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# **“TEACHERS TELL AND CHILDREN SHOW AND EXPLAIN”: THE COMPLEMENTARY DYNAMICS OF TEACHER AND PEER SCAFFOLDING TECHNIQUES IN A MIXED ABILITY GROUP**

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## **Abstract:**

This study reports on an investigation into teacher and peer scaffolding techniques that were observed during a discrete learning activity in a primary classroom.

The paper is framed by a discussion about the nature of constructivism and the social context, the Zone of Proximal Development and scaffolding, and the nature of social interaction in the learning process (with specific reference to differences between peer tutoring and collaborative learning).

The study analyses interaction using a qualitative methodology and reports a number of findings which support the principle that learning within a task is dependent upon a reflexive dialogue between the task participants.

## **Keywords:**

scaffolding; teacher strategies; design technology; Vygotsky

**JEL Classification:** I21

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## 1 Introduction

This study is based on the proposition that learning is dependent upon interaction. Integral to this is recognition of Vygotsky's model of the ZPD which holds that the dialectical relationship between teacher and learner explains how development may occur.

This study observes a teacher and a mixed-ability group of pupils on a set task, focusing on those teacher-learner and learner-learner interactions that are considered to be 'scaffolding' strategies. The inquiry investigates whether learners scaffold each other's learning and, if so, which scaffolds are employed. If the learners are seen to scaffold each other's learning, then this may offer clues as to how effective learning may be structured within a learning environment.

It also investigates the children's own perceptions of learning, asking them about how they believed they were helped to further their understanding.

## 2 Constructivism and the social learning context

Vygotsky claimed that 'the child learns to practice with respect to himself the same forms of behaviour that others formerly practiced with respect to him' (1963, 36), and that 'we become ourselves through others' (1963, 39). Here Vygotsky alludes to the belief that individual development is dependent upon collective interaction with external players, stimulating development so that the 'external' becomes 'internal' and consciousness emerges out of social life.

Through the combination of context, task and personal interrelationship, developmental patterns may vary. In attempting to explain the dynamic interplay of these factors, Vygotsky developed his model of the 'Zone of Proximal Development' (ZPD), from which grew the concept of 'scaffolding'. In Vygotsky's conception, the ZPD is the space between what children can do independently, and that which they are capable of with the assistance of a more able partner.

Vygotsky also suggested that a dialectical process may underpin social interactions between teacher and learner and drive cognitive development. Vygotsky took language to be a mediating tool with which humans internalise and memorise mental processes, and that dialectical interaction led to developments in mental processes. If the learner's initial level of understanding represents a 'thesis', then the teacher's learning intention represents the 'antithesis'. The 'synthesis' occurs when both the teacher and learner expose their understandings through dialogue, and aspects of the new knowledge engage with areas of the original level of understanding to forge a higher level of understanding. This is not only a development of cognition for the learner. The teacher's understanding of the learner has also increased allowing the dialectical process to operate again at a higher level, starting from a different thesis.

### 2.1 Scaffolding strategies identified

Building on the concept of the ZPD, Vygotskian theorists have attempted to strengthen the linkage between learning and development through a concept called scaffolding. Wertsch (1985) suggests that if intrapsychological functioning is said to grow out of interpsychological functioning, then instruction can only be said to be 'good' if it proceeds ahead of development. Vygotsky had argued that an expert could help a novice to move across their ZPD to a degree to which they

could not have managed by themselves. The concept of scaffolding has sought to explain the strategies which enable this movement.

Wood (1986) adopts a model of learners as limited information processors and argues that experts have a greater capacity to observe, take in and remember experience than novices, because there is a positive correlation between 'feelings of certainty' and accuracy of perception and powers of memory. In this sense, scaffolding strategies serve to reduce uncertainty on the part of the learner. These may include task induction procedures which create a mutual understanding of tasks and goals. The expert may highlight crucial features of the task since the novice has a limited propensity to attend to many problematic features. The expert may also help the child to analyse the task, acting as a memory store or as a store of past experience. Wood later reinforced his argument by adding 'many seemingly simple and even trivial things that the more mature do as they help children take on an important significance' (1998, 98), since adults may provide insights into expert thinking, or help maintain novice engagement long enough for the learner to complete the activity.

Rogoff and Gardner (1984) looked at interactions between mothers and pre-school children. They noticed that the adult provided tasks in a structured context, as well as the cognition required for task completion. Throughout a concrete activity the adult assessed the child's ability and modified the task or support where appropriate. Rogoff, Ellis and Gardner noted that 'assistance with cognitive tasks is tailored to the perceived needs of the children in the particular problem context' (1984, 193). This modification of support by the expert was identified by Wood (1998) as representing an effective factor of contingent instruction. He argued that effective tutoring occurred where the tutor increased help if the child enjoyed success. Rogoff and Gardner (1984) identified a range of strategies employed by adults, including the provision of mnemonic structures, the use of differentiated forms of communication, the provision of directives, asking open-ended questions, and using non-verbal instructions, whilst subtly testing the child's understanding by reducing support and allowing the child to gradually participate in the task to a greater extent.

For Radziszewska and Rogoff (1988) this passing of responsibility from adult to child is one of the key features of the scaffolding process since it is argued that as independence grows, the novice gradually internalises the adult scaffold, in order that problems solved initially on the social plane now move to the individual plane.

Meadows (1996) recognises that scaffolding represents a complex package of behaviours, and Wood, Bruner and Ross (1976) went some way towards defining what those behaviours involved. They argued that the scaffolding process involved recruitment; initially enlisting the interest of the learner. They recognised the importance of the control and reduction of degrees of freedom, involving task simplification and feedback by the expert, a strategy that has been seen as important in other recounts. The expert may support direction maintenance through actions that the tutor initiates in order to keep the learner in pursuit of a particular objective, thus helping to maintain motivation. Wood et al., (1976) noticed that the expert would mark critical features, accentuating important features of the task, and sometimes as a consequence accentuating the discrepancy between the child's production and the correct outcome. The tutor was seen to act as a frustration control during the task, and may also have demonstrated idealising the act from which the learner imitated back behaviours in an appropriate form.

Gallimore and Tharp (1990) went some way towards reinforcing and clarifying these scaffolding strategies, and moved on to relate them to educators. Gallimore and Tharp suggested that direct scaffolding occurs when a teacher combines a set of opportunities and skills. Whilst these strategies are primarily 1:1, there are a number of indirect scaffolding strategies that a teacher may employ. The use of texts, diagrams and visual cues may be used to reinforce ideas from the verbal plane. Mirroring Rogoff and Gardner's (1984) observations in relation to maternal discourse, diagrams and texts may allow verbal messages to become sufficiently redundant since, 'if a child does not understand one aspect of the communication, other forms are available to make the meaning clear' (Vygotsky; cited in Donaldson, 1983, 109), in a sense providing a safety net through which the learner may not fall.

Bliss, Askew and Macrae (1996) undertook research to identify scaffolding strategies in primary classrooms. Their preliminary work involved the collection of different scaffolding strategies. These included:

- *Introduction Strategies (making the task clear; referring to previous work; linking task to other work; referring to everyday situations; demonstration; checking understanding; metaphor and analogy)*
- *Task Management Strategies (breaking a task into steps; focusing on immediate actions; acting as a 'memory bank')*
- *Task Scaffolding Strategies (talking at a high level with visual back-up; combining visual and verbal instructions; extending verbalization)*
- *Encouraging Peer-Scaffolding (getting pupils to explain; referring to pupil's ideas and encouraging interaction; encouraging pupils to listen and critically respond)*
- *Self-Management Strategies (encouraging pupils to check own understanding/results; helping pupils to develop a plan for the task)*
- *Holding Strategies (repeating back; reflective thinking; confirmation; pretending to need clarity)*

## **2.2 Interaction**

The implications of Vygotsky's model for teachers are very important. The Vygotskian teacher fulfils an intellectually challenging process. The position demands a dynamic ability to constantly appraise their own and their learner's performances in relation to each other, establishing opportunities to assess individual children through meaningful discourse, and an ability to reflect based on very clear goals. The centrality of the relationship between teacher and learner is clear. In order for scaffolding strategies to be employed, opportunities for perceptive/intensive discourse must be built. Without such discourse, effective assessment and further teacher planned action cannot occur, therefore disrupting the journey across the ZPD.

This observation contrasts starkly with findings about prevailing practices in the UK. Concerns have been raised about the prevalence of teacher dominated discourse and the lack of dialogic interactions within UK primary classrooms due to curricular time pressures and prescriptive

teaching initiatives such as the National Literacy and Numeracy strategies (Myhill 2006; Parker and Hurry 2007; Hardman et al. 2003).

Rogoff questions the wisdom of focusing attention purely on adult-child interactions. Rogoff argues that child-adult interaction does not necessarily entail rapid progress, in fact, 'features of adult-child interaction...may have little relation to children's learning' (1990, 130).

When dealing with the issue of peer interaction it is important to make a distinction between two forms of interaction; collaborative learning, and peer-tutoring. Although important differences exist between the two forms of interaction, they have a number of common features. It is widely recognised that a common dynamic within both collaborative learning and peer-tutoring is the special quality of the relationship between peers, which adds to the motivational quality of the activity. Another important consideration may be the qualitative difference in power relations between the peers in comparison to traditional adult-child interactions. A simple but important function of this qualitative difference may lie in the role of language used between peers. Forman and Cazden (1985) argue that the need to communicate with others, combined with the fact that, 'children interact more directly than adults' (Rogoff 1990, p.198), then leads to the encouragement of the verbalisation of perceptions between peers, and therefore the basis for cognitive development. Azmitia (1988) has published a number of findings which she believes help to explain how peer interaction can foster cognitive development. She argues that peer discussion can help individuals restructure their ideas. Time on task tends to increase with less 'giving up' and more enjoyment experienced. She also noted that peers can acquire new strategies from working with other children. In her study of pre-school learners Azmitia (1988) found that peer collaboration could lead to increased learning when compared to individual work. Furthermore, she argued that learning was maximised when peers worked with expert partners.

### **2.3 Peer-tutoring**

The dynamic within this learning relationship is based on a disparity of skills between participants. Rogoff (1990) suggests that ideal partners possess unequal skills and understanding but not unequal power since the equality of status helps to maintain motivation levels within the learning discourse. Briggs (1998, 9) notes that, 'peer tutoring provides individualised instruction, as well as increasing the motivation to learn'. He suggests that reasons for such a supposition are that peers share a common language, which raises the quality of interaction and reduces ambiguities. This in itself is seen as a spur to motivation since it denotes an equality of status within the relationship, despite the existence of an expert and a novice.

Tudge (1990) has explored the possibility of peer scaffolding in a school environment. By mixing children of differing abilities, and establishing novice-expert partnerships, it has been argued that positive cognitive development can be achieved without direct adult intervention.

### **2.4 Collaborative learning**

Collaborative learning assumes a more equal skills relationship than peer-tutoring. Not only are the peers socially equal, but more than likely equal within their understanding of a given problem. Collaborative learning can be understood from the perspective of Piagetian Constructivism since it deals with the overcoming of internal contradictions through external interaction between peers at similar stages of thinking. This concept of knowledge is based on the idea that true knowledge

is constructed by individuals, and is not simply transmitted from teacher to learner through instructions, but can be encouraged by engagement in group activity, since the apposition of viewpoints leads to the confrontation of ideas. The power of this conjecture may be explained at a psychological level. Constructivists argue that new ideas and meaning making develop through the conflict and undermining of previously held ideas, and that this may be due to a psychological arousal that occurs when predicted outcomes fail to materialise in given tasks. Doise, Mugny and Perret-Clermont (1975) reinforce this idea when they argue that the interaction of two children on a given task presents the opportunity for systems of action and representation centred on different aspects of the task to be confronted with each other.

### 3 Research design

The research objective was to investigate scaffolding strategies in a mixed ability group learning situation. Since the study aimed to look at some very particular teaching skills, rather than issues related to how teachers organise and interact with classes as a whole, it was decided to stage the observation in an isolated classroom. This would help to reduce other procedural, non-task related interruptions, which may have detracted from the quality of the observed interactions.

The group teaching activity was based around a ½ hour Design and Technology task involving four learners and one teacher. Interactions at different stages of the task were recorded during the task and were validated with a video recording of the session. Observations were coded using a modified Flanders Interaction Analysis Categories (FIAC) (Wragg, 1994) observation tool. The scaffolding categories of the FIAC (Appendix 1) were based upon scaffolding strategies identified in the preliminary work of Bliss, Askew and Macrae (1996).

The study involved four mixed ability learners from a large suburban English Primary School. The group comprised two girls and two boys currently in Year Six (10 and 11 years of age). Group construction was based on two criteria:

- (i) Academic ability: reference to a variety of standardised and teacher assessments, including reading comprehension, language and science understanding (Table 1);
- (ii) Considerations of friendship grouping: since this could affect the level of support/involvement which the children were prepared to give.

**Table 1: learner ability data**

		Ann	Bob	Cass	Dan
	Edinburgh Reading Test (Standardised)	126	109	86	84
	Year 4 Standardised Reading Assessment Task	139+	113	81	99
Year 4 Teacher Assessments <sup>1</sup> (Non-Standardised)	Language	Level 4	Level 3	Level 1	Level 2
	Science (Experimental /Investigative Knowledge)	Level 3	Level 3	Level 2	Level 2
	Science (Knowledge of Materials)	Level 4	Level 3	Level 3	Level 2

<sup>1</sup> 'Levels' refer to 'National Curriculum Levels'

The Design and Technology task asked the group to devise a mechanism which would switch on a bulb when the water level in a container was about 5cm from the top. The skill demand of the task spanned a number of levels of the National Curriculum for both Science and Design and Technology.

Prior to the task the experience and understanding of the group members in relation to the concepts of electric circuits, switches, conductors and insulators was assessed through a semi-structured interview. These interviews showed that all of the participants could explain how to make an electric circuit, but could elaborate very little further. When asked to explain how electrical circuits work, one of the children could not begin, whilst the remainders could only give a practical explanation of the elements needed and their necessary attachment in order to make the circuit work. When probed about their wider understanding of concepts such as 'insulation', 'conduction' and the relationship of materials to such concepts, only Bob could satisfactorily explain what the terms meant and identify materials which would serve the purpose of 'conducting' or 'insulating' an electrical current.

The task was then introduced on a resource sheet with the additional materials required for the task provided. After task completion, another semi-structured interview was conducted three days after the task in order to gauge the development in understanding of the participants and to ask them about which of the interactional events they felt had helped them to reach the end point of the task.

#### 4 Findings

Observation and video-analysis showed that the main elements of the task were completed by the 18 minute stage. The rest of the interactions extended and elaborated the task beyond its prescribed aims. As a consequence, it is the first 18 minutes of the task that have been the focus of analysis. '*Comparison of Introduction Strategies used by a teacher during the task*' (Table 2) contained the largest group of possible scaffolding strategies.

**Table 2: Comparison of Introduction Strategies used by a teacher during the task**

	1-3 min	4-6 min	7-9 min	10-12 min	13-15 min	16-18 min
making task clear	2	0	0	0	0	0
refer to previous work	0	0	0	1	0	0
link task to other work	0	1	0	0	0	0
refer to everyday situation	3	1	0	0	0	0
demonstration	0	0	0	0	0	0
checking understanding	1	0	0	1	0	0
metaphor and analogy	1	1	0	0	0	0

Analysis shows that all of the strategies were employed by the teacher, but 'referring to everyday situations' was the most common, being used four times. 'Making the task clear' and 'checking understanding' were both used twice, whilst all other strategies were employed once.

The timing of strategy use appears significant. Of the eleven uses of 'Introductory Strategies', nine were used in the first 6 minutes, showing that their function is heavily involved in the earlier stages of task completion. This suggests that these strategies are employed in order to induct the children into the task through varying contextualising and checking strategies. The checking strategies may serve the function of allowing the teacher to pace the task according to the ongoing level of understanding being made evident from the children's responses. It is interesting that in the first 3 minutes, seven of the strategies were used, suggesting that a close relationship exists between the contextualising, clarifying and checking strategies. Their inter-relationship may have an important role in establishing the task, and setting it within a firm context. 'Comparison of Task Management Strategies used by a teacher during the task' (Table 3) involved a possible three different strategies related to how a teacher organises the task.

**Table 3: Comparison of Task Management Strategies used by a teacher during the task**

	1-3 min	4-6 min	7-9 min	10-12 min	13-15 min	16-18 min
break task into steps	0	1	0	0	0	0
focus on immediate actions	0	1	0	1	0	0
acting as a 'memory bank'	0	0	0	0	0	0

These strategies were the least employed group of strategies. 'Focusing on immediate actions' was used twice and the teacher broke the task into steps once. The use of 'acting as a 'memory bank'' was not employed. 'Comparison of Task Scaffolding Strategies used by a teacher during the task' (Table 4) is concerned with strategies that extend understanding through language and visual means. Each strategy is noted for its emphasis upon the extension of understanding.

**Table 4: Comparison of Task Scaffolding Strategies used by a teacher during the task**

	1-3 min	4-6 min	7-9 min	10-12 min	13-15 min	16-18 min
Talking at a high level with visual back-up	0	1	0	1	0	0
combining visual and verbal instructions	0	0	0	1	0	0
extending verbalisation	1	1	2	3	0	0

Within this group of strategies 'extending verbalisation' was the most common, being used seven times. The time frame is again significant since use of the strategy increased as the task developed. This suggests that the use of scientific and concept related language only began to grow after the participants were inducted into the task. This also suggests that this was the part of the task where 'teaching' occurs, since all of the 'task scaffolding' strategies were employed by the 12<sup>th</sup> minute. '*Comparison of Peer-Scaffolding Strategies used by a teacher during the task*' (Table 5) concerned strategies employed by the teacher to encourage pupil-interaction. This includes involving children with the teacher's ideas as well as with each other's ideas.

**Table 5: Comparison of Peer Scaffolding Strategies used by a teacher during the task**

	1-3 min	4-6 min	7-9 min	10-12 min	13-15 min	16-18 min
Getting pupils to explain	4	3	4	0	1	0
referring to pupils ideas and encouraging interaction	1	2	4	1	0	0
encouraging pupils to listen and critically respond	0	0	0	1	1	0

'Getting the pupils to explain' was the most commonly used strategy of the group, (and second-most used of all strategies), being employed twelve times. The time frame is perhaps significant in that eleven of these were found in the first-half of the task. 'Referring to pupil's ideas and encouraging interaction' was used eight times. Again, all but one of these was to be found in the first 9 minutes of the task. 'Encouraging pupils to listen and critically respond' differed from the other two strategies since it was used relatively few times. It was only used twice, and both of these fell within the second-half of the task. This would lead to the suggestion that the purpose of this strategy was different from its partners. Arguably, encouragement to explain, interact and share ideas was heavily involved in the contextualisation and induction of the pupil into the task. On the other hand, encouraging pupils to listen and respond may refer more to a management strategy which re-focused children at a particular stage of the task- perhaps when the teacher perceived that the children had drifted away from the desired focus. '*Comparison of Self-Management Strategies used by a teacher during the task*' (Table 6) concerns strategies designed to transfer the responsibility of the management of the task to the children.

**Table 6: Comparison of Self Management Strategies used by a teacher during the task**

	1-3 min	4-6 min	7-9 min	10-12 min	13-15 min	16-18 min
encourage pupils to check own understanding/results	0	0	0	0	0	1
help to develop a plan for the task	0	1	1	2	0	0

Both of these strategies are concerned with encouraging the children to take responsibility for the task. The most commonly used of these strategies was 'helping to develop a plan for the task', which was used four times. '*Comparison of Holding Strategies used by a teacher during the task*' (Table 7) produced the largest amount of quantitative data. This category included four types of strategy which are employed by a teacher in order to pace the activity and focus participants:

**Table 7: Comparison of Holding Strategies used by a teacher during the task**

	1-3 min	4-6 min	7-9 min	10-12 min	13-15 min	16-18 min
repeating back	0	0	1	3	0	0
reflective thinking	0	0	0	3	0	0
confirmation	2	1	4	3	3	2
pretending to need clarity	0	2	0	0	1	0

'Confirmation' proved to be the most commonly used strategy of all, being employed fifteen times in 18 minutes. 'Repeating back' was used four times, whilst the other two strategies were used three times each. Although the use of these strategies was spread throughout the duration of the task, a closer examination of the time frames provides an insight into the dynamics of the task and its dialogue. Between the 10<sup>th</sup>-12<sup>th</sup> minute period there is a concentration of 'holding strategies'. Since the strategies in this section are largely concerned with how the teacher temporarily pauses the development of the task in order to focus participants, or allow children to catch up with the conceptual level of the dialogue, this could represent an important juncture within the task. This would suggest that the teacher perceived this area of the task to be where significant cognitive gains may be developing. This supports the data relating to the strategies surrounding the teacher's attempts to extend the children's understanding (Table 4), which suggested that the use of such strategies reaches a peak by the 12<sup>th</sup> minute.

The FIAC tool was used to analyse learner interactions. '*Frequency and Type of Pupil Interactions during the Task*' (Table 8) demonstrates coded learner interactions, since one of the aims of the study was to investigate whether children were able to scaffold their peer's learning. Of all the strategies previously outlined in relation to possible teacher scaffolding, nine were identified that could potentially apply to pupil interactions

Table 8 shows that two of these potential strategies were not used. These were 'referring to previous work' and 'linking to other work', perhaps reflecting the fact that this task was largely 'stand-alone' in nature and not set within any ongoing classwork context. 'Pupils critically respond' proved to be the most commonly used strategy, being used eight times. This was followed by 'pupils explaining their ideas', 'demonstrating' and 'referring to everyday situations', all being used twice. The remaining strategies; 'break task into steps' and 'pupils use other pupil's ideas and extend' were used only once.

**Table 8: Frequency and type of Pupil Interactions during the task**

	1-3 min	4-6 min	7-9 min	10-12 min	13-15 min	16-18 min
Refer to previous work	0	0	0	0	0	0
Link task to other work	0	0	0	0	0	0
Refer to everyday situation	1	1	0	0	0	0
Demonstration	0	0	0	0	1	1
Break task into steps	0	1	0	0	0	0
Extending verbalisation	0	0	0	0	2	0
Pupils explain	0	0	2	0	0	0
Pupils use other pupil's idea and extend	0	0	1	0	0	0
Pupils critically respond	0	0	1	0	4	3

When the time frame of the task is taken into consideration, the spread of the strategies used by the children gives an insight into the development of the task. The first 6 minutes of the task are notable for there being very few pupil scaffolds. Two of the three scaffolding interactions are heavily related to the contextualisation of the task, where a pupil refers to an everyday situation when elaborating their ideas. After the 6<sup>th</sup> minute a rise in pupil scaffolds is noted. There is a change in the nature of the scaffolds employed, with less emphasis on contextualisation and more on pupils explaining, extending and responding. The 13<sup>th</sup>-15<sup>th</sup> minute period marks the greatest level of activity, with a mixture of pupil demonstration, extending each other's verbalisation and responding critically. During this period there are seven interactions, which is nearly half of all the pupil scaffolds used during the task. After this point the number of pupil scaffolds begins to diminish again. This pattern may suggest that the pupil scaffolding interactions reflect a growing involvement by the pupils during the development of the task.

The final set of data gathered was based upon the evidence of the post-study interviews. The interview was designed to allow the children to explain who they believed had helped them to develop their understanding, and how this had been achieved. Bob had the firmest initial ideas as to how the task problem would be completed, and he had a clear sense of how to approach the task at an early stage. This is verified by the data where he exclaims during the introduction to the task objectives *'I've got an idea!*', and soon afterwards he shows an important grasp of the relationship of the materials to the task objective when he suggests, *'this is float wood this is...I've got an idea.'*

Bob expresses the clarity of his thought when he incorporates the 'float wood' into his sketch design. The suggestion that Bob's initial ideas were the clearest is reinforced by data from the

other post-study interviews. All of the other children identified Bob as being responsible for changing their ideas about how to solve the task.

The post-study interviews also give an insight into how the children perceived their development to have occurred. Interestingly, when questioned separately, all of the children's names were mentioned when participants were asked to identify which of the group members had helped them to develop their ideas. Bob believed that Dan was responsible for changing his ideas; Dan felt that Ann helped him when he was stuck, and both Ann and Cass suggested that Bob changed their thinking. This reinforces the Vygotskian idea that the development of learning may involve a network of ideas which affect each other through the mediation of dialogue. Even though Bob had the clearest solution to the problem, this did not undermine the involvement of all the group members in reaching the final goal. The nature of the help given by the others within the group was identified as being either through 'showing' or 'explanation'.

The post-study interviews provided evidence of another insight into the task. This concerned the children's perceptions of how teachers might help children to learn. Only one of the children, Ann, who had been identified as being the most academically able, felt that the kind of help that teachers give to children was not different from the type of help that children give each other. When asked about being stuck in the task she suggested that the teacher and children combined to help her. When asked whether the type of help given by both was different she stated a categorical 'No'. The less able children had a different perspective. The remaining three group members all suggested that children help each other in ways that teachers do not. These children believed that the way that teachers tend to relate to children differs from the way that children interact, and that these two methods may complement each other. Dan suggested succinctly that *'Teachers give better understanding than children and they have a technique, but sometimes teachers don't know what you are talking about and other children explain it back to the teacher more clearly, so it gives a better understanding to the teacher'*. This role of children as intermediaries in the learning process was also alluded to by Cass, who focused on the differences between the ways that teachers and children use language. Cass claimed that *'Teachers tell and children show and explain. Children say things in a different way than teachers. Children use words that are easier to understand'*. Reinforcing this view, Bob suggested that *'Children talk it over between them(selves), the teacher tells you what to do and asks questions afterwards'*.

## 5 Discussion

The case study approach has a number of weaknesses largely related to issues of subjectivity and scale. The small scale nature of case studies can question the extent to which findings can be widely extrapolated. Evans (1984) argues that to some extent this problem may be overcome by the study of group teaching since it is a more natural context in which to learn, shifting focus away from particular individuals and their perceptions of being observed. The level of extrapolation of research findings, whilst not being too ambitious about their implications for the wider population, may be valid within other group teaching situations with a similar cohort of children.

The concept of the ZPD is presented by Vygotskyans as a model to explain how the cognition of individuals might develop. Study data presented here suggest that both teachers and children can

employ scaffolding strategies, but interestingly, the nature of these interactions might be different. The evidence from the post-study interviews reinforces this point; with three of the children suggest that children interact in a way so as to complement the teacher's involvement in learning.

The data also supports the proposition that the nature of strategies employed by the teacher differ according to their particular qualities, and chosen purpose. Consequently, relationships can be made between the use of strategies and the development of the task. Vygotskyans would not find this difficult to imagine since they would argue that 'learning involves a discourse' and the actions of a teacher or expert will change in direct response to the actions of a learner.

When exploring the techniques that appear to have influenced the development of the group's thinking, the role of teacher and pupil scaffolding becomes important. The children's own recollections in the post-study interviews provide two points of interest. Firstly, the dynamic nature of group interactions is clearly represented by the children's own recollections of who they believed helped them to learn. Although the observational data clearly suggest that Bob 'led the way' in terms of providing the solution to the problem, each child believed that they were helped by other members of the group. Interestingly, this 'mutual recognition' did not include the teacher. This might suggest that a difference exists between the observer's and the pupils' perceptions of the activity, since observational data would have suggested that pupils might have recognised the teacher's role in their thinking.

The second important point raised by the children's reflections relates to a subtle recognition of power relationships within learning. When asked about how teachers help children, and whether it is different to the help that children provide for each other, three of the children suggested that there was a clear difference. Although this was not pursued, there may be a recognition here that the effect of scaffolding strategies does not simply depend on the choice and application of a particular strategy. Since the children recognised each other's role in their own learning, perhaps the power of a particular scaffold depends partly upon the relationship of the 'scaffolder' to the learner. For example, it could be suggested that a strategy employed by a teacher may have less effect on a learner than if the same strategy is used by a peer, since it may be argued that the children are more attentive to each other's actions than they are to those of the teacher. Forman and Cazden (1985) and Azmitia (1988) have alluded to the fact that the power relationship between peers is an important influence on cognitive development. The relative equality of peers within the learning cohort may explain why they are apparently more receptive to their peer's scaffolds, where perhaps ideas of reciprocity and sharing are the foundations for group interactions. This argument mirrors those of Rogoff (1990) who suggests that ideal learning partnerships consist of members with equal power and unequal abilities.

Another important consideration must be the nature of scaffolds which the children perceive as having influenced their learning. When asked about the strategies that made them change their ideas, it was noticeable that 'showing' was mentioned three times and 'explaining' only mentioned once. There may be an underlying notion here that children at particular stages of learning or development are more influenced by particular strategies, in this case 'modelling'. This point becomes perhaps more significant when considering the children's responses to a question about whether there are differences between the types of help that teachers and children give each other. During the post-study interview, three of the four respondents alluded to the teacher's use of language being different to that of children's. Cass, Dan and Bob all suggested that teachers

may only use dialogue in a narrow sense. When Cass stated, *'Teachers tell and children show and explain. Children say things in a different way than teachers. Children use words that are easier to understand'*, she is reinforcing the message that 'modelling' is an important strategy for learning. She is also suggesting that the language used by teachers is sometimes too difficult for children to understand. As a consequence, children may rely upon each other to mediate between the teacher and fellow learners. This mediation technique is supported by Dan, who also argues that the mediation exists in two directions. He says that, *'Teachers sometimes don't know what you're talking about, and other children explain it back to the teacher more clearly so it gives (the teacher) a better understanding'*. Bob's insight supports the notion that there might be a difference between the nature of talk used by teachers and children. He also raises the issue that the relative status and equality of the participants is an important part of the equation. Bob said that *'Children talk it over between them(selves), the teacher tells you what to do and asks for questions afterwards'*.

This observation leads to the suggestion that there is an equality of opinion and mutual respect between peers. At the same time, there is also a suggestion that the teacher does not use language for 'dialogue' purposes, but simply in order to transmit a message and check understanding. In this sense he feels that the power relationship between the teacher and the learner leads to the teacher dominating the learner through the use of language.

Recognition that cognitive development is promoted through working in mixed-ability groups is a confirmation of a Vygotskian perspective. Interestingly, the least-able children were able to identify a greater difference between the techniques of teachers and children's own support strategies. This reinforces the idea that children provide a 'mediation' function during learning interactions. In Vygotskian terms, the gap between the expert's use of language and the learner's understanding is too great. The strength of a mixed-ability group is that it allows other children to fill this language-understanding gap. This strand of thinking represents an unpacking of the relationships involved in the development of a group ZPD. The teacher-expert provides the conceptual direction based upon their understanding of the children's cognitive development. At the same time, since the use of language is a vital function in the learning dialogue, it is important to recognise that a gap may exist between the teacher's use and expectation of language, and the comprehension abilities of the children. This is where other children may be able to provide a mediation function. Since the children's experience of language, and capacity to use language, is closer to each other than that of the teacher, a Vygotskian explanation would suggest that children may be able to exhibit a particular ability to scaffold each other's understanding. They may do this through adapting the teacher's language into more 'child-friendly' terminology. This appears to mirror the views of Briggs (1998), who argues that peers share a common language which raises the quality of interaction and reduces the possibility of ambiguity.

The question may be raised whether both teacher and pupil scaffolds have the same intent. The direction from which teachers and children approach a task are necessarily different, and this affects the behaviours of each of the participants, and their reasons for employing scaffolding strategies. For Vygotsky, the teacher has a clear idea of the intended learning outcome and the strategies which may be used in order to reach that point. Constant assessment informs the teacher of the appropriateness of those strategies that they choose to employ. The inter-relationship of all these factors leads to the use of particular scaffolding strategies, and the

recognition of such factors allows an observer an insight into the intentions of a teacher's behaviour whilst teaching a group.

On the other hand, children have only a gradually developing awareness of the outcome of a task, and they alter their behaviour according to ongoing assessments as they move through the task. It must be recognised that the children's choice of strategies will be more limited than the teacher's, since the children are learning and testing their own understanding of concepts as they pass through the task.

Rogoff and Gardner (1984) and Radziszewska and Rogoff (1988) have argued that the intention of a teacher employing scaffolding strategies is to gradually reduce their use, as the children become more involved in the task. This is apparent in this study. It is also clear from the study data that the teacher has a wider array of strategies to choose from. It appears that the intention of the children who use scaffolding strategies is simply to help each other through a task, although they possess fewer strategies to choose from. It could be argued that both intentions are complementary, and drive the learning through meaningful interaction and dialogue. If this conjecture is true, then we would expect to see a relationship between those scaffolds employed by the teacher and those used by the children within the study data.

When the task is analysed carefully it is clear that the teacher and pupil responses are dependent on, and altered in accordance with each other. During the early stages of the task the teacher uses a variety of contextualisation strategies. This is very evident during the 1-3 minute period, when the teacher refers to an everyday situation and uses analogy to reinforce this. This is reciprocated by Dan who elaborates his ideas by stating, *'You know like a fish pump? There's the electric thing that powers the actual pump..the thing (motions with his hands making a container shape) it protects it from the electric circuit outside'*. His interjection serves to build the context further.

The 4-6 minute phase represents a further period of heavily teacher dominated interaction. This falls mainly into the category of 'task-management' strategies where the teacher gives out paper encouraging the children to plan their outcomes. During the first six minutes of the task the children's responses are few, and the teacher works at encouraging pupil involvement. This is signified by the large number of attempts to get the pupils to explain their ideas, using peer-scaffolding strategies, during the early stages of the task.

It is not until the 7<sup>th</sup> minute of the task that the interactions represent more of a dialogue, where the children take more responsibility for their involvement. It is here that the number of pupil scaffolds double. This phase also coincides with the growth in the use of 'holding strategies' by the teacher. There are gaps in the teacher's questioning that encourage the pupils to reflect on their learning, for example, *'Wouldn't the current go through the wood? [pause]'*. The use of confirmation in response to pupil's ideas also grows dramatically following the 7<sup>th</sup> minute.

In all it appears that the first six minutes of the task represent a phase of 'inducting' the pupils into the task, through contextualisation and the explanation of objectives and constraints. This is a heavily teacher dominated phase. The second phase of the task represents a shift in the focus of the interactions. There is a more equal balance within the dialogue, reflecting the increased involvement of the children. This phase is a lively interactional phase, although it is difficult to perceive whether the children are responding to the teacher's lead, or vice versa. In a Vygotskyan

'dialectical' sense it is impossible to separate both, since the learning that develops through this dialogue is a direct response to the active 'synthesis' of the shared ideas.

This phase of the task is also marked by an increase in the 'extension of verbalisation' by the teacher, including the use of more conceptual/scientific language. This phase may represent a more intense 'learning' situation than the earlier period, since the dialogue represents a 'higher level' of instruction and questioning. During this time it appears that the teacher notices a useful strand of thinking, shares some reflective thinking, and checks the children's understanding. The teacher asks: '*What is breaking?*'; '*What would happen if....?*'; '*What does a switch do?.....how?*'; whilst maintaining eye-contact and pointing at particular individuals, serving to disperse the interaction. During this stage it appears that the teacher feels that the discussion is moving too quickly for some of the group members, leading him to say, '*Take it back*'. This represents the perceived need to retain the focus of the children upon the dialogue, and requests a repetition of salient points in order to allow all participants to catch up with the level of the discussion. The reason why the phase between the 6<sup>th</sup> -12<sup>th</sup> minutes may represent a greater degree of cognitive growth, and specific conceptual teaching through language extension seems to be spurred on by the noticeable growth in pupil involvement. This represents a time when the children are successfully 'inducted' into the task.

## 6 Conclusion

Romera (2003) argues that we need to question which types of strategies are best to teach. An important part of this particular study has been to make explicit the scaffolding strategies that underpin a group learning episode. This episode highlights some of the positive qualities of mixed ability group working through its exemplification of the ways that children can mediate the learning intention of a teacher and scaffold each other's learning. This study resonates with the implications outlined by Thurston et al. (2006) who argue that teacher practice can benefit from focusing on the quantity and quality of their interactions.

This study also brings to the fore some of the pedagogical challenges inherent to Vygotskian method. One of these is the suggestion that the strength of a scaffolding strategy may be partly dependent upon the relationship of the teacher to the learner. This questions any perspective that holds that the art of teaching is reducible to a set of pedagogical skills and that the value of relationships in the learning process should be recognised.

Another implication from this research is that scaffolded learning might require a classroom environment which respects the value of peer interaction. This might require the classroom to be organised so as to allow a variety of discourses to operate, in order to encourage the fullest involvement of all pupils. There is an implication here that the learning environment will be organised in a way that enables children to discuss their ideas in an open way, allowing a democratic sharing of views in smaller and larger groups. This contrasts worryingly with recent research findings from the UK which suggest that teaching styles might be tending towards allowing less dialogic discourse.

## 7 References

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