tasks in the hope of focusing children on relevant aspects of the task in hand. I cannot offer any easy answers here but attempt to draw appropriate conclusions and recommendations in the section that follows.

I now wish to offer interpretive summaries of the issues raised above, prior to identifying the key findings of this study.

Overview of Sub-Sections/Categories

The four categories, discussed above, were chosen as a means of both exemplifying key findings from the data collected and analysed during the study and in order to illustrate the complex interrelationship between a range of factors impacting upon young children operating as reflective practitioners, that has emerged during the course of the research undertaken. Their selection stemmed from a wish to provide opportunities to show where support for children as reasoned decision makers is most effective together with examples of processes that have been seen to undermine the

optimised resolution of problems in hand, an issue that has been a focus for this investigation. They are summarised as follows:

1. Metacognitive Questioning and Reflective Practitioners - best practice

First, and most positively, I would wish to note that where children have been seen working in contexts that support, at least to some extent, their use of reflective practice, the resulting interaction between members of the observed team led to progress (*problem resolution*) based on reasoned decision making. As such, designing or manufacturing strategies were developed on a clearer, co-constructed understanding of how to move work on in an optimised manner.

However, evidence also suggests that such favourable situations are not a key feature of collaborative group work during practical problem solving activities and in the majority of cases interaction (*teacher - pupil(s), pupil - pupil*) did not afford the same benefits.

Consequently:

2. Reflective Practitioners - not quite there!

Observed classroom interaction often led to what one might describe as 'half-way house' positions. By this, I mean sessions during which teachers failed to encourage pupils to justify their intentions, thereby leaving them in positions where they were willing to identify, champion or challenge alternative perspectives, during dialogic exchanges, but without engaging as critically and constructively with each others' ideas as they might have done. In Mercer's (1996) terms, interaction exhibited limited evidence of 'exploratory talk'.

3. Reflective Practitioners – Inconsistencies

Evidence was also noted of children seeming to operate somewhat inconsistently in terms of their willingness to engage in those aspects of reflective practice set out in Chapter 1: Key Issues pp. 18-27. Here, a focus has been placed on differences between classroom and non-classroom interaction, teacher-pupil as compared to pupil-pupil interaction and pupils' intuitive belief in the ability of their peers.

4. Reflective Practitioners – teacher limitations

Why then might these less favourable circumstances (*2 and 3 above*) arise? This prompts a final consideration of evidence related to a number of allied factors. For example, during the study it became clear that a teacher's use of 'metacognitive questioning', their ability to structure tasks effectively and the setting of appropriate ground-rules for collaborative endeavour are key, interrelated elements in facilitating young children to operate as reflective practitioners. Furthermore, a number of factors appear to impact upon this interrelationship, not least: 'time' limitations and a teacher's perception of their subject (*design and technology*) based expertise.

On the basis of the issues discussed in this chapter and the summaries offered above, the following key findings can be identified:

- **the role of the teacher is both central to the aim of promoting young children as reflective practitioners and complex;**

- **the encouragement of young children as reflective practitioners is related to an effective interplay between metacognitive questioning, clear task structuring and well organised collaborative endeavour based on sound ground rules;**

- **however, even when these key elements of effective classroom practice are appropriately employed to support children when working as a team, other factors seem to impact upon their ability to reach a shared and suitably justified/agreed understanding of how to make proficient progress. In short, to 'reason together'. These factors, which tend to undermine a group's ability to work towards optimised solutions to the problem(s) they are faced with, have been linked to the notion of 'cognitive dissonance'. This includes, for example, children's concerns about their personal levels of uncertainty, their perception of their place within the group: not least how they view their own and others designing and manufacturing skills, combined and overriding positions based on friendship rather than reasoned argument, in the most critically constructive sense, the need for reward or a simple desire to be getting on with the 'doing' rather than engaging in further 'thinking' Whatever the cause, the outcome can be seen to be part of the complex make up of children asked to interact in group settings.**

Chapter 5: Conclusions, recommendations and looking to the future

In the introduction to this thesis I identified the focus of this research as an investigation of the factors that impact upon children operating, in junior classrooms, as reflective practitioners in the context of group-based, practical problem solving activities. Furthermore, this focus was shown to be underpinned by a recognition, noted in my rationale for the study (see pp. 2-18), that design and technology tasks, usually based upon collaborative endeavour, lend themselves, when appropriately managed, to what McCormick (1999) referred to as: 'qualitative reasoning'. Such reasoning was further clarified through my classification of junior aged children utilising decisions and actions that stem from 'measured deliberation' (*see pp. 20-22*); a willingness on their part, in simple terms, to be constructively critical of their own and others thoughts and actions. The outcome of the work undertaken, whilst indicating that limited evidence of children operating as 'reflective practitioners' was observed, has drawn attention to how reasoned decision making can be supported by effective pedagogy together with a far better understanding of the complexities associated with proficient/optimised group-based, practical problem solving activities. I am certainly left with a number questions still to answer, but the key findings noted above (*see pp. 164-165*) provide a signpost for further investigations and a foundation upon which to liase with colleagues and pupils as a means of improving classroom practice. This is clearly of significance because whilst I set out to investigate an area that was of personal interest, I did so in the hope that dissemination of my findings would be helpful to both those who participated in the study; and teachers and pupils more generally!

With these points in mind, I would now wish to offer some final thoughts as means of drawing major elements of the study together.

Mercer (1996) has identified three levels of analysis in connection with classroom talk: *lingustic* – analysis of the content and function of

talk, *psychological* – an analysis of talk as thought and action (*for me thought into action*) and *cultural* – language which embodies certain principles of accountability, of clarity, of constructive criticism and receptiveness to well-argued proposals (p.370). Whilst I have not sought to offer a detailed reflection on all these levels, their identification does draw attention to the complex interweaving of the functions of dialogue and, accordingly, lends some weight to the difficulties experienced in achieving any definitive position in respect of the extent to which young children are encouraged to operate as reflective practitioners in support of reasoned decision making.

However, these complexities, together with others identified in the preceding text, do not seem to diminish the general thread emerging from the study. Namely, that in the context of group-based, design and technology, practical problem-solving activities, it now seems clear that the answer to the question – 'how might junior aged children best be encouraged to operate as reflective practitioners' – involves the need for teachers to consider the ways in which their interaction with pupils impacts upon relevant task behaviour, in the short term, and the associated classroom culture in which activities take place, in the broader sense. Not least, a culture in which all players recognise that both 'action' and 'reflection', are valued components of educational progress; both in relation to proficient practical problem solving and the curriculum in general. In short, that the effective management of the 'process' supports efficient development of the end product. Here, not surprisingly, teachers must see themselves as key players. Indeed, in a recent article in the Journal of Design and Technology Education, Richard Kimbell (2003), citing the work of Patricia Murphy and David Barlex noted that:

'Collaboration is an important aspect of problem solving, which enhances learning (*including planning*) by making thinking more explicit and accessible and enabling pupils to construct joint understanding of tasks and solutions. In the case of design and

technology we would expect procedural knowledge to become more explicit.' (*cited by Murphy, P. p.13*)

Moreover,

'Patricia believes passionately in the benefits of collaborative learning, but is well aware that the gatekeeper to these benefits is the teacher.' (*cited by Barlex, D. p.13*)

It is in support of this role, as 'gatekeeper of collaborative endeavour', that I would hope that teachers could usefully draw upon the lines of thought and argument developed within this thesis. Not least because there was clear evidence from the data collected of pupils' understanding of the advantages to be gained from acting as reflective practitioners. As such, a foundation exists for putting this level of appreciation into practice. For encouraging children to actively 'think' before they 'do'; to engage purposefully in the iterative process of reflection and action.

If classroom practitioners, like me, are keen to promote the social significance of learning and the opportunities to be afforded by well managed and thoughtfully delivered group based, practical problem solving activities, then I would wish to contend that there is plenty here for them to be thinking about. Not least, their recognition of the interrelationship between the organisation of tasks, management of collaborative endeavour and questioning techniques as a means of developing 'reflective practitioners' – children as 'reasoned thinkers and doers'. In this context, Mercer (2000 p.55) suggests that:

'Good teachers help students to see the educational wood for the trees, and it is through teachers' effective use of language that a history of classroom experience can be transformed into a future of educational progress..... In other words, learning is more likely to occur when teachers use language to encourage and support children's use of language for thinking through what they have done.'

However, whilst I would concur with the general sentiment outlined here, I'm surprised to find that the benefits seen to accrue from effective language use are focused essentially on retrospection – on what has been done. For me, encouraging children to 'see the educational woods for the trees' needs also to be about helping them to use language as a means of thinking, in collaboration with others, in the moment. As argued previously (*see Chapter 1 p.11*), it is about 'contemporaneous reflection' – stop and think action – the provision of opportunities, supported by effective teacher-pupil interaction, that encourages children to be increasingly rational and judicious; that prompts them to analyse and make judgements about the progress of their own work. This is not to say that children should not be drawing upon past experiences. Indeed, one hopes that in working towards an optimal resolution to practical problems that they will make use of the knowledge and skills that they currently possess. However, what remains important is that such usage is based on reasoned argument.

Moreover, in encouraging children to reflect, in promoting their developing understanding of what Wells (1992) has seen as the centrality of talk in education, particularly discourse that occurs during purposeful lingustic interaction with others, teachers will be positioning themselves within classrooms in which dialogue is viewed as a:

> 'Resource to be encouraged and exploited as a powerful means of learning.' (p.284)

Wells (ibid), citing Latham, also draws attention to some key beliefs about effective learning. These include classrooms in which children are keen to develop their own problem solving strategies, where collaborative enterprise leading to the co-construction of meaning is evident and where 'reflection' is seen to be an essential part of the educational process. He notes that:

'In producing and responding to the linked and reciprocally related moves that make up a sequence of discourse, participants are able to act on each other, guiding and influencing each other's understanding of, and involvement in, their joint endeavour.' (p.287)

In similar vein, Mercer (2003) argues that children encouraged to make greater use of exploratory talk appear to exhibit an improvement in their:

'Reasoning capabilities by taking part in the group experience of explicit, rational, collaborative problem-solving'

Oh, that it were as simple as the picture painted here. However, as evidence from this study indicates, meaningful collaborative endeavour is not always manifest in practice and needs to be supported by effective teacher interaction. Where aspects of such interaction do help to secure lines of thought and action that are reasoned about, children can be seen, in the context of practical problem solving, to work towards optimised resolutions – developed through joint meaning making. More often, other factors impinge upon such processes to minimise the impact of the collaboration sought, not least because participants in group based activities may fail to reach or uphold a shared, intersubjective understanding of how progress can best be achieved. They may, for any number of reasons, be unable or unwilling to modify their current viewpoints and intentions and in so doing fail to acknowledge a different and possibly more appropriate perspective.

For example, reference to Festinger's (1957) work and the notion of cognitive dissonance has also engendered an awareness of the complexities associated with analysing interaction (*teacher-pupil or pupil-pupil*) and the related problems associated with being able to assign any firm conclusions as to the reasons for children interacting in the way that they do. As noted previously (*see Cognitive Dissonance pp. 71-84)* among other things, children's expectations, status, prior achievement and communication skills will all differ and

impact upon the notion of 'meaning-making' as a result of individuals, in one sense or other, attempting to minimise uncertainty as a means of securing, at a personal level, a more harmonious state of mind. Consequently, therein also lies the difficulty of deciding upon the most appropriate means by which teachers can help pupils to operate in a more collaboratively purposeful manner, not least as it can be argued that dissonance almost always exists within decision-making processes requiring reflection upon two or more alternatives.

Recommendations

So, where does all this leave me? Here, I shall offer suggestions to support classroom practice before considering briefly how the study might be taken forward in research terms.

POLICY DOCUMENTATION

The study would support a call for schools to include within their aims for Design and Technology a need for teachers to actively support those aspects of current National Curriculum documentation that reference the need for children to operate in a reasoned manner. This requirement was set out in the rationale for this study and includes a focus on opportunities for children to:

> 'Develop and apply their skills of asking questions. Making predictions and coming to informed decisions' (ACCAC, 2000 p.5)

Moreover, policy documents should also recognise the multi-disciplinary nature of design and technology activities and, in so doing, underscore the generic benefits for the whole curriculum of the part that reflective practice plays in supporting the notion of 'thinking in education'.

INSET

In association with policy statements, and as a means of putting theory into practice, schools will also need to examine their position on continuing professional development and support, as appropriate, the development of pedagogy in relation to the key aspects of this study: metacognitive questioning, task structuring, the effective management of group-based collaborative activities and a growing recognition of the complexities associated with pupil-pupil and teacher-pupil interactions and how these might best be accommodated.

As part of such INSET the significance of a teacher modelling reflective practice could usefully be built into the structure of any such provision and might usefully draw upon examples drawn from other curriculum areas. This study has certainly identified the fact that teachers do not always make use of effective teaching and learning strategies used in other subject areas as part of their management of practical problem solving activities.

Again, whilst this might benefit teachers and pupils in direct relation to practical-problem solving tasks, the implications for the whole curriculum are clearly evident.

DISSEMINATION OF BEST PRACTICE

I would also recommend that with the likelihood of continuing professional development becoming based on a system of accredited training (GTCW, 2002), including action research, and the need for teachers to be reflective practitioners in their own right, that schools should encourage members of staff to engage with the issues raised in this study and the possible lines of further enquiry outline below.

If reflection is seen to be a key component of personal and professional development in the work-force, then I would argue that

related skills need to be effectively provided as a part of children's general educational growth.

Looking to The Future

The raising of additional related questions, rather than the provision of any definitive answers, indicates further scope for continuing elements of the process commenced here. A number of avenues of associated enquiry can thus be identified:

1. A more detailed consideration of the extent to which classroom micro-cultures affect the ways in which pupils respond to the opportunities to solve problems in a collaborative manner.

Research questions might include:

- A further consideration of the extent to which pupil-pupil interaction, in the context of collaborative endeavour, is mediated by the perception of status within the group. Here, 'status' might be seen to refer to pupils' perception of relative worth within a group based on what they believe to be their personal levels of designing and or making expertise.

2. A more detailed exploration of the affect of establishing effective ground rules for collaborative endeavour as a precursor to practical problem solving activities.

Research questions might include:

- Identifying the extent to which the use of a pre-determined set of ground rules, actively discussed at the outset of practical problem solving activities, supports the notion of 'intersubjectivity' and the appropriate agreement of a unified 'action pattern' to underpin the effective progress of product development.

Attention to this question could offer the opportunity for a comparative study, evaluating the interaction of pupils within groups who are operating with/without teacher inputs related to ground rules; or a longitudinal study, assessing the extent to which effective collaborative interaction is developed over time on the basis of groups receiving the same guidelines (*ground rules*) for engagement during practical problem solving tasks.

I would also hope to be able to publish elements of this research study and or future activity. The rationale for doing so would rest largely on a desire to disseminate the professional and theoretical implications of the study in order to broaden existing debates about, for example, thinking in education, effective group-work, the role of teacher questioning etc. The following journals could form a focus for this endeavour:

DATA (Design and Technology Association)

The Journal of Design and Technology

This is the only national, subject specific journal currently available and is published quarterly. It has a separate section for research and is refereed by a distinguished panel of educationalists in the field. Publishing in this journal would be aimed primarily at colleagues operating in both the classroom (*professionals*) and associated research domains (*academics*). DATA also run a national yearly conference, through which feedback could be offered and in association with CRIPT (*Centre for Research in Primary Technology*) an international conference that could support a wider distribution of relevant detail.

Other publications could include:

British Educational Research Journal
Language and Education
Learning and Instruction

Social Development
Support for Learning
Teaching and Change
Teaching Thinking

In all of this I would hope to support, the practice of my colleagues in primary classrooms, discussion amongst academics in the field of education and, not least, my own thinking and pedagogy. As such, this research study, and the dissemination that will hopefully follow, supports the notion of continuing professional development. Indeed, in line with Craft (2000 2nd edn.) it can be seen to underpin the notion of 'extended professionalism' and, in particular, a view of teaching as:

> 'A rational activity amenable to improvement on the basis of research and development activities, particularly those involving extended study' (p.198)

Finally, and by way of an overview, this study has shed further light on the fact that getting collaborative endeavour right is obviously challenging. Finding the time and appropriate means to encourage young children to operate as reflective practitioners is far from simplistic. However, I remain committed to the view that young children ought to be offered as many opportunities as possible to 'think' and 'do' for and by themselves. Such opportunities provide an excellent springboard to future activities within and beyond the realms of education and hopefully the text contained in this presentation will afford teachers the chance of either modifying or consolidating their practice, as necessary, in order to support the aims of the study. One would not expect them to do so in a revolutionary fashion. Indeed, as Fullan (2000, 2nd edn.), for example, has noted, 'effective change takes time' (p.106). Moreover, it will require those who wish to act upon the suggestions offered herein to develop their own meaning of the change required. To come to see how it might fit best into their own classroom practice and how, in that context, it will support children's learning. However,

Fullan (ibid) also notes that, 'no amount of knowledge will ever make it totally clear what action should be taken' (p.107). As such, I cannot conclude with any certainty that an adoption of any of the strategies that can be deduced from what has been considered here will secure the necessary benefits that any individual teacher may wish to accrue, in terms of associated teaching and learning experiences. However, I would hope, that at the very least, it causes an appropriate degree of contemplation. Contemplation, not least to support, for example, the issue raised by the class teacher at School G - 4/2/02:

T Group work has got tremendous benefits, particularly in a classroom situation for resourcing and yes, practice is important. It's social skills, social skills that they don't necessarily use, some of them, and less and less at the moment.

Consequently, I will leave the reader with the quotation that set the scene for the line of argument that has been developed in this text:

'If you cannot increase reflective power in people, you might as well not teach, because reflection is the only thing in the long run that changes anybody.'
(Howe A. 1997 p.12)

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APPENDIX 1

Overview of Data Collection

OVERVIEW OF DATA COLLECTION SCHOOLS - Please note that all of the children's names are fictitious

KEY: **GO** – Group Observation **PO** – Post Observation Interviews (*Pupils and Teacher*)
TO – Teacher Observation (*Initial Input Audio Recorded*)

SCHOOL	DESCRIPTION	CLASS	PUPILS	TEACHER'S REASON FOR CHOICE	VISIT DATES	FOCUS	ACTIVITIES
A	Urban Junior school 355 pupils on roll	YR. 4	Claire David Samantha Tom (absent)	Not ascertained	8/11/00 15/11/00	Preliminary Visit GO	15/11: Designing/Planning (talking, sketching, writing) Design and make a balloon powered monster
B	Urban primary school 213 pupils on roll	YR. 5	Anne Jessica Peter Stephen	Not ascertained	20/11/00 27/11/00 4/12/00	Preliminary Visit GO GO	27/11& 4/12: Designing/Planning (talking, sketching, writing) Design and make a Fairground Ride
C	Urban primary school 335 pupils on roll	YR. 5/6	James Joanna Greg Rhiannon (all from Yr.5)	Not ascertained	26/1/01 2/2/01 16/2/01	Preliminary Visit GO GO	2/2: Designing/Planning (talking, sketching, writing) 16/2: Discussing simple mechanisms Design and make a simple cam operated automata

D	Semi -urban primary school 345 pupils on roll	YR. 5	David Jane Julie Robert	A group of mixed ability children who generally work well together and would be willing to converse	30/10/01 7/11/01 21/11/01 11/12/01	Preliminary Visit GO PO & GO PO	7/11/01: Designing/Planning (talking, sketching, writing) Designing and making moving Christmas cards
E	Rural primary school 215 pupils on roll	YR. 6	Christopher Erica Julian Michelle	A group of able pupils who had worked together before on D&T projects and were seen to be cooperative and willing to converse	7/11/01 14/11/01 28/11/01 12/12/01	Preliminary Visit GO PO & GO PO	14/11/01: Investigating gears 28/11/01: Making a framework Design and make a model of the Globe Theatre
F	Urban Primary school 330 pupils on roll	Year 5	Caroline Katherine Mark Peter	A group of able pupils that had worked well together before in D&T and were active participants in Q/A sessions	23/1/02 30/1/02 6/2/02	Preliminary Visit GO PO	30/1: Designing/Planning (talking, sketching, writing) Design and make cards including simple electronic circuit
G1	Urban Primary school 246 pupils on roll	Year 5A	Christopher Elinor Katrina Paul	Both groups were of mixed ability children who were familiar with group based D&T activities. The class teacher felt that they would respond orally in a generally confident manner	23/1/02 31/1/02 4/2/02	Preliminary Visit GO PO	31/1: Designing/Planning (talking, sketching, writing) Design and make a Pizza
G2		Year 5B	Carl Kirsty Mark Chloe		23/1/02 31/1/02 4/2/02	Preliminary Visit GO PO	31/1: Designing/Planning (talking, sketching, writing) Design and make a Pizza

H1	Rural Primary school 120 pupils on roll	Year 6	Rachel Sian Sophie	Chosen as a friendship group with an expected willingness to both collaborate and discuss work freely	9/10/02 16/10/02 30/10/02	Preliminary visit TO & GO PO	16/10: Designing/Planning (talking, sketching, writing) Design and make a model of a Tudor house
H2		Year 5	Craig Natalie Richard Teresa	Teacher saw the group as an interesting mix of pupils (*ability levels varied*) with a special interest in the extent to which Richard (*low ability*) would interact in these types of activity	23/10/02 30/10/02 6/11/02 27/11/02 4/12/02	Preliminary Visit TO1 & GO1 PO1 TO2 & GO2 PO2	30/10: Designing/Planning (talking, sketching, writing) Design and make a model of The Globe Theatre 27/11: Designing/Planning (talking, sketching, writing) Design and make a model of The Globe Theatre

Please note:

G1 and G2 refer to two Year 5 groups within the same school. On the afternoon of observation the sane class teacher managed one class of children before afternoon break and a second class in the final session of the day.

H1 and H2 refer to a year 6 and year 5 class within the same school.

APPENDIX 2

Example transcription of teacher observation session

SCHOOL H2 : VISIT 27th November 2002

Initial Teacher Input 3 : Year 5 pupils

This was a continuation of the Year 5 design and technology topic based on the Globe Theatre. The two-week break in observations/activity was due to class teacher illness and my own absence from work.

On this occasion, the class teacher provided a good deal of input related to the setting of ground rules for collaborative endeavour. And wrote key words on a blackboard. I have indicated this in bold black type below:

Teacher Tell me, what were you planning? What were you designing? What were your plans all about *(terminology)*? Richard?

Q1 What do you see as the distinction between 'planning and 'designing'

Richard About the heavens and the stage

Teacher So we were focusing on the stage area, good boy. Sally?

Sally The inside of the Globe Theatre

Teacher So, we were considering the inside of the Globe Theatre. Now, you were working in groups, so lets just have a think, to remind ourselves about what we need to do when we are working as a group. Remember that we've worked quite a lot in groups this year so what's it all about, Josh?

Josh Learning to work together.

Teacher Yes, and we also called it teamwork, didn't we. So what should we be doing, Faye?

Faye We **cooperate.**

Teacher Good girl. We should be cooperating, which is another way of saying helping each other. Natalie?

Natalie You **discuss.**

Teacher Good girl. Lets write some of these key words up. (*she does so on a blackboard*)

Q2	**What benefit might you/the pupils accrue from having these key words permanently displayed**
Teacher	So what is it that you're going to discuss?
Pupil	**What** you are going to do and **how** you are going to do it.
Teacher	Is it important that everybody in the group joins in this discussion?
Paul	Yes because they might have other, better ideas.
Teacher	OK. So are you just going to go along with any idea that's put forward to you?
Paul	No.
Teacher	So what do you think is a good way of working within the group Paul?
Paul	**Talking to each other** and **listening to each other**
Teacher	So you talk to each other and you listen to each other. Sally?
Sally	You use a group voice.
Teacher	Yes, you need to use a group voice so that noise levels don't go through the roof. You need to be able to hear each other. So **group voices** are important. Laura?
Laura	You have to make sure that everyone is doing something and no one is left out.
Teacher	So you have to **include everyone**. Now let's think a bit more about the word discussion. Paul?
Paul	Well, if you want to discuss something, you may need to wait before somebody else has something to say.
Teacher	Good point. Laine?
Laine	When you are discussing maybe you have an idea in your head and someone else does, and you can put them together.
Teacher	Good. So you are? ...

Chorused response of 'sharing'.

Teacher	Brilliant. You are **sharing** your ideas. If you just give the group your idea .... What do you then need to do? Jill?
Jill	Extend it.

Teacher Extend it or? .....

Laine Explain it.

Teacher Good girl Laine. So you share your ideas, Mark, and you explain what you mean. If very important for you to explain because the rest of your group might not have understood your idea entirely., or they may not tell you that they don't understand. So, it's always a good idea to explain your ideas rather than just telling them.....Now the rest of the group, what do you do if you don't understand or agree with an idea? Do you just sit there and go along with it? What do we need to do Louise?

Louise We need to ask someone else.

Teacher Yes. Or what else Richard?

Richard Compromise.

Teacher Possibly. Do you tell the person that you agree or don't understand?

Paul You tell the person that you don't agree and then maybe they might fit in your idea with theirs.

Teacher OK. So, we need to **challenge** people. But do you just say: 'well I don't agree with that'?

Paul No, you have to say why.

Teacher So this word explain is very important. You explain your ideas and then you explain why you might not agree with something.....So, teamwork, what's it all about? What are we trying to reach?

Paul Our goal.

Teacher Our goal. So we mustn't lose sight of what we are aiming for. Now, what are we aiming for today? Everyone's hand up. I want you all thinking. Josh?

Josh Creating.

Teacher yes we are creating, but what do we want to achieve by the end of the lesson Craig?

Craig So completed plans.

Teacher Good boy. You want some completed plans, that you can use to make your model. So, you must keep that

target, that aim in mind. How are you going to get there Craig?

Q3 **Again, to what extent might your use of terminology, here, be clouding the issue with regard to developing organisational skills alongside creative skill?**

Craig Working together.

Teacher Good boy. Doing all of the things we've discussed. Paul?

Paul We can use a bit of what we've been doing in our English to explain what we're going to make.

Teacher So what have we been doing in English?

Paul We've been doing .... doing .... We've been saying how we would make of cup of tea or something.

Teacher So we've been writing? ....

Paul Instructions.

Teacher And what do instructions have to be?

Chorused response of 'clear'.

Teacher Clear. So what's important when you talk to the rest of your group?

A number of inaudible responses here. Followed a teacher summary:

Teacher So you need to make your ideas, and the steps that you think need to be taken, clear.

Q4 **Here you are making a distinction, how might you be more consistent in your use of terminology?**

Teacher So, any more questions on group work? .... What happens if you challenge someone? What do the group need to be able to do? Barbara?

Barbara Agree.

Teacher Yes, agree. Good girl. We are going to reach agreement. Cassie?

Cassie Listen to other peoples ideas.

Teacher Yes, that's right. Challenge, question each other and use that important word ...?

Chorused response of 'why'.

The teacher then set out some parameters for the task ahead and reinforced the work in English when discussing ideas. She concluded a dialogue with Paul, by saying:

Teacher Yes, we're planning today.

This begs a recurring question about terminology and the association between 'designing' and 'planning' noted previously.

Q5 **What do you think the children's current perception of 'planning' is and how might that cause confusion within a collaborative endeavour setting?**

Q6 **Given that the observed children still spent some considerable Richard working individually or in pairs how might their initial interaction, when working independently from you as teacher, be more focused? What additional strategies might you need to develop alongside them?**

Q7 **How might you encourage the children to focus on key elements of the design rather than getting bogged down in enhancements?**

APPENDIX 3

Example transcription of group work observation session

SCHOOL H2: VISIT 27th November 2002

Pupil Observation 3 : Year 5 pupils

On this occasion, the observed Year 5 group was reduced, in the absence of Teresa, to three pupils, They were set the task of developing their design ideas for a model of the stage and 'heavens' elements of the Globe Theatre. This followed on from previous work, undertaken almost a month previously. The gap in contact was due to the class teacher's illness and my own personal circumstances, which required me to be in London for a short while.

The quality of the recording, in terms of transcription opportunities was marred to an extent by a nearby carol concert rehearsal undertaken by Infant children

At the outset, Natalie moved directly into sketching mode with little initial interaction with Craig and Richard. The two boys picked up lids of a photocopier box, to be used for the stage and 'heavens' elements of the model, and begin to both gesticulate and talk:

Q	**When you began to work, Natalie started drawing and Craig and Richard talked about the shape/look of the 'heavens'. What do you think might have been a better way for you to have started as a group?**
Richard	There's going to be a trap door at the top .... and a winch
Craig	I know
Richard	And a few windows, because that's the 'heavens'
Natalie	Yes, star shaped windows (clarified – on what basis?)
Craig	I know, star shapes and moon shapes can be windows (extending idea)
Natalie	Yes
Craig	And also, we are going to have a part coming down from the back, stairs from the 'heavens'
Richard	Yes and a background (no clarification/justification)
Q	**When Richard suggests an idea like this, why not ask him to explain it in some more detail?**

A short break in discussion here as they think about different elements of the model, with Craig and Richard going over to look at Natalie's sketch. Craig begins to make some suggestions (inaudible) and then:

Craig It would be better if we had two big houses rather than three (*he means enhancements to the 'heavens' element of the model* (*2D representations*) .... (idea but no justification)

Richard What about a guardhouse? (idea)

Craig Yes that would be good (not seeking clarification) Natalie Two, one there (*pointing at box lid*) and one there

Craig Did Teresa put down all the things we needed (*materials*)? (planning ahead)

Richard It's in her tray

Craig and Richard continue to watch Natalie sketching without interaction until:

Craig I started drawing a winch, which you two didn't understand

There is no response to this and a further short interlude takes place with limited interaction. However, though dialogue is inaudible here, video evidence shows Natalie making some changes to the design work (rubbing things out and re-drawing)

Richard I could draw the background on the back

Natalie Well there will be people acting there (*pointing to the stage*), like Zombies, and there will and a hole there so that people could like come up (*on to the stage*) from underneath and ....

There is an interlude here with a good deal of giggling and a focus on the appearance and use of the stage area aligned to real events. They begin to talk about dressing rooms, for boys and girls, rather than focusing on the practicalities at hand. It leads on to a discussion about curtains and more talk of monsters and Zombies without moving their design details forward in any specific way.

Richard There could be a trap door in the middle and then they could get pulled up (*to the 'Heavens'*)

Craig Yes, we could make a lift for them to go up in .... if they had electricity then they could like ....

Some giggling then:

Richard We could get a battery (consolidating the idea suggested by Craig, but this has not been considered in any depth)

Craig Yes

They begin to talk at speed about the use of rope, in relation to the winch, as a means of pulling/lowering characters up from/down to the stage. Craig and Richard return to watch Natalie sketching.

Natalie That looks like a fire-fighters pole (*pointing to something on Natalie's sketch*), that does
....

Natalie It's actually a piece of rope and we're going to like lower ..... (offers partial explanation)

Craig It's going to be a winch (clarifying, but not in detail)

Richard It's much easier with out Teresa (*laughs*)

Natalie No, because there's not enough people to do it (*the work*) with

Craig Yes, because she's got the ..... (*planning sheet*)

Inaudible section

Craig But what will we put the 'heavens' on? We'd have to make .... We haven't really thought about making the 'heavens' because .... Like we'd just .... Because we'd just have it like that (*gesticulates*) and the 'heavens will have to be pointing up (*referring to background elements*)

Richard Yes, because if you are doing the drawing (*to Natalie*) then you'd want spikes (roofs) on there (*pointing to sketch*) (clarifying/justifying own idea)

Craig Yes, because that will be the top there (*pointing to a box lid*) and then we'd have the 'heavens' wouldn't we..... (*Craig lays a box lid onto the sketch sheet Natalie is using to* justify/clarify his idea)

Richard Yes

Craig So you'd need .... well we could draw it and then cut it out and stick it up on there, 2D, not 3D (clarifying and planning ahead) .... If you wanted it 3D then you would have to stick it across (he gesticulates to show objects placed across the box lid, and with
depth - clarifying)

Natalie Yes you could stick a piece of card and not paper

(alternative – perhaps because of strength, but not clarified?)

Richard Yes, because paper would just go grrrrrrrrrrrrrrr (gesticulates failure-justifying others choice)

They then talk over each other (inaudible) for a short while as they manipulate box lids to aid their discussion. Then:

Craig You could put some houses on there (*top box lid*), just there on top, houses and people (idea)

Richard If you had this piece down (*one long side of a box lid*) then you could put the 'heavens' on their, little houses on top (evaluation of others idea, clarification and justification of own idea)

Craig Yes

Richard Houses on there, with people (gesticulates to help visualisation of idea)

At this point they seem to wait for Natalie to add to the sketch

Craig We need the list (*planning list previously done by Teresa*)

Natalie We'll need a hacksaw, string (planning ahead)

Craig No, because Teresa's already done the list

Richard So lets nick some things from Teresa's (*list*)

Craig No, it's the group's (*meaning Teresa has not done the list for herself*)

Richard Well, what if we take something that's wrong? (challenge)

Craig Well we wouldn't take that obviously, would we (challenge, but no justification)

Some off task talk here about 'my boyfriend is', 'I love' etc. This is followed by a brief conversation in which they discuss the types of stairs that might lead up to the 'heavens', including the possibility of a spiral staircase. Difficult to ascribe comments to individuals here, but Natalie continues sketching with an inaudible interaction as they haunch over the paper.

Craig Have we agreed that we would have the stick the same .... That we would .... Push it through there (*square section timber through the box lid*), to make it more stable (planning ahead)

Richard Oh, yes .... And then we could glue it (clarifying others idea)

There is a gap here with limited interaction, as the boys watch Natalie sketch, then:

Craig — Yes, if we had a stick (*square section timber*) we could cut it off there (*indicating length*) and have it inside there (reiterating idea), because it would be more stable (justification) (*At this point, Craig adds to the sketch*)

Natalie — Yes, I think we should leave it the height that it is, so that we can glue it (consolidating idea)

Richard — Glue it, glue it (suggestion but no explanation)

Craig — That's right .... So that much would need to be taken off it (*indicating place to cut the timber*) (further consolidation)

Richard — Why don't we just get that (*box lid*) and put 3D houses on it (idea), like pieces of paper stuck together (clarifying). Bent into little houses with spikes on top (?)

Q — **What did you mean by spikes on top?**

There is some arguing at this point (inaudible), then:

Natalie — Do you mean the roof? (*Richard nods*) .... Then call them roofs , not spikes (seeking clarification)

They then begin to argue, in essence, about whether all the enhancements in the 'heavens' will get in the way of the function this part is to serve. That is, to house a winch mechanism. Again, not easy to transcribe all this.

Craig — Well OK, instead of having the roofs meeting (*Craig sketches idea on the sheet that Natalie has been using*), you'd have them so that you could put men Inside (idea)

Q — **You spent a great deal of Richard discussing fine detail here, before you had really got to grips with the structure and mechanism. Why did you think that it was so important to talk about how it was going to look, rather than how it was going to work?**

Richard — But what I don't get is, why don't we use paper to make 3D houses with spikes on? (challenge)

Natalie — Why do you keep saying spikes (challenge / seeking clarification)

Richard — Because they're there (*points to box lid*) ....

Natalie They're roofs

Richard Yes

Craig But 2D's better (no justification)

Richard I don't understand what you mean

Natalie box lid) He means (*Craig*) pull this down (one side of a and stick houses on it (clarifying others idea)

Richard Yes, houses.

Natalie definition Not houses, 'heavens'. (challenge but own not provided)

There is clearly a lack of group understanding here, of what the 'heavens' was.

Q **Why did you seem to be unable to agree on what the top box should be used for? And why do you think that you had different opinions of what the 'heavens' meant?**

Craig We could have some little cardboard boxes (for houses, clarification)

Richard That's what I mean. Cardboard boxes, like little houses. It's what I mean.

At this point the class teacher enters and interacts with the group:

Teacher OK, have we come to any agreement?

Richard Me and Craig have but Natalie wont really agree because I think we should put lots of cardboard houses on the top and ....

Teacher Are there some things that you've definitely agreed on?

Richard That we are going to have 'heavens', guard-houses and a trap door

Q **Richard, what did you mean by 'heavens'?**

Teacher Have you worked out how you are going to work the trap door? (seeking clarification)

Richard Yes, with a winch.

Q **How might it help if your teacher asked you to clarify your ideas to her, in some more detail?**

Teacher And, have you written down what you'll need

(prompting planning ahead)

Richard Teresa has, but she's not here.

Teacher Is there anything that you haven't agreed on?

Richard Yes.

Natalie What? (challenge)

Teacher What haven't you agreed on, Richard?

Richard Well Craig ..... well when I ....

Teacher Have you explained your idea clearly (prompting clarification)?

Richard Craig said he didn't understand, but then said he did, but Natalie still doesn't agree.

Natalie I do agree.

Richard then goes on to explain that he wishes to fold one side of the top box lid down and add form pieces of cardboard into squares, with spiky roofs on top, to decorate the 'heavens', including a guard-house.

Q **Why did you explain in more detail to your teacher than you had to the rest of your group?**

Teacher So you believe that these 'heavens' along the top ....

Richard Yes, and a guard-house on the inside

Teacher You think that they should be placed just on this flat piece here (*indicating side of box lid folded down*)(seeking clarification). So use these materials to picture what you are doing. (*She lifts up two box lids and holds them apart to demonstrate the structure required*) You have your base, and this is your heavens ....

Craig With a trap door there and there (*top and bottom*) (clarification)

Teacher And you want to put ....

Richard Yes, fold that bit down (*side of box lid*) and put little pieces of square cardboard with like spiked roofs, with guard-houses on each side (clarifying)

Teacher Natalie, what did you not agree with. If you don't agree that's fine. But you need to explain why it's not a good idea

Natalie continued to sketch during the previous interactions

Natalie because — Because what I thought was ,that ... well ... we wanted to have windows (*points to sketch*) and ... (fails to offer a clearly argued alternative)

Q — **Natalie, what did you actually want to say here, and how important do you think it is to be able to justify your own viewpoint?**

Richard — We can still have windows

Teacher — Well, what we found out during our research was that the 'heavens' was called that because ....

Natalie — It had stars and ....

They then continue to argue about what should be at the front/back of this section of the model, though there remains some uncertainty of what the 'heavens' function was. This key issue seems to be undervalued in relation to enhancements

Q — **Why did you seem to get so involved in what the model was to look like, rather than how it was going to work effectively?**

Teacher — What do you think is the most important thing about designing this?

Natalie — The 'heavens'

Teacher — Do you think that you need to prioritise? What would happen, for example, if I were to let go of this now? (*the top box lid*)

Chorused response of – 'the top will fall down'

Natalie (justifies idea for structure) — We need some wood (*meaning a structure*)

Teacher — So, have we agreed on what's important?

Craig — Yes I had a stick that I thought we could cut off .... (but that's not an agreed position)

Q — **Craig, you are stating your position here. When had you agreed that your idea was best, and when did you justify your point of view?**

Teacher — So have you taken any measurements (prompting planning ahead)

Chorused responses but no agreement here

Teacher So we don't yet know exactly how long we want the pieces?

Richard suggests that they can cut off the same amount of waste material from separate pieces of square section timber.

Teacher But what might be the problem of measuring from a single piece of wood. (prompting planning ahead) (*because the children were going to use a small piece of timber to mark the amount to be cut off each other pieces of different lengths*)

Richard They might not be the same size (finished pieces) (evaluating suggestions and clarifying error)

Teacher Yes, so I think that you need to prioritise what are the most important decisions that now need to be made. Craig, what do we need to decide to do now?

No immediate response

Teacher Do you think that you need to know the length of each piece of wood? (prompting planning ahead, but not seeking a justification)

Richard Yes, otherwise it's going to be .... wobbly (clarifying)

Teacher Yes Richard, if we end up we something that looks like this (*models with boxes*), then you'll not be happy with the result

Natalie It might collapse (clarifying)

Teacher So, as a group, you need to decide upon what are the important decisions, agree on those decisions and make sure that you have the actual construction details sorted out. Because these things that you've been discussing are just cosmetics, what the overall thing is going to look like at the end. It is important, because it's to do with the presentation of your work. But is it as important as the actual construction?

Chorused response of no

Richard No, because what's the point of doing all those things if you don't actually know how to construct it (*accurately/solidly*) (evaluating and challenging current position)

Teacher So what are we going to do now Craig? (prompting planning ahead)

Craig Cut the sticks and put them between these (box lids) to

make it stronger (planning ahead)

Teacher So now we are talking about strength. And why is that important? (seeking clarification)

Craig Because we don't want it to fall down (clarifying)

There is then a discussion about the plans (designs) for the trap door and winch mechanisms and the pupils inform the class teacher that they have already discussed this and that Teresa has drawn up a planning list. Craig describes how the winch will work.

Q **At the need of the discussion with your class teacher you seem to be able to agree on what is important: the structure. Why didn't you agree this at the beginning of the session? And, how might it have helped you as a group if you had decided to make this your focus?**

The class teacher also reinforces the need for explanations

Teacher Remember Richard, when you have your ideas, explain them and say why you think that they are a good idea. And, Natalie, if you don't agree you are perfectly right to say so, but you'll need to explain why you don't agree. It's important to reach agreement as a group.

At this point in proceedings there is a further brief discussion about the enhancements to the 'heavens' area, directed at Richard, who is asked to justify his ideas for houses at the top and front of the model.

Richard Well I think that they (*houses*) should go along the front because if you put them on the flap then they wont get in the way of the pieces of wood going up (*the vertical members of the structure*) (justification and clarification of own idea)

Teacher So what is the purpose of these (*the houses*)?

Natalie For people to get ready. (clarifying)

Craig Changing rooms (clarifying)

Here again, there is a focus here on the practicalities of the theatre, as it may have operated, rather than on the practicalities of the model to be designed and made. The group even begin to talk about the actors needing somewhere to stand so that they don't get cold and on where the actors will need to go for dinner. The teacher asks them to think about the practicalities of making and seeks a clarification of whether they are thinking of a picture-based enhancement or something more than this. Some disagreement then ensues with Natalie keener on 2D than Richard and his 3D work.

Q **How could you decide as a group on what things to ignore, in order to concentrate on the important aspects that your class teacher was referring to?**

As break Richard approaches, the group has still got some way to go in order to agree important detail, in particular the format for the structure.

APPENDIX 4

Example transcription of post observation
Interview with class teacher

SCHOOL H2 : VISIT 4th December 2002

Post Observation 3 – Year 5 Teacher

Q First question, at the beginning (*of whole class discussion*) you said, tell me what were you planning, what were you designing, what were your plans about, and then you asked Richard? Now this relates to a question asked of your Year 6 colleague, what is the distinction for you between planning and designing? I'm not sure that the children are absolutely sure?

T Right. Em ..... I've interchanged them and I do usually try to use the term design.

Q So how might the way you interchange the terms impact upon the way in which they operate and what they are focused on?

T It's tough that .... And I think I would prefer to use the word design as it would help them to focus on the fact that they were being asked to finish off their designs in order to make. Perhaps planning is more about discussion .... I don't know .... It's tricky that one.

Q It is, because do you think that they can have distinct areas of designing, in terms of them coming up with ideas as opposed to planning about how they intend to go about their making? Or do you think that the two areas are so closely related that ....

T They are, but for me design is more about the final product, you have your design and can now make it .... I haven't really thought about this before .... I wasn't aware of the fact that I'd used those terms in that way.

Q Well, for example, when they are doing a design sketch and are annotating it to say card or square section timber, that is a form of planning, because they are beginning to think about materials and perhaps techniques. So they are closely aligned, but you may need to start thinking carefully about how you make use of such terminology.

T Yes

This inappropriate use of subject terminology, noted during other observational work, is for me an important issue in terms of children establishing clear expectations about the way in which they go about their work and what certain vocabulary requires by way of outcome. This, again, is linked to the significance of appropriate task setting as an aid to scaffolding pupils' management of group based activities and practical problem solving in particular.

Q OK. Now you also went through key words in terms of collaborative group work but what benefits do you think might accrue from having these words permanently displayed in your classroom?

T (Hesitation then) Em .... I think that they would benefit from a display

Q Because? I'm asking this because you told me that you often discuss group work in English.

T Just as a reminder I suppose, because you do expect them to take what they have learned in one lesson, to another, but often they don't, because they isolate ideas to one particular lesson. So what we have discussed in Drama they might no carry over to D&T.

Q Which is what you told me last time.

T So if I had a display on teamwork then .... It would be benefit providing that it's not linked to just one subject area.

There is then another discussion about the teacher's use of the term plan, in discussion with Craig, when on this occasion she was clearly using it to mean drawing.

Q When the children first started to work as a group, Natalie got straight into sketching while Craig and Richard were working with materials and talking together at a distance form Natalie. Now, in terms of having discussed with them how they should work as a team, what additional ground rule do you think you might be able to come up with that would encourage them to work more collaboratively at the outset?

T Quite often before writing I give them five minutes thinking time, where they are not allowed to do any writing. So, if it's a creative piece of work, they are being asked, before they put pen to paper, to sit quietly, with no talking, and think. So they know that they are not supposed to just dive in. So I suppose I could say that I don't want anyone doing any writing or drawing or doing their own thing, you must spend the first, and say how many minutes, discussing.

Q Thinking time in creative writing is linked to individual activity ....

T Yes, you'd have to put a different slant on it. I don't want you to go off and do your own individual things before .... You must spend the first few minutes discussing

Q And do you think that you would have to say discussing .... your initial course of action

T Yes

Q You see, Natalie was beginning to do all the enhancements, the boys came across, noticed that she was drawing stars and Craig suggested that these became windows and Richard said moons. But they didn't then agree on any specific detail, numbers of, size or position. They seemed to be, sort of picking up certain vibes and then separating, rather than working effectively as a team.

T Then if you said to them, five minutes discussion time, you would have to give them a focus, including what they should have achieved by the end of that. So in that way you would have narrowed it down. It might be handy, as we discussed last time, to set them bite sized chunks.

The class teacher's recognition of the possible need to mange the work in terms of 'bite sized chunks' is an important one here in relation to my argument for meshing ground rules to appropriately challenging tasks

Q Well my question to the group, and it was your question to them when you came out to talk to them, was about how they choose to focus on priorities. Interestingly, Craig and Richard ended by saying that the mechanism wasn't important because they wouldn't use it in real life. They seemed to be thinking about how they might model real life theatre through the model they are designing and making here.

T Yes.

Q Getting back to a previous question, and having listen to some of the other inputs I've made, what do you think the children's current perception of the term 'planning' is?

T I would have thought that ..... It would be about what they needed and the steps they need to take ..... and I would think that they would see their designs as drawing

Q Ask them, because they might think it's just to do with drawing. Now, question six we've done but a related question is, which I haven't written down, once you have three working rather than four, and particularly when it's two boys and a girl, what disadvantages might accrue from that in terms of Natalie's position within the group?

T The boys team up and quite happily let Natalie get on with what she's was doing. Because last time, I asked you if the two boys teamed up and the two girls teamed up and you said they did

Q Yes, they did. And do you that it might be common for the boys, as they did on this occasion, to be manipulating

materials and talking about how the product might be put together, and leaving the girl to do the drawing, though they admitted that they thought that this was her strength?

A short silence here

Q Or do you think that the boys might have adopted this position even if they hadn't thought that Natalie was good at drawing?

T I think that Natalie would have done that anyway, so as to give herself something to do.

Q Is she a fairly shy or reserved pupil?

T No, though she can be quite moody. She's not shy or reserved. However, she might have been put out that Teresa was away and she might not have liked being the only girl on the table.

Q I did notice that there were fewer interactions between Natalie and either Richard or Craig than there had been during the previous visit.

T Well I think that Teresa might have helped here with that, she's more outgoing than Natalie, particularly in terms of taking the lead in a group situation. Teresa can be very bossy, though Natalie also has a strong personality and the boys may not have wanted to try and tell her what to do.

Though the gender issue has not been a key feature of the research, it seems to have some influence on the levels of interaction that one might observe, particularly when the gender balance is disturbed.

Q Last question, it goes back to this idea of having a focus again. Why do you think that they got so bogged down in fine detail, the business of guardhouses and star shaped windows

T To them, their finished product seems to be about how it works rather than how it looks.

Q As Richard said, 'if the mechanism doesn't work, it can still be a good model'.

T Yes, so they obviously .... So maybe we need to re-focus them by saying in the initial teaching that it isn't just about how it looks but how the mechanism works and how well it does the job it's supposed to do.

Q So it's about function as well as form?

T Yes ....

Q Well you kept saying to them that if their structure wasn't right,

and they said it might wobble and collapse. So they seemed to understand what was important, but they didn't spend any time discussing or thinking about the structure.

T Em.

Q So, perhaps unless you break down the work into chunks that have a clear focus, for example, you work on the structure and once you have something that is operational you can then be as creative as you wish in terms of its appearance .....

T And I think that that would make them realise the importance of why they need to do some things first and other things second. Perhaps the evaluation will be the most important part of the whole exercise.

Q You mean the end-on evaluation?

T Yes, after the making. A focus on the organisation of their work, so that in the next project they can look at what's important in a different way.

Q So is it possible that one of the reasons that they weren't structuring themselves, leaving aside the fact that you hadn't asked them to structure their work in a particular way, is that their lack of experience in this area means that they don't have strategies that they fully understand, yet?

T Yes.

The final sequence returns to the issue of 'scaffolding' and identifies the need for children's organisational abilities to be developed over time. As such, it draws a link, if not in any depth, to the notion of situated cognition and the limited transferability of knowledge and skills from one subject area to another. This class teacher has indicated, on several occasions, that ground rules for group work are a common part of her approach in English and, more especially. Drama. Yet pupils did not seem to apply them effectively in the context of this D & T work. A common approach across all subject domains might well alleviate this problem, particularly, I would suggest, when combined with well-defined task goals.

APPENDIX 5

Example transcription of post observation
Interview with pupils

SCHOOL H2 : VISIT 4th December 2002

Post Observation 3 – Year 5 Pupils

This interaction took place following the discussion of very specific ground rules for group work. However, evidence of the participating children engaging with these ground rules is limited and I would argue that this limitation is, in part, conditioned by the teacher's failure to structure the task in order to provider a clearer focus for the work to be undertaken. (see also Post Observation – Year 5 teacher, 27th November)

Q When you first began to work, Natalie started sketching and you two (Richard and Craig) began to work with pieces of material and to discuss ideas. But you weren't all talking together. What might have been a better way to start?

Craig To discuss what we need to do so that we can split up the things to do.

Richard I thought discuss first too.

Q Why

Richard Because then we would all know what we were doing .... Rather than us just like .... I thought I knew what we were doing

Natalie I think that we should well .... discuss it first, because

we all knew what we were doing and we can find it easier to do stuff

In terms of ground rules, this begs the question of the extent to which pupils do feel that they are able to make progress without an initial 'planning ahead' stage. Their responses tend to indicate that at a sub-conscious level, they feel confident about how their group peers will move forward.

Q So, Natalie, why did you immediately come to the table and start sketching, without telling these two (Craig and Richard) what it was that you were doing?

Natalie I'm not sure ....

Richard I think that when we were moving to our table that we did say something

Q So you think that Natalie already knew what she had to do?

Richard Yes

Q So, Richard, as an example, when you said you needed a background (*to the model*) you didn't give any further information. So what do you think that they (*Natalie and Craig*) understood by you saying 'let's have a background'.

Richard Well .... like, draw a background, like scenery ....

Q On the 'heavens' part of the model?

Richard Yes

Q A two-dimensional background, just a sheet of card or something ....?

Richard Yes, with drawings on and painted.

Q Natalie, did you think that that was what Richard wanted?

Natalie Yes

Q So why didn't either of you two say, 'lets' have a flat piece of card with some pictures drawn on it'. Or, do you all assume that you know what each other is thinking and you don't need to say it?

Natalie and We probably would have the same sort of ideas, we could probably sort it out after it was drawn.

Q But let's say that you start drawing the background, without these two watching, and that did happen quite a lot, how would you know that what you were drawing was what Richard wanted?

Richard Well, I think it was like on the first one (*previous sketch*) that .... well we sort of knew what she was sketching.

Again, an indication of a belief in successful joint endeavour, irrespective of the extent to which any 'exploratory talk' has lent weight to the importance of clarifying and justifying ideas – to reasoned decision-making

Q OK. So, this is for you Richard. What did you mean when you first said 'we need spikes'?

Richard I meant a roof, because like ....

Natalie I drew points in the 'heavens'

Q How important do you think it is then to use the correct words, when explaining ideas?

Richard (*chuckling*) Very important.

Q Now Natalie, you got a bit angry with Richard. You said, 'if you mean a roof, call them roofs, not spikes'. So, why didn't you explain to Richard what you thought he meant by the term 'spikes'? Because you explained it to me by putting your hands together to look like the sloping sides of a roof.

Natalie Well, I thought that he knew what he meant but he wouldn't say roof.

Q So do you think that he was using the term 'spike' intentionally? Was he trying to wind you up? Or was he making a genuine mistake?

Natalie Probably, yes, just a mistake.

Q So perhaps you do have to think about using the correct words. And rather than getting angry with one another, one of you has to explain what you think a particular word means.

This is a useful example of a pupil being able to offer a sound line of argument with me as adult, yet being unwilling to do so with a peer, based on a joint belief that each knows what the other is trying to say.

Richard like when Craig said 'stuff'

Q Yes, that was last week wasn't it?

Richard Yes

Q Now, I understand why you wanted to talk about what was available in real theatres, but Your teacher asked you later to think later on whether that was important, before you started discussing some of the other details about how the model was going to stand up and work. So, the question is, do you think that you need as a group to discuss the order in which things are going to be done, because you were discussing detail before you even had a theatre (*structure*) that was standing up, strong, and ready to have detail added to it? How do you think that you might have gone about the work in a more structured way?

Craig We should have discussed how it was going to be built and then ..... after that we could have .... We could

have done the detail last.

Richard I think that .... we should have .... discussed the detail at the start .... because then you know what to do .... Like if you know what you want on the floor (*of the 'heavens'*) then you can put that on (*I assume the sketch*) at the beginning. You'd already have it drawn on.

Q So you think that it is important to consider detail before you get too far with the making?

Richard I think that it's important on some things but not others.

Q So was it more important here to discuss detail before discussing the structure – how the two boxes were going to be held apart? Or do you think it was more important to discuss the background and the spikes.

Richard Perhaps we should have discussed it in the middle .... If you discussed it in the middle then you would know what to do and would have time to write it in (*on the sketch*)

Q So, do you think that you need to be thinking about the whole thing?

Richard Yes

Q Natalie?

Natalie I think we should discuss how big we should have the wood first, and then discuss the heavens and guardhouses after we've done that

Q So do you think that you should have got the structure sorted out first?

Natalie Yes

Here is an important piece of evidence in relation to a consideration of task structuring (scaffolding). There is obviously no consensus here about how the work should have been organised/sequenced. Each pupil seems to have different intentions in terms of their preferred 'action pattern' and the consequence of these differences was a failure to focus sufficiently, as a group, on key features of the task in hand. It is this sort of confusion that needs to be minimised by appropriate guidance from the teacher; such that their expectations (idealised 'action pattern') are transmitted more openly to students, prior to the commencement of collaborative work.

Q Natalie, you've all been talking about the 'heavens', so

what is it?

Natalie people get — It's like .... well it's like houses .... It's where lowered down through the trap door and where they get their costumes and stuff

Q — OK. So it's where people get ready and from where they're lowered down to the stage.

Natalie — And it has stars, moons and clouds on.

Q — Which bits have these things on?

Natalie — I think it's the under bit, the bit under the ....

Q — Do you mean under the heavens but above the stage?

Natalie — Well em ....?

Q — Craig, what do you mean by the term the 'heavens'?

Craig — Em .... well ... they had the sound effects up there, instruments.

Q — So, Craig what was the most important part of the 'heavens'?

Craig — The sound effects and the trap door.

Q — Richard?

Richard — I reckon it was the star, moons and clouds because that was why it was called the 'heavens'.

Q — Natalie?

Natalie things — Probably the same as Richard, the stars and

Q — OK, so we have sound effects, the trap door and stars, moons and clouds. Now none of you have said that the mechanism that was used to lower the actors down to the stage or pulled them up from the stage. So do you think that that was why none of you discussed, last week, the mechanism and where it was going to fit and how all the other things would fit around it?

Richard — Well she (Natalie) had drawn the stars and moon on the sketch and last week Craig kept talking about a winch and how to work it. So it had been done.

Q — But until you've decided as a group how that winch

might be made, what size it will be and where you will place it in the 'heavens', how sensible is it to discuss how many guardhouses to have?

Tom — Well like I just said, Craig had already discussed that, get a piece of stick (*dowel*) and a cotton reel and ....

Q — But you hadn't decided on any real detail had you?

Craig — Well we did say that we would put men on it (*the rope being lowered/raised*) but I didn't think that there was much point in .... because we could just pretend that ....

Q — Natalie, do you think that you should have spent a little more time talking about the mechanism?

Natalie — Yes, because it's more important than the little bits. It's the whole point of it (*the 'heavens'*), because if you didn't have it then it wouldn't work properly .... So it's quite important ....

Q — Quite important? So if the mechanism didn't work properly but the model looked very with all the guardhouse and stars etc; then would the mode have been well designed and made?

Natalie — No.

Richard — I think that it would still be good because .... just because one thing doesn't work it doesn't mean that it's bad.

Craig — And also, we don't really nerd a mechanism because .....

Richard — Because we're not exactly going to use it in real life are we

An interesting statement! In the context of this project, there seems to be some confusion about the key aspects of the work that can be linked to children's understanding of how theatres (modern) operate. During the two observations with this group of children there have been references to changing rooms for boys and girls, scenery, sound effects etc; none of which are directly significant to the production of a stable and efficiently working model. Again, this begs the question of how effectively expectations are being shared between teacher and pupils (see above)

Q — Natalie, your teacher came to speak with you once during your work last week and asked you about how you were getting on. Do you think it would help you to operate better as a team if she interacted with you

more often? Or would you sooner be left to sort these things out for yourself?

Natalie — Probably easier to try and sort it out for yourself.

Q — Why?

Natalie — If your teacher is with you it's not really your .....

Craig — Ideas

Natalie — Yeah, she's telling you what to do?

Q — Do you thin she is telling you what to do, or do you think that she should question you in such a way but tries to get answers from you?

Richard — Yes

Q — Is that what normally happens?

Richard — Teachers normally tell you what to do but if you want to work as a team you might as well be left alone. Otherwise the teacher is making .... like telling you to be quiet and only listen to one person ....

Craig — Yeah, if we get told by the teacher all the time we wont learn from our mistakes.

Q — So you wont learn from your mistakes. So, when your teacher did come to speak to you, I thought that you tended to explain things in more detail to her than you do to one another. Why is that, why do explain things more carefully to a teacher than to your friends?

Richard — Well otherwise she asks you loads more questions

Q — So, do you think that's not what your friends would do, would they just accept what you say?

Richard — Well .... The teacher gives you ideas and so you can explain an idea that she's had. But with your friends if you have an idea that you've had .... I can't seem to explain it very well ....

Q — OK, let's think about it another way. Why do you think it might be that you said to Craig, 'let's have windows shaped like stars' and Craig says, 'good idea'. But that you don't say to Craig, 'let's have windows shaped like stars in the front of the 'heavens' and we'll cut them out using scissors and we'll paint them blue'. You didn't give Craig any detail.

Richard Well .... Because Natalie had already done the design and ....

Q But Natalie had done the design without talking to you about it! So, Natalie, why didn't you explain to Richard and Craig why you were doing the designs that you did?

Natalie Well .... I did say that we should have windows because Craig said the stars (*that she was drawing*) could be windows.

Q But you didn't agree how many stars, what shape, what size ....

Natalie and they Yeah, but they could see what I was drawing knew what I was doing because they saw what I was doing.

Q Well yes, Craig, you two (*Richard and he*) did go across to look at Natalie's work from time to time but you didn't ask her why she was doing things the way she was. So, Craig, why didn't you spend a little more time asking Natalie things like, why have you chosen six stars, why that shape, do you think that they would be better on the left of the model rather than the right?

Craig I'm not really sure. I did say that we should have two guardhouses but .....

Q Remember that your teacher told you at the start of the lesson how you could best operate most effectively as a team. By explaining and justifying your ideas to one another, but I didn't see a lot of that going on.

There is an indication here that the absence of criticism, however constructive, is an indication of tacit approval and agreement within the group. Whilst this allows progress to be made, it does not support the notion of 'optimisation' in an effective manner.

Q So, Natalie, how important do you think it is to justify your ideas to your friends?

Natalie doing Very, because they need to know what you're

Though there is no stress on why, here.

Q So if you think it's very important, why did you not always do that?

Natalie Em .....

Q What is it that you want to get on with, that might prevent you from having more discussion?

Natalie Trying to get on with the theatre ....

Q Do you want to get it made?

Natalie Yes

Q Richard, do you think it's important to justify ideas?

Richard Yes, because when your friends know what you're doing .... like I could discuss something with Craig and then ask Natalie because I don't want to interrupt her while she's thinking ... doing the sketch

Q But what if she's thinking the wrong things

Craig We've got to see what she's doing because she might be doing things we don't want her to be doing

Q So how would you get her to justify?

Craig Ask her to rub it out?

Q Well she could rub it out if you thought that it was wrong, but how would you argue your point of view with Natalie?

Craig We could discus about what we think is better and see if she agrees. But if she doesn't then we could find a way that we all agree on. But Natalie is good at sketching so I thought that it wouldn't matter what she did, because I thought that she would do something that was good.

Q So you had faith in her?

Craig/Richard Yes

Again, another example of this sub-conscious agreement that seems to exist between pupils who know each other well and feel that they can simply really upon each others strengths, as opposed to recognising the need to at least look for what night be areas for improvement.

Q So here's the last question. How do you think, as a group, that you decide on what things you might ignore, in order to concentrate on the things that you think are important?

Craig We should try and work together and think about things more to get things right rather than wrong

Q Richard?

Richard Well .... we could see .... we could use discussing, like saying that's a good idea and see if others think that. Asking everyone else what they thought

Q Natalie, what do you think, because there was more conversation between Richard and Craig than there was between either you and Richard or you and Craig? How could you have got more involved?

Natalie By listening to them and not just drawing

Q So, why weren't you listening as much as you might have done?

Natalie I was too busy sketching .... And I didn't really know what they were talking about (*I'm assuming here that this could refer to the boys discussion about the structure*)

Q So, if you didn't know what they were talking about, how were you able to develop the design sketch

Richard She can read minds
Q So, can you read minds Natalie?

Natalie Well I was too busy drawing.

Q So because you were busy, do you think you were always doing the right thing?

Natalie No

Richard's comment about mind reading, though said essentially in jest, does seem to be based on more than a grain a truth. As noted above, peer groups do seem at times to operate on a shared belief that thoughts an actions, that are not jointly constructed and agreed, are nevertheless inherently worthy, particularly if being carried out by what individuals see as a competent performer – e.g. Natalie and her ability to sketch.