Analysis of factors influencing the contribution of talk to learning during collaborative group work in science

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Introduction

Although greater emphasis has been placed on the significance of talk in learning in recent years, in an evaluation of the impact of the Primary National Strategy on pupil attainment, Ofsted associated the poor language skills of many lower attaining pupils with their slow progress throughout the curriculum (Ofsted, 2005). Much research has been carried out into the potential of collaborative working for supporting learning through talk, however just because children are involved in a group activity, it does not necessarily follow that the interactions taking place are actually furthering their learning.

‘...observational research in British primary schools has shown that the talk which takes place when children are asked to work together is often uncooperative, off-task, inequitable and ultimately unproductive.’ (Mercer et al. 2004:361).

Teachers’ choice of grouping is rarely related to any educational purpose, rather these decisions are driven by class control and organisational issues (Baines et al., 2007). Therefore the rationale for decisions relating to grouping tends to focus on teacher-learner considerations rather than potential learner-learner benefits. Reasons why teachers tended to avoid collaborative group work were identified by Baines et al. (2007) in a review of research:

- concerns that there would be loss of control resulting in off-task or disruptive behaviours
- beliefs held by the teachers that peer interaction does not facilitate learning.

Where collaborative group work is used, teachers often do not have a clear understanding of the nature or purpose of the talk they want the children to engage in. Consequences of this are that children do not have:

- a clear understanding of what they are expected to do
- a perception of what constitutes an effective discussion (Mercer, 1996).
In a review of research studies carried by Howe and Mercer (2007) it was found that only a small proportion of the interactions taking place during group work actually contributed to the children’s learning. This highlights the importance of developing approaches for analysing the interactions taking place during collaborative group work in order to identify those that support effective learning. Children are often unclear about what they should be doing and what the aims of the activity are in collaborative learning situations (Mercer, 1996). Findings of research studies have shown that in order for the potential benefits of small group work to be realised in practice, it is necessary to provide structure that enables children to work together effectively (Gillies, 2003). In a study investigating the role of talk in learning science, it was found teaching children language associated with collective reasoning to support talk increased the incidence of cognitively demanding exchanges (Mercer, et. al., 2004).

This paper analyses factors influencing peer contribution to science learning during collaborative group work in science. The potential for increasing the level of cognitive interaction within collaborative group work through pedagogical interaction will also be explored.

Research questions:
- How do the behaviours and interactions observed during collaborative group work in science impact on the level of cognitive demand of talk episodes?
- What kinds of intervention support the development of peer interactions to facilitate more effective learning of science through talk?

**Categorisation of the level of cognitive demand of talk**
Mercer (1995) devised a classification system for talk episodes depending on the degree to which the talk contributed to new learning:

**Disputational talk**
‘...is characterised by disagreement and individualised decision-making. There are few attempts to pool resources or to offer constructive criticism of suggestions.’ (Mercer 1995: 104)

**Cumulative talk**
‘speakers build positively but uncritically on what the other has said. Partners use talk to construct ‘common knowledge’ by accumulation. Cumulative discourse is characterised by repetitions, confirmations and elaborations.’ (Mercer 1995: 104)

Brown and Palinscar (1986) also identified the importance of shared expertise within group work contexts. The level of discussion where the main interaction taking place involves information exchange equates to Mercer’s category of ‘cumulative talk’.

**Exploratory talk**
Exploratory talk is characterised by co-construction of understanding through critical but constructive engagement of learners in each other’s ideas and reasoning is apparent in the talk. Indicators of exploratory talk include:
- the views of all members of the group are sought, respected and considered
- ideas need to be made clear and explicit
- proposals are challenged and may even be counter-challenged, but reasons are given for challenges
- alternative ideas are valued
- the group seeks to reach agreement through negotiation and evaluation of different views before taking a decision or acting
- different viewpoints are discussed and reasoning is applied
- agreement is sought and joint decisions reached
(Mercer et al., 2004; Rojas-Drummond and Mercer (2003); Mercer, 1996).

**Scaffolding vs Co-construction**

It is important to consider the nature of exploratory talk in relation to the concepts of scaffolding and co-construction. Wood et al. (1976, cited in Jordan, 2004) developed the model of ‘scaffolding’ in which a more competent learner provides ‘scaffolding’ to facilitate learning of another less competent learner. In this model the assisted learner is supported in achieving at a higher level within their Zone of Proximal Development (Vygotsky 1926/1997, cited in Jordan, 2004), gradually the more competent learner releases control to the assisted learner until eventually s/he is able to achieve that higher level of functioning without the additional support. In contrast to this co-construction of understanding can be defined as the development of new shared understanding that has developed through inter-subjective interaction (Topping, 2005). The interactions taking place during exploratory talk take the form of co-construction of understanding, whereas cumulative talk has elements of scaffolding.

Brown and Palinscar (1986) in their extensive review of research into collaborative interactions concluded that ‘the superiority of collaborative cognition cannot be accounted for simply in terms of the less informed children imitating those who already know’ (p 32). Also they found that that group interactions can result in cognitive restructuring rather than merely ‘temporary compliance or imitation’ (p 31).

In order for true learning to take place ‘pseudoconcsensus’ needs to be avoided ie when group members resolve a conflict in their ideas by adopting an explanation or solution which enables both views to be accepted but does not take into account all of the relevant evidence or information (Russell, 1982, cited in Brown and Palinscar, 1986).

> Though conflict may be an essential trigger, change is mediated, change is mediated through a process of co-elaboration and co-construction (Bryant, 1982; Russell, 1982a, 1982b). Confrontation provides a vantage point from which the children come to challenge both points of view. Together they elaborate, modify, and restructure, thereby producing a new theory that takes into account their individual differences.’

(Brown and Palinscar, 1986: 33)
Piagetan views of learning focus on creating cognitive conflict so that existing ideas are challenged in the light of new evidence. A major aim of research into group work is how to promote more effective cooperation – however it is interesting that exploratory talk is related to the creation of constructive conflict and characterised by the challenging of others’ ideas (Mercer, 1996). A significant contributor to collaborative learning success was found to be the degree to which discussion, defending particular viewpoints and evaluating ideas took place. This process of confrontation is proposed to be the ‘catalyst of change’ (Brown and Palinscar, 1986: 23) and fits with the Piagetan view of learning as assimilation and accommodation.

Research evidence indicated that for collaborative learning to be effective ‘the child must be faced with a view that not only conflicts with his own but is also one he can take seriously…it forces the child to question his own position’ (Brown and Palinscar, 1986: 31). In order for ideas to be taken seriously evidence to justify viewpoints needs to be presented. This may take the form of:

- sharing of observations or personal experience; or
- statement of general principles.

Counter arguments may then take the form of user of personal experience to challenge and demonstrate limitations to the general principle. The role of critic in the group is of particular importance and group contexts therefore have the potential for modelling of the process of argumentation. Structural elements of discussions involving argument were identified by Toulmin (1958, cited in Brown and Palinscar, 1986):

- at the first level a claim is stated
- at the second level evidence is presented to back the claim which may be in response to challenges from group members
- at the third level there may be further justification in response to more challenges from group members

In the context of collaborative learning Topping (2005) proposes that the greater the differential between the understanding of the helper and the helped the more likely it is that the interaction will take the form of scaffolding rather than co-construction, since opportunities for cognitive conflict will be reduced. With regard to power relationships, the locus of control in exchanges where co-construction is taking place is more evenly distributed between participants than for situations that predominantly involve scaffolding, where the control is with the more competent learner (Jordan, 2004).

**Factors contributing to exploratory talk**

**Ground rules for talk**

Ground rules can be viewed as mutual understandings about the way in which exchanges are structured. Mercer (1996) proposes that an aspect of being educated
is a process of learning to implement these ground rules. Research carried out by Wegerif et al (1999) supports the idea that teaching ground rules for talk results in higher level exchanges. As part of their research children were taught the following ground rules for exploratory talk:

1. all relevant information is shared;
2. the group seeks to reach agreement;
3. the group takes responsibility for decisions;
4. reasons are expected;
5. challenges are accepted;
6. alternatives are discussed before a decision is taken; and
7. all in the group are encouraged to speak by other group members

Wegerif et al. (1999: 496).

Lambirth challenged the use of ground rules for talk on the basis that they could be viewed as a form of cultural capital (Bourdieu and Passeron, 1977 cited in Lambirth, 2006) and raises the issue of their potential negative impact on motivation, particularly for children whose home discourse does not include these structures:

by privileging one form of cultural capital above another in the form of spoken communicative repertoires there are real dangers of discriminating against other groups who use other forms of talk which are intrinsically linked to their identify and culture.

(Lambirth, 206: 66).

Approaches that impose ground rules for talk are called into question by Lambirth (2006) on the basis that they may contribute to feelings of alienation and that rather children’s ‘talk repertoires need to be respected and utilized as genuine and valid forms of effective communication’ (p.69). Mercer (2004) who has led much research in this area counters this view: ‘providing children with ‘rules’ for talk may seem constraining, but if children agree ground rules and then implement them, this can represent a kind of freedom’ (p.375). Howe and Mercer (2007) explored the potential impact of children’s social histories on the quality of talk taking place during collaborative group work and it was recognised that the social experience of these children outside of school provides impacts on their use of ‘language as a tool for reasoning and learning in school’ (p 14).

Social and emotional aspects of group work
The positive emotional and cognitive effects of shared responsibility observed within group problem solving situations have been proposed to result from ‘the thinking load’ being ‘distributed among the members, with both cognitive and emotional consequences’ (Brown and Palinscar, 1986: 17). For example shared responsibility for thinking has been found to result in reduced anxiety in carrying out activities. Research carried out by Gillies (2003) identified social skills that contribute to effective collaborative working, for example active listening in which the ideas and
perspectives of others are acknowledged and considered and the ability to resolve conflicts positively.

Bandura (1977) developed a theoretical model related to the impact of self-efficacy expectation on task outcomes. Self-efficacy expectation is the belief by an individual that they can successfully carry out necessary behaviours that are necessary to produce successful outcomes in a task. This model proposes that self-efficacy beliefs influence people's decision-making and behaviours, for example whether they will even attempt a particular task. ‘According to Dweck’s social-cognitive model of motivation, differences in the way individuals approach achievement situations are linked to the implicit theories they hold about their intellectual ability’ (Robins and Pals, 2002: 314). Robins and Pals (2002) carried out research to find out if this model applied to ‘real-world’ contexts through studying behaviours of college students and discovered that implicit self-theories impacted on:

- goals that individuals decided to pursue
- emotional and behavioural responses in situations that were academically challenging

Collaborative working may result in social gains such as ‘increased self-belief, internal attribution for success, and consequently self-regulation of subsequent learning behaviour’ (Schunk and Zimmermann, 1994; Topping 2005: 641).

Mercer (1996) describes learner-learner interactions as ‘more symmetrical’ than teacher-learner interactions. Topping (2005) identifies the affective component of peer-assisted learning identifying the significance of power relationships ‘a trusting relationship with a peer who holds no position of authority might facilitate self-disclosure of ignorance and misconception, enabling subsequent diagnosis and correction’ (p 637). In contexts where adults are working with children the issues of compliance and pseudoconsensus need to be considered (Brown and Palinscar, 1986). However peer groupings do not guarantee equity in power sharing within groups as the social status of individuals in the group will affect power relationships. ‘One member of the group must not be so dominant that the result is pseudoconsensus, with a weaker child giving way to a dominant one without considering an alternative view (Russell, 1982, cited in Brown and Palinscar, 1986: 31). Mercer (1996) found that the most successful paired collaborative interactions took place the more evenly the decision-making process was shared.

Roles in group work
Maloney (2007) analysed observed behaviours of children working in groups and used these to develop a classification of roles adopted by the children. These were grouped into positive and negative roles depending the extent to which they contributed to collaborative working:

Positive roles:
1. Chair – coordinates the work of the group asking for contributions and directing discussion, providing suggestions for action
2. Discussion manager – responsible for decision-making within the group relating to directing action
3. Information manager – checks on aspects of tasks and considers validity of evidence
4. Promoter of ideas – comes up with ideas (not responsive to the ideas of others)
5. Influential contributor – interprets data and responds to the ideas of other group members with questions and challenges

Negative roles related to behaviours such as: not being sufficiently forceful to get their own ideas considered or in challenging decisions; lack of contribution; and distraction of the group form the task.

Maloney identified the role of Chair as particularly important for the success of the group as they facilitated formation of links between group members and enabled the group to engage with the task. However the most effective group was found to be one in which had the highest number of Influential Contributors, the role associated with challenging of ideas presented by others. In the classification of talk episodes proposed by Mercer (1996) the exploratory talk, which involved the highest level of cognitive demand, was characterised by constructive challenging of ideas. Barnes and Todd (1995, cited in Alexander, 2003) identified the absence of prior roles and authority by right as a feature of small group discussion where high quality talk or dialogue was observed. Brown and Palinscar in a review of research found that in some groups roles were fluid and could be adopted by different group members at different times, whereas in other groups they were fixed.

**Significance of task design**
In a review of literature carried out by Howe and Mercer (2007) it was concluded that the nature of the activities is important for collaborative activity to be productive. Features of activities that were found to promote effective collaborative interaction:

- the activity must facilitate exploration of different perspectives
- the design of the activity should explicitly require input from several individuals for it to be completed successfully
- the level of challenge of the activity should be appropriate to engage children (the point was raised that many tasks in school are too easy for children and therefore they do not need to put in much effort or gain any satisfaction from completing them)

Prescriptive design of the activity has been found to have a negative impact on the quality of verbal interaction during collaborative group work:

...students asked mainly procedural questions when the assigned tasks required them to follow given instructions and step-by-step procedures, and this did not engage them at high cognitive levels. During such activities, most
of the verbal interaction consisted of procedural and observational rather than analytical, conceptual or metaconceptual statements.

(Chin et al., 2002: 543).

Brown and Palinscar propose that ‘only when a child has a partial grasp of the concept in question will peer interaction be effective’ (1986: 31). This has implications for the level of cognitive demand of tasks used as a context for collaborative group work.

**Composition of groups**

Lambirth (2006) reviewed research which identified factors influencing the level of learners’ motivation and interest and these included:

- personality
- social background
- historical relationships

Howe and Mercer (2007) carried out a review of literature into peer interactions and found that ‘friends are more likely than non-friends to engage in interaction where knowledge is shared, ideas are challenged, evidence is evaluated, and opinions are reasoned about. As a result friends are more likely than non-friends to succeed with the task’ (p.13). It is however important to consider the criteria for identification of friendship groups and that popularity rather than relationship could be a factor. In this case intrinsic factors influencing popularity of particular children could be correlated with their ability to engage in exploratory talk.

With regard to the ability of individuals in a group, the research findings of Mercer found that similar ability groupings were more effective in promoting the learning of pairs of children than ‘those in asymmetrical pairs. Working with a more knowledgeable and capable partner who dominates decision making and insists on the use of their own problem-solving strategies may hinder rather than help the less able’ (1996: 361).

**Methodology**

Studies into collaborative learning have been classified by Mercer (1996) into two main groups:

- Experimental approach where intervention is carried out and impact on the quality of interactions taking place during group work (usually in problem solving contexts) is measured
- Analysis of observations of the interactions taking place during collaborative activity – particularly the talk

In an experimental approach certain assumptions have been made regarding the nature of the interactions and a hypothesis developed regarding what ‘works’ in an
attempt to isolate variables in what is a complex situation. This approach could result in significant aspects being missed. Therefore as a consequence of the complexity of the interactions taking place in collaborative group work, it was decided to use unstructured observation as the principal method of data collection in this current study to gain insights into the range of different factors interacting and contributing to the quality of the talk in normal classroom settings. The form of observation chosen was participant observation and the extent of researcher participation in the group interactions varied depending on the context.

The selection of the classes and activities were predominantly dependent on opportunities available for observation of collaborative group work. This was difficult to negotiate as it appears to be used relatively infrequently in schools. A total of 10 observations were carried out in three different schools, comprising a total of 15 hours of observation time. Tape recordings were made where possible, however in some contexts the activities involved too much movement to make this viable. In all cases detailed field notes were taken. The aim of this paper is to analyse the observed interactions taking place which contribute to collaborative learning, making links to theoretical perspectives from a wide range of related areas of research.

**Analytical framework**

The aim of the analysis is to facilitate exploration of the behaviours and interactions taking place during collaborative group work in science to identify factors that contribute to or inhibit development of concept understanding through:

- Use of categories developed by Mercer (1996) to focus semi-structured observations with the aim of identifying different levels of cognitive demand in talk episodes taking place during collaborative group work in science based. Mercer’s approach makes it possible to assign the discourse to one of three levels of cognitive demand, namely disputational, cumulative or exploratory talk, based on the extent to which co-construction of understanding is taking place during talk episodes.

- Analysis of transcripts of talk episodes using a framework developed as part of this research project focuses on identifying the types of behaviours and interaction taking place within the collaborative learning experience. Using this approach it is then possible to explore the relationship between the observed behaviours and interactions and the level of cognitive demand of the talk.

**Discussion of findings**

A framework for categorising the factors which impact on the quality of talk within collaborative group work was devised through analysis of the observation data to identify factors which impacted the quality of observed talk. The criteria devised by Mercer (1996) were used to determine the level of cognitive demand within the exchanges and to identify instances of exploratory talk.
Framework for analysing collaborative group interactions

The factors which have been identified as contributing to the potential for exploratory talk within collaborative group work:

- Reaching consensus
- Shared goals
- Ground rules for talk
- Self-efficacy and perseverance
- Roles in the group
- Task design
- Social and emotional factors
  - Social skills
  - Power relationships
  - Impact of competition on collaborative working
  - Valuing contributions
  - Composition of groups: significance of friendship groups

Analysing the nature of exploratory talk

Scaffolding vs Co-construction

Scaffolding

Transcript 1: Reception - Constructing a boat

Three boys had been working for approximately half an hour constructing a boat to carry pirate treasure out of junk modelling materials. At this stage they were still deciding what would be best to make the base of the boat out of.

B1 Shall we try this out? [Picks up the shoe box lid]
B4 [Who had previously been working on a computer nearby came up and observed] That [pointing to the shoe box lid] will sink..... it’s cardboard [then walks away]
B1 We need this so it definitely won’t sink [Picks up a plastic ice cream tub lid and puts the shoe box lid inside it]
B1 Shall we try this one out? [B1 puts it in the water] Now get it out [urgency in his voice]
R Why do you need to get it out?
B1 It will get all soggy. [Some water had gone over the edge of plastic lid and the cardboard lid was getting wet].
B2 We’ve done something wrong [none of the others follows this up]
B2 I’m going to make a boat that sinks [puts a sheet of paper in the water]
All three boys watch it sink
B3 I’m going to make a boat that floats [B3 puts the ice cream tub lid with the shoebox lid inside and places the wet paper over this. The other two boys watch with interest as the paper now floats.]
The three boys now move onto another activity.

Commentary
The comment from B4 provided the group with information about a factor influencing floating and sinking: that cardboard is not waterproof. B1 subsequently adapted the design of the boat so that a waterproof object was used as a barrier between the water and the cardboard shoe box lid. B3 then applies this principle further with the paper towel.

**Transcript 2: Year 3 - Making switches**
Excerpt 1 is taken from the activity in which the group were making a switch from a folded card with two pieces of foil:
G1 OK I put a light in there....It doesn’t work [laughing].
B It doesn’t work!!!
G2 We needed a battery...we forgot about that.
B You don’t need one here.
G1 Are you sure?
G2 How are you meant to light it up without a battery?
B But it doesn’t say nothing here [looks at the diagram – which only shows the switch not the circuit the switch needs to be attached to]

Excerpt 2 is taken from the activity which followed on from Excerpt 1, in which the group made a switch out of a peg with pieces of foil attached to each end
B I’ll start getting the wires.
G1 We need something to clip onto this [pointing to the end of the peg which is too large for a crocodile clip]
B How are you supposed to put the battery in?

**Commentary**
It can be seen that G2’s interaction with the boy in Excerpt 1 was effective in scaffolding his learning and in the subsequent activity he recognised the need for a cell in the circuit.

**Cumulative talk – a form of scaffolding?**
**Transcript 3: Reception – Rescuing a bear**
Context – the teacher reads a story ‘The Bear and the Scary Night’ in which a toy bear falls into a pond and is rescued by a man using a trombone. The children were asked to find other ways to rescue the bear.
G1 How about if we make a net?
G2 We could put a net on this piece of string. [G2 ties some string around the opening of the net but this causes the opening of the net to close]
R [To G2] If my hand is the Teddy – how will the net catch it? [Trying to help her to realise that the net needs to be kept open]
G2 We could tie that [pointing to a pipe cleaner] around the net.
G1 G2 you could thread these through [G2 starts threading a pipe cleaner through the holes around the opening which stops the net closing]
**Examples of co-construction: exploratory talk**

*Transcript 4: Reception - Sorting animals*

Three girls in a Reception class are setting up animals in stables when the researcher arrives – they are engaged in fantasy play.

R Can you help me to sort these animals? *There is a farm outline with pictures of different parts of a farm, including different kinds of field*

G2 The sheep can go there *identifies a part of the farm outline near the pond to put them in*

G3 No that’s where the pond is.

G2 I know where they can live – in the muddy part. *There is a muddy field in the farm outline*

G3 No the pigs go there.

G2 But the pigs might fight with the cows

G1 I’ve got an idea G2…How about the cows go on that side and the sheep in that side *G1 puts a piece of fence across the field*

*The girls proceed to put cows and sheep on different sides of the fence

**Commentary**

G3 challenges the ideas of others
G2 also challenges ideas and provides justification for the challenge e.g. ‘the pigs might fight with the cows’
G2 finds solutions to the problems raised by G3
Consensus is reached

*Transcript 5: Year 3 – Rolling shopping*

This example of exploratory talk was observed in a Year 3 class with a group of two girls and a boy working on a fair test investigation to find out which type of shopping would go the furthest. At this point in the discussion they are deciding on their prediction. The references to the pirate relate to a small toy pirate on a stick which one member of the group (the boy) had noticed in the room and asked the researcher if they could pass it around using it like a microphone so that it was only possible to speak when holding the pirate.

G2 I think beans because its smooth and soft so I think it’ll go further

G1 puts hand up and G2 passes the pirate

G1 I think nutmeg because its more circular – like there and there

B puts hand up and pirate passed

B I disagree with that because its a bit bumpy on the sides *referring to the nutmeg container* I agree with C because that just has a flat surface *meaning no bumps and referring to the baked bean tin*…that’s bumpy *pointing to the nutmeg container*

G2 I agree with B because if you look right at the bottom it’s got bumps and it might stop it going a bit further

G1 I’m going to join the baked beans now

**Commentary**
This exchange has the characteristics of exploratory talk (Mercer et al., 2004; Rojas-Drummond and Mercer (2003); Mercer, 1996), with B presenting a constructive challenge to the idea of G1, and all of the members of the group gave a justification for their ideas. Also the group reached a consensus decision based on the evidence presented.

Factors contributing to exploratory talk

Reaching consensus

In a brief interview with the children from Year 3 who carried out the fair test into the distance shopping would roll the children themselves recognise the need to come to a consensus and how this supports learning.

Interview 1

G1 I think that when we've got talking partners they don't work as well. But today we've worked as a team and decided all the stuff together.

R Do you think making decisions together is important?

All Yeah.

G2 Because it's important to do it together because then you can finally get the right answer together because when you work together you'll finally discover that one of...say G1 were right and I were wrong I might agree with G1 and that might be the right answer.

R Do you think by talking about things you might get to a better answer?

All nod

G1 Well I think that we actually worked better than we normally do because we actually tried our best and we agreed and we wasn't going aw...but...and not joining in.

The importance of exploring different viewpoints until ultimately a consensus was reached was identified as significant by the Year 3 children interviewed. They recognised that this process was a means of helping them learn,

Shared goals

The significance of having a shared understanding of what the participants were trying to achieve through the activity was identified by Barnes and Todd (1978) as contributing to the effectiveness of collaborative learning.

Transcript 7: Reception – Rescuing a bear

B3 Creates a design to rescue the teddy consisting of a piece of elastic made into a loop and held by a split pin – this is to go around the bear. The threads a pipe cleaner through as a means to move the elastic loop through the water.

B1 is sitting next to B3 attaching a piece of string to a plastic food tray.

R What's it for?

B1 So when we rescue Teddy we can put him in it.

B1 goes to another part of the room look for some more materials, during which time B3 takes his own construction together with the plastic food tray which B1 is working on to the water area to try it out.
B1 [Returns to the construction area and looks for the plastic tray – he is very concerned] Where’s the boat gone?  
B3 [calls across from the water area] I’ve got it  
Commentary  
R questioned B3 to find out if he understood the purpose of the plastic tray – he is able to explain clearly its function. B1 had conveyed his ideas to B3 during the activity when the R was with another pair – B3 showed his commitment to the idea by taking the plastic try together with his construction to the water area.

Transcript 8: Nursery – Creating a beach  
Two children are playing together in the sand (a boy and a girl. They are cooperating getting sand out of a bucket, each using their own spade and putting it onto one of two pieces of wood that run across the top of the sand tray.  
The girl moves down to the other end of the sand tray and starts doing the same on the second bridge.  
B Get the dinosaur out [a small dinosaur was in the one of the spades of sand the girl put on the bridge].  
The girl hands a trowel to the researcher for her to join in and help.  
B What’s that? [Another object appears on the girl’s bridge]  
G A stone.  
B Why is it there?  
G I don’t know.  
Two other girls come along and watch.  
B Take all that off now [indicating to G to take all the sand off her bridge – B comes along and helps by tipping it up. B does the same to his bridge].  
The new girls start putting dinosaurs on the bridge.  
B Don’t put dinosaurs on, we’re making a beach.  
The two girls leave to play with another activity.  
B [To the original girl who was playing in the sand] You do that one and I’ll do this one.  
By this time the two children have been engaged for over half an hour on this task.  
Commentary  
In this activity the boy and girl who were playing together initially in the sand had a clear shared purpose for the activity. It was not possible to discover how this purpose was originally established, however both children were very committed to it and showed high levels of perseverance. The two girls who came along to join in were not discouraged from doing so by the two children already working in the sand, however the boy attempted to impose the original purpose of the play onto the girls. Rather than engaging them in the activity this resulted in them leaving to do something else.

From the observations presented the significance of shared goals is apparent. A factor that Mercer (1996) found to influence the level of collaborative interaction in
experimental conditions is the extent to which learners ‘have to communicate and collaborate to solve a problem rather than simply being allowed to do so’ (361).

In the examples in the nursery there has been communication of the goals of the activity in a way which the initiator of the activity has motivated the other participant to engage actively in the activity. Further questions that need to be explored:
- Why are shared goals important?
- In what ways do children communicate these to peers?
- Are peer initiated goals more effective at motivating learners than teacher initiated goals?

**Ground rules for talk**
Mercer (1996) identified two levels at which talk could be analysed:
Linguistic level – content, structural features and function of the talk
Psychological level – relates to the ground rules the speakers appear to be following, how the speakers interact, the extent to which the focus of the discussion reflects their interests and concerns, the level of reasoning within the exchanges.

Ground rules for talk were established in one of the schools visited as part of the research where two different groups were observed carrying out a fair test in two consecutive lessons in a Year 3 class. Below are the talk partner phrases which were encouraged during collaborative group work, together with a list of success criteria for children to apply to evaluate the effectiveness of their interactions. The use of these will be analysed and potential factors influencing their effectiveness in promoting high quality talk will be discussed.

**Talk partner phrases:**
- I would have preferred if
- Don’t you think it would have been better if...?
- I disagree with that because...
- I think ....because....
- What do you think...?
- Perhaps a better way would have been...
- It makes it seem...
- It seems to me that...

**Success criteria for talk partners:**
- Use helpful words and phrases
- Look interested and don’t get put off
- Be clear about what you mean
- Take turns with your partner
- Only talk about the question / activity
Analysis of talk episodes was carried out using indicator words identified by Mercer et al. (2004) as being present more frequently in exploratory talk: because; if; I think; would; could.

The incidence of these words was analysed in both collaborative interactions.

The first group that was observed consisted of two girls (G1 and G2) and a boy (B). One of the girls (G1) dominated the discussion by taking on the role of coordinating the discussion by reading out the sections from the planning sheet and also acting as scribe. This role was not negotiated, rather the child pulled the planning sheet next to her when the group arrived at the table. There was evidence of some of the talk partner phrases being used (see also transcripts 16 and 18 for example talk excerpts). The phrase used most frequently was: ‘I think (that)...’

This was used 19 times in total with 13 of these by G1 and 6 by B. However most of these instances were merely a repetition of the wording of the prompts on the planning sheet.

The other talk partner phrase used was ‘What do you think...?’

This was used 7 times in total, each time by G1.

None of the phrases designed to foster exploration of alternative ideas by demonstrating disagreement was used, however G2 did put forward an alternative view to G1 over the number of people who should be involved in carrying out the different kinds of exercise.

G1 also adapted the phrase ‘I think that...because...’ designed to promote justification of views:

‘I agree with that because running is faster.’

This was in response to G1’s prediction that running would cause pulse rate to go up more than walking or jumping.

Analysis of indicator word use identifying the number of times each word or phrase was used:

- because 5
- I think (that) 19 (however mostly repetition of phrase on planning sheet)
- if 5
- would 2
- could 1

The second observation carried out with a different group of children from the same class was also in the context of a fair test investigation. The talk was at a higher level than that in the first observation and was characterised by examples of exploratory talk. In this activity the teacher allowed the group more flexibility in the decision making and the researcher intervened at points in the discussion. During this observation there was relatively little use made of the talk partner phrases.
established within the class, other than in an exploratory talk episode (see transcript 5).

Analysis of indicator word use identifying the number of times each word or phrase was used:

- because: 15
- I think (that): 13
- if: 10
- would: 1
- could: 4

It is interesting to note that there is clustering of these terms in the more cognitively demanding talk episodes, particularly the exploratory talk episode and two other exchanges that had some of the characteristics of exploratory talk, namely challenging of the ideas of others and justification of viewpoints. The use of ‘because’ was associated with justification of viewpoints.

From the two observations carried out in this Year 3 class it can be concluded that use of the talk partner phrases and establishing other ground rules for talk were not necessarily associated with cognitively demanding talk. Other factors were found to influence the quality of the talk, particularly the roles taken on by group members and interplay power relationships. Indicator words ‘because’ and ‘if’ were found to be effective indicators of exchanges where elements of exploratory talk, such as challenging of the ideas of others and justifying viewpoints.

**Self-efficacy and perseverance**

*Transcript 9: Reception – Constructing a boat*

Two girls are working together to construct a boat. At this stage in the observation the boat consists of the top of an egg box with some other bits of junk modelling material inside. G1 puts the boat that she and G2 have constructed into the water. They watch as it soaks up the water and becomes waterlogged.

G2 We’ve got water in ours.

R Why did it get water in?

G2 It wasn’t strong enough

G1 We have to try again [At this point G1 has been working on this activity for almost an hour – for half an hour she worked alone and then G2 joined her].

**Commentary**

G1 held the belief that she was able to achieve success in the activity if she persevered and this caused her to continue despite the first boat becoming waterlogged. This episode demonstrates a link between self...

*Transcript 10: Reception – Rescuing a bear*
G2 Cut this [holding the cardboard tube from a paper towel]. You could put some string in this then. [G2 cuts the cardboard cylinder into a complex shape so that there is an open end that forms a type of scoop]

They also engage in making a net to rescue the bear and attach the net to one end of the paper

G1 pushes the net towards the bear using the cut paper towel holder – but the net keeps closing. Eventually she turns it around and uses the cut paper towel holder as a scoop which works immediately. The teacher discusses what has happened with the girls and this helps them to verbalise the problem of the net closing. They then go away and try to find a solution.

Later on in the activity after modifying the net G1 picks up another cardboard cylinder (paper roll towel holder). A boy working in a group nearby is observing G1.

B I know that we definitely couldn’t use that.
R Why?
B It goes all soggy.

G1 discards this and picks up the net with the plastic container inside, then places some cloth inside that. G2 suddenly leaves at this point and goes to join in with another activity.

**Commentary**

G2 created an effective design for the cardboard tube which enabled her to successfully rescue the bear earlier on in the afternoon. The only problem with this was the material which soaked up water and meant that the tube could not be reused. After that the two girls worked together to improve the other part of the design involving the net. The comment by the boy from the other group inadvertently calls into question the effectiveness of G2’s earlier design. The most significant factor found by Bandura (1997) to improve self-efficacy was ‘mastery experiences’ in which learners experienced success in dealing with specific challenges. Therefore this negative experience is likely to have impacted on G2’s self-efficacy. Self-efficacy has been found to correlate positively with effort (Palmer, 2005) and the comment has an immediate impact on her level of intrinsic motivation and she does not carry on any further with the activity.

**Roles in the group**

*Transcript 11: Year 3 – Making switches*

Three children (two girls and a boy from Year 3) were observed creating different kinds of switch in a simple series circuit. In this part of the activity they were making a switch from a piece of folded thin card with two pieces of foil attached to two ends of the card – when it was folded the switch was closed.

B Where’s the paper? [Finds a piece of thin card]
G1 [Looks at the diagram of the switch provided then gets a piece of foil] You need to hang that (piece of foil) onto there (end of the card)
G1 We need a wire [picks up a wire with a crocodile clip]
We need another wire too [picks up a wire with a crocodile clip] Then we get the wires. What are we supposed to do next?
G1 We have to clip the other one onto there
B No...no!
G1 Yeah you clip them up there [pointing to the pieces of foil folded over the ends of the card].
B attaches the crocodile clips.
G2 Then we put a light in here.
G1 OK I put a light in there....It doesn’t work [laughing].
B It doesn’t work!!!
G2 We needed a battery...we forgot about that.
B You don’t need one here.
G1 Are you sure?
G2 How are you meant to light it up without a battery?
B But it doesn’t say nothing here [looks at the diagram – which only shows the switch not the circuit the switch needs to be attached to]
G1 I’ll connect this one to this thing [attaches a crocodile clip from one side of the foil on the switch the a terminal of the cell]
B This is hard isn’t it. How are you supposed to put the battery in?
G2 Puts crocodile clips onto both pieces of foil. Now the circuit is joined up with a switch and cell but no bulb.
G1 We haven’t got a bulb.
B Connects the bulb with another crocodile clip onto one of the pieces of foil on the switch – however it is not connected into the circuit with the cell] How are we supposed to do this then?
G1 But it isn’t lighting
G2 This one ....you take it out [takes a crocodile clip off one of the terminals of the cell and connects the bulb to this terminal with another wire]
G1 I don’t think it’s going to work.
B Closes the switch and the bulb lights.
G2 It’s working...it’s working!!!

Commentary
B took on a monitoring role with a commentary on the progress of the group. Also he carried out much of the practical implementation.
G1 interpreted the diagram for the others and gave them directions from this.
G2 took on a problem solving role and was able to identify why the circuit was not lighting - G2 had the strongest subject knowledge.
The roles were spontaneously adopted by the members of the group and were maintained in the other three activities observed.

Analysis of 'Transcript 16: Year 3 - Pulse rate' was carried out through application of group roles proposed by Maloney (2007) to the discussion : G1 – took on the roles of chair and discussion manger
B – the closest match to the behaviours exhibited by this child related to the role of discussion manager, as he did focus on decision making in relation to practical elements of the task, however was G1 was more dominant in this role

G2 – had the characteristics of an influential contributor’ as she was able to present challenges to G1’s ideas and to justify her own ideas.

A significant characteristic of exploratory talk (Mercer, 1996) is constructive challenge of the ideas of others. Although the exchanges that took place during this collaborative activity did not reach the level of exploratory talk, it is G2 who made the greatest contributions towards this. The main cause of this was the imbalance of power relationships within the group, with G1 dominating the discussion and decision-making.

**Task design**

Two observations were carried out on two consecutive weeks in the Year 3 class where the children were required to carry out a fair test. In the first lesson the teacher provided a great deal of structure to the lesson and talked through the investigation in detail with the class. This had an impact on the potential of the activity for promoting cognitively demanding talk, as it limited the possibility for decision making in the design of the investigation to the selection of alternatives that had already been discussed. The following excerpt illustrates the level of interaction taking place:

*Transcript 12: Year 3 - Pulse rate*

G1 I think we should put what we want to find out.
B I agree with that. If you put that down then we'll know what we want to find.
G1 W what do you think?
G2 I agree with that. Then we can find out about what’s your favourite type.
G1 Writes on planning board saying the words out loud ‘Which exercise shall tire Nora.....
B What you writing?
G2 Which exercise shall tire Nora out?’
G1 What do you think we shall use? ..[no response]..What do you think we shall use?
B I think if we get a fast runner
G1 I think we should use a playground
B Yeah I think we should use a playground...then change running to jumping

A second observation was carried out in the same class the following week. The context for this investigation was a story from Discovery Dog and the children were required to find out which item of shopping would roll the furthest. No prior input was given regarding the variables or how the investigation should be carried out and the excerpt below illustrates the difference in the quality of talk:

*Transcript 13: Year 3 – Rolling shopping*
G2 We'll measure which goes the furthest [Write this down]
G1 We'll drop the item and see which one....
B from the same height....but if you drop they they'll bust
G2 I know
B I'll just roll them down
G1 or just drop them
B I wouldn't drop them if I was you
G1 I'd just let them fall..But then you're cheating...because that platform was straight
[the floor shown in the story]
B I say we just roll them
G1 I think we should drop them because they dropped them [in the story]
R Does it matter if we don’t do it exactly the same as in the story.
B No not really ...you can just roll it...because if you drop it then you might smash it if it's glass like that
G2 If you were at a hill you could like B said put it on its side and let it roll

Social and emotional factors
Social skills
Transcript 15: Reception = Rescuing a bear
A boy, who for the purpose of this analysis will be called Tim, was observed working on the activity in the Reception class involving trying to rescue the bear.
B Is not engaging with any of the materials or the other children and is sitting on the floor looking worried.
B [To R] Can I stop doing this now?
R Yes. Do you want to find something else that you would like to do?

When asked about why he did not want to carry on with the activity Tim stated that he didn’t know how to make a trombone (which is what was used to rescue the bear in the story). However further evidence regarding why he did not engage in the collaborative activity came during a separate observation during outside play pointing to difficulties engaging appropriately with the other children. Tim was observed chasing another boy who was responding negatively to being chased. However Tim was unable to interpret the boy’s responses and persisted happily, completely unaware that the other child was not happy, until the other boy complained to a teacher. Throughout the rest of the outdoor play Tim did not manage to successfully integrate into any of the other group activities. From this it can be concluded that Tim has not developed social skills to the level needed to interact positively with other children during play. Tim’s lack of engagement with the other children during the activity with the bear could therefore be attributed to his poorly developed social skills. Training in interpersonal skills was identified by Gillies (2003) as significant in facilitating effective learning through collaborative group work. These included listening to others, providing constructive feedback, encouraging contributions and actively attempting to understand the views and perspectives of other.
**Power relationships**

*Transcript 16: Year 3 - Pulse rate*

Prior to this exchange G1 and G2 had been presenting their different viewpoints regarding whether all of the group or only one person should do the exercises. The previous discussion had ended with G1 just writing down her view onto the planning sheet under ‘What we shall do..’ The issue surfaces again when the group reaches the fair test heading:

G1 I think it would make it fair [reading from the planning sheet] ...by everyone actually doing the same thing...and it would make it fair if all of us do it someone one at a time then someone else. What do you think?
B I agree
G2 nods – looks discouraged and by this time has given up trying to put her viewpoint across
R Are you supposed to all do it?
G2 The teacher said only one person is supposed to do it.
R Are all three supposed to do it?
G2 No only one is supposed to do them all

Commentary

Brown and Palinscar (1986) identified the potential for pseudoconsensus to be arrived at if one individual is stronger in a group. In this example G1 is the most powerful and has used various strategies to assert this control. The result is that G2 eventually agrees with G1’s idea that all members of the group should carry out the exercise rather than just one person. However this agreement does not reflect a change in G2’s thinking, because later in the activity this issue arises again and when questioned by the researcher, G2 expresses her original view. Pseudoconsensus is damaging both to the process of negotiation within the group and to the self-efficacy beliefs of the individual whose ideas have not been properly listened to or discussed.

It is interesting to note that only certain talk partner phrases were used and only G2 made use of phrases which facilitated justification of ideas; also she did attempt to challenge the ideas of G1 however she did not utilise the talk partner phrases to phrase her arguments. This raises the issue that children who successfully learn the language of argumentation have the potential to exert greater power within the group.

**Impact of competition on collaborative working**

*Observation 17: Year 3 – Making switches*

B OK shall we stop it there [referring to the previous activity]?
G1 We need to do the next one.
B I’m doing the next bit [tries to take all the foil]
G1 Why aren’t you working with us? We’re working together.
B starts on the next activity by himself.
G1 He’s not working with us, he’s started the next activity.
B [Joins in again with the two girls] I’ll start getting the wires.

Commentary
In this exchange B was trying to get ahead of the other two members of the group and make the next type of switch on his own. G2 did not appear to be aware of this and continued to find materials to contribute to the group task, whereas G1 showed a high degree of insight into the impact of B’s behaviour on the effectiveness of the group as shown by here comment on this episode after the activity:
’It’s better when no one is arguing. ...when you all help each other and no one goes onto something different....so if someone’s got something wrong you can help each other.’
Howe and Mercer (2007) in their review of factors impacting on peer interaction, found that competition within or between groups reduces the effectiveness of collaborative interactions.

Valuing contributions
Transcript 18: Year 3 – Pulse rate
G1 I think we’ll change our exercise...and what we look like.
G1 Looks at G2 whose ideas she has ignored so far in the discussion.
G2 Yeah [in a resigned tone]
G1[speaking as she writes] We will change our exercise ..shall I put and our shape?
[starts to write again without waiting for a response - speaks out what she is writing]
and... our ...shape

Commentary
Lack of active listening by G1 resulted in loss of motivation of the other two group members. Also the responses of G1 to G2’s suggestions conveyed that her contributions were not of value. Significantly (see Observation 16) G2 was the most effective at engaging in the types of exchange associated with exploratory talk, and although the level of exchange did not reach this level for a variety of reasons, it was her contributions which were most likely to have facilitated engaging in exploratory talk.
In Howe and Mercer’s review of factors impacting on peer interaction (2007) an aspect of classroom climate that was found to impact on the effectiveness of collaborative interactions was the degree to which group members believed that their contributions were critical to the group’s attainment. Where this was the case they were more motivated and put in greater effort to the collaborative task.

Composition of groups: significance of friendship groups
Transcript 19: Reception – Building a bridge
Two boys are working together building a bridge. They had decided to work together as no constraints had been placed on choice of group.
R Why did you decide to work together?
B1 Because we can make it bigger.
R Why did you (B2) decide to work with B1.
B2 Because we are friends.
B1 We’re in different groups.
R Do you play together at playtimes?
B1 Yes.

Commentary
It is interesting that B1 thought it significant to mention that in ability grouped activities they were in different groups. Discussion with the class teacher revealed that she considers it important for children to have opportunities to work in friendship groups as well as ability groups. In the review of literature carried out by Howe and Mercer (2007) friendship groups were found to be more likely to succeed than non-friendship groups. Aspects such as compatible personality and sharing of common interests are potential factors that could contribute to the positive impact of friendship grouping on the effectiveness of collaborative interactions.

Summary of teacher behaviours that enhance the quality of learning

- Active listening facilitating asking of questions that relate to the child’s/group’s thought processes
- Careful observation and interpretation of the interactions taking place within the group before intervening
- Questioning to scaffold learning rather than ‘telling’
- Clear communication of expectations that children will work together and of how they should behave
- Following the children’s interests rather than directing the learning in a set direction to meet curricular objectives
- Helping children to identify and reflect on the nature of difficulties they are encountering
- Facilitating structured sharing of ideas for how to overcome difficulties
- Allowing sufficient time for children to complete an activity and facilitating return to this activity at a later date
- Enabling the children to identify different roles in the activity

Conclusion

Through analysis of the observations of interactions taking place during collaborative group work it was possible to identify factors that potentially have a significant influence on the cognitive level of talk episodes and these are summarised below.

- An important aspect of exploratory talk is challenging of different viewpoints and the attainment of consensus. The value of the process of reaching a
consensus was recognised by Year 3 pupils interviewed as part of this research.

- A fundamental aspect of effective collaboration was that group members had shared goals for the activity that they were engaged in. Further research is needed into the significance of goals developed by children themselves and how children communicate these goals to one another.

- A great deal of emphasis has been placed on developing ground rules for talk as a means of improving the quality of that talk (Wegerif, et al., 1999). It is proposed that the learners themselves should have a significant role in establishment of these ground rules: ‘…to place the responsibility in the learners’ hands changes the nature of that learning by requiring them to negotiate their own criteria of relevance and truth’ (Barnes and Todd, 1978:127).

- Self-efficacy has been found to have an impact on the level of engagement with an activity and the degree to which children persevere in the face of difficulties and challenges.

- Roles which children adopted in group work were related to their areas of strength and preliminary findings indicated these to be maintained in different activities. Application of the categories devised by Maloney (2007) to the analysis of one group engaged in collaborative interaction indicated the significance of the role of individuals who challenged ideas – which is a pivotal aspect of exploratory talk.

- Task design impacted on the potential for exploratory talk to develop within collaborative group work. Where there had been a lot of teacher direction this limited the possibility for the children to interact at a deeper cognitive level, which was reflected in the quality of the talk.

- Social and emotional aspects of group work were found to be particularly significant with regard to the successes of the interactions and the level of cognitive demand of the talk episodes.
  - Without appropriate social skills, children were unable to maintain the interactions needed for collaborative activity to progress.
  - Power relationships impacted on the potential of disempowered individuals to present their ideas effectively. Being able to use the language of argumentation was observed to enable individuals to exert greater power within the group.
  - Competition was found to have a negative impact on the collaborative interactions.
  - The significance of contributions of others being valued was shown in the episode where a child’s ideas were ignored, resulting in decreased motivation and loss of interest in the activity.
  - Finally composition of groups is important and children appear to work better in groups which they have formed themselves, therefore friendship is an important factor impacting on the quality of interactions.
It is proposed that these factors can be used as the basis of a framework to support practitioners in enhancing the development of the quality of talk during collaborative group work.
References


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