

Research Report

Enhancing Self-Reflection in Children: the Use of Digital Video in the Primary Science Classroom

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Abstract

This paper examines the use of digital video editing as a tool for encouraging self-reflection in children. In the context of this research, self-reflection is that type of introspective functioning and intentional activity that stimulates intellectual exploration of learning experiences. In particular, this research is keen to study how self-reflection leads to the development of new meaning in a cognate area - in this case in school science.

One underlying assumption to this work is that children learn self-reflection through creating a video-documentary of their own learning activities. The study uses digital video film-making as a means of creating an integrative science learning environment that focuses upon collaborative rather than individual activity. Children develop reflection both by exposure to ideas and through the shaping of an end product within a social peer-group setting. The film editing provides a unique platform for collaborative 'composition' of a visual text as the children address their films to real audiences (peers, teachers, parents). A second key assumption is that children can generate increased self-direction and motivation in science by, for example, thinking about their own learning through a video record of their own activities, and thereby develop a new sense of themselves as learners.

This paper discusses a quasi-experimental approach to 'real-world' research conducted within the ambit of everyday schooling, and analyses the reflective discourse of 30 children in one class, during collaborative science problem solving processes in a south London primary school.

1. Introduction

The present research is built on work in three main domains. First, research in the area of children's cognitive development and self-reflection; second, research on reflective thinking in science education and, third, a larger corpus of work that has explored various uses of technology assisted learning environments to evoke self-reflection.

The phenomenon of self - reflection - has been described by many as a process which is active, deliberate, conscious, internal, dialectical and goal-directed (for example, by Dewey, 1933; Vygotsky, 1962; Piaget, 1993; Johnson, 1991; Bandura, 1997; Moon, 1999; Clegg, Tan, Saeidi, 2002; Hmelo & Lin, 2000). In the context of this project,

reflection refers to the intentional activities that stimulate the intellect to explore learning experiences and lead to the development of new meanings.

The research in developmental psychology indicates that in late childhood (7 - 12 year old children) the child has the ability to learn from experience through self-reflection as a self-conscious activity (Yussen, 1985; Zelazo, 2000; Clark, Beck, Sloane, Goldsmith, Jenson, Bowen & Kehle, 1993). That said it is also difficult for children to reflect spontaneously. There is a clear need to build a particular learning environment as a way of stimulating self-reflection in children.

Knowledge of self-as-learner plays a pivotal role in the success of learning a particular subject domain (Dweck, 1999; Stein & Markus, 1996). Research findings demonstrate that self-reflection can help students develop understanding of science ideas. Many different methods for generating self-reflection in science have been explored through, for example, journals, portfolios and concept mapping as ways of encouraging students to reflect on their plans and past experiences (Pumntambekar & Koldner, 1998). However, these methods have mainly addressed secondary school and higher education students, and the research on cognitive tools to support self-reflection in primary classroom is very limited.

There has been a recent increase in studies that focus on the role of technology-based environments for encouraging self-reflection. These centre on the opportunity of interactive computer environments, such as simulations (Hartley, Ravenscroft & Williams, 1992), tutorials (Graesser, 2000; Wiemer-Hastings, 2000), collaborative computer games (Sedighian, 1997) and various kinds of instructional software as a factor in self-reflection. More recent support for self-reflection in young children has emphasised the use of analogue video editing as a way of provoking self-reflection (Forman, 2002; Zelazo & Boseovski, 2001). The findings of George Forman at the University of Massachusetts demonstrate that children are more reflective about what they have done when they explain what they are doing when revisiting video tape recordings (Forman, 2000). Nowadays the development of software for digital video editing enables even primary school children to edit short films with sound, titles and subtitles. The thrust of the research study conducted here is the belief that creating a film of one's own learning can be used as a cognitive tool for self-reflection in primary science classrooms. This method has many benefits compared to existing ways of generating self-reflection, i.e. increased self-direction and motivation, children's new sense of themselves as learners, and opportunities to share with others what they have learned. Such a technology-integrated science-learning environment has different characteristics from the usual physical environment and provides a different set of educational possibilities. It requires an approach that integrates technology into the curriculum, aligns it with student learning goals, and uses it for learning projects (Grabe & Grabe, 1996). This research explores digital video film making as a means of creating an integrative science-learning environment that requires collaboration rather than isolation.

The **overall aim** of this work is to construct a concept of child's self-reflection that takes account of theory but that can be applied practically as a technology-based cognitive tool

for encouraging student's self-reflection in a primary science-learning environment. The study explores a classroom science project-based system called " Filming in My Science Class".

2. Theoretical framework

This research focuses on the integration of internal maturational factors and external experiences in development of self-reflection. Much of this work is led by theoretical views, such as those of Piaget (1977) on the role of reflection or 'conscious thoughts' in the cognitive development of children. The study is conducted within a constructivist paradigm implementing an approach based on the theoretical objectives of coordination of constructivist and sociocultural perspectives. We seek to explore and explicate the relationship between the individual and sociocultural (understood as "mediated action") context in which it develops.

Self-reflection is associated with enhanced self-esteem and independence. The aim of this work on reflection is to increase the person's self-consciousness, improving the learners' autonomy not only in the learning process but also as a person. Motivating children to reflect is a crucial issue in learning. A key question is how to motivate young children to reflect. Piaget & Inhelder (1993) have pointed out that it is possible to engender in children an 'inner discussion' and that 'later on this inner discussion starts a kind of thinking over, or reflection' (Piaget & Inhelder, 1993, p. 217). Piaget has used the terms 'thinking over', 'reflection', 'conscious of the own thoughts' to explain these 'inner' arguments, conversations, and discussions within children. From the perspective of genetic epistemology, self-reflection is involved with sociocognitive conflict. This perspective, which is derived from Piagetian theory (Piaget 1977, 1970), emphasizes individual knowledge construction stimulated by internal cognitive conflict as learners strive to resolve mental disequilibrium. This is accomplished through individual or socially mediated discovery-oriented learning activities.

Jonassen (1994) describes the common characteristics in cognitive and social constructivism and argues that constructivist learning environments encourage thoughtful reflection on experience and support collaborative construction of knowledge through social negotiation. There is strong agreement among researchers (Dewey, 1933; Hmelo & Lin, 2000; Bielaczyc, Pirolli & Brown, 1995) that such a dialogue is a vital factor for self-reflection in learning.

A large body of research on promoting reflection looks at developing a learning environment for eliciting self-explanation. These researchers argue that explanation in collaborative activity has a powerful role in constructing new knowledge. For example, Bielaczyc, Pirolli & Brown (1995) found out that students can be trained to give self-explanations during learning and this training promotes improved understanding. Also, Bandura's (1997) study suggested that students do not spontaneously explain their thinking during the process of learning unless they are encouraged to do so. 'Thinking aloud' has been used over the past decades as both a mode of inquiry and a method of instruction. Little of this work, however, has been undertaken with young children.

For the purpose of this study 'self-reflective explanation' is defined broadly as a speaker's utterance, describing own beliefs, knowledge, self-estimations and self-perceptions, that calls forth responses by one or more participants during an exchange. The presented project involves an approach enabling children to share their learning experience with others. We believe that children learn not only by exposure to ideas and by thinking about them, but also by their social settings. Digital film editing provides a unique platform for collaborative 'writing' of visual text and students can address their films to real audiences who can respond instantly and who participate in the collective activity. This project examines whether this enhances self-reflection in children. In particular, this study examines the following questions:

1. Is the editing of digital video films about one's own learning activity an effective method for enhancing of self-reflection in 7 year-old children?
2. How does creating films about one's own science learning process affect self-reflective explanation in children's collaborative problem solving?

3. Research

The groups of children in this research are parallel equivalents and similar but not identical. The two groups (A and B) are two parts of a class in a primary school. Both groups contain children with very similar characteristics, the only difference is one group engaged in the project called "Filming in my science class". The other part of the class was engaged in other work and was used as the comparative group. The pre-test and the post-test with Group A and Group B consist of observation of children's group discussions as a means of exploring their reflective explanations, chosen to minimise intrusive effects. The comparison of data gathered at two different points of time allows for changes and progress to be measured.

The research was conducted in a primary school in South London. The chosen school is well equipped with appropriate PCs and software for digital video editing. The subjects of the research were 7-year-old children a Key Stage 2 Year 3 class of 30 pupils. The children were organized into two groups - 15 in the treatment group and 15 in the control group. The study commenced in April 2003 and has been continued for 5 weeks (for a long enough period for children to learn the new skills of video editing, and short enough to avoid to great a level of maturation. In the first and in the last weeks, pre-test and post-test observations were undertaken. Children's verbal communication and interactions during group activities in the science classroom were audio and video-recorded. The video recordings were carried-out in the first and last week of the experimental study. The video-recording transcript data were analysed through discourse analysis, focussing on five themes: 'learning', 'knowledge', 'science', 'collaboration' and 'project ideas'. All statements – reflective and not reflective - were analysed. The discourse analysis is used to clarify the ways in which children structure and maintain self-reflection during the learning process.

3.1. Data Collection

For the purpose of pre-test and post-test, two science sessions in a classroom were video and tape-recorded. The science unit of the National Curriculum was called *Unit 3E "Light and Shadows"* for the first session, and *Unit 3B (Year 3) Helping plants grow well* for the last session. After the teacher's instructions, the children worked in groups of six at five separate tables. Two teachers and two teacher assistants participated in the first science sessions and one teacher and one teacher assistant in the second.

At the start of each session, an audiocassette recorder was placed on each group's table. Two video cameras from two different view angles captured each group's discussion to provide a record of the events that occurred in the classroom. The use of different devices allowed most of the classroom discourse to be captured.

3.2. Treatment

The classroom projects, 'Filming in My Science Class', uses a constructivist approach. This is intended to enable children to successfully engage in self-reflection. It applies project-enhanced collaborative learning in technology-supported environments, which includes shared goals and joint construction of a knowledge base. The instructional approach of the science sessions was the same for the Group A and Group B. One session with children's experiments with light and shadows was video recorded. The recorded video film was given to the children as 'work print' files for editing into short films about their own experimentation in the science classroom. The children were told that the purpose of the editing was to produce a short film to show to family and friends what they had learned in science. It was to allow children to share their experiences and the way that they made meaning of their experiences. The digital video editing was undertaken in the computer classroom. During the sessions the children created film presentations with QuickTime Pro software: "Why I enjoy my science class?". Four ICT sessions were held:

1. Session One: Video revising of the recorded film by an analogue video player. Introduction of QuickTime Pro Player – moving markers, copying portions, pasting portion, saving a file.
 2. Session Two: Video revising of work print clips. Revising of 14 short Quick Time Pro video clips and choosing four of them for their own video film
 3. Session Three: Adding text (titles). Creating a title with Paint and pasting it into the film. Assembling clips in order and rearranging them
 4. Session Four: Presentation to parents in the computer room.
- The total length of each session within the study was forty minutes.

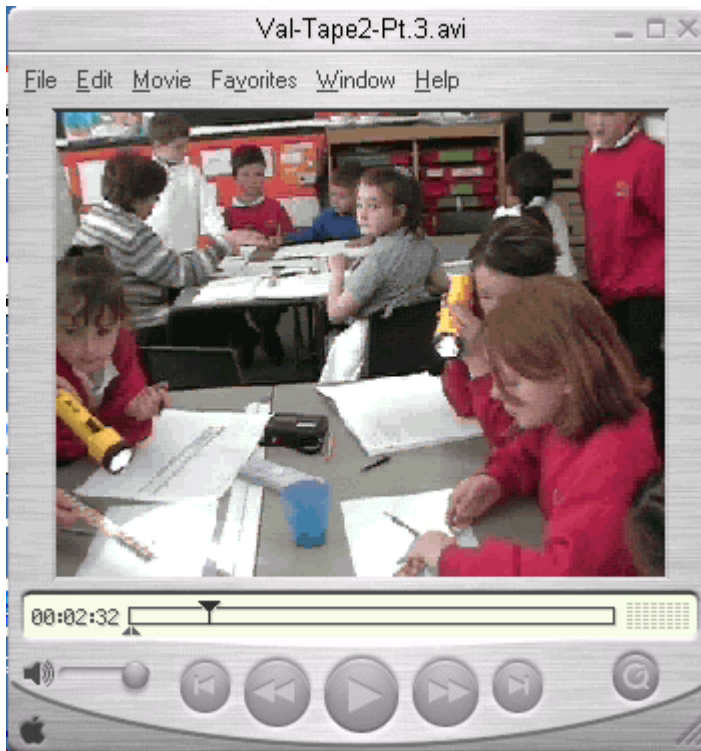


Fig. 1. Quick Time Pro Window

3.3 Outcomes

The children's talk, captured during the sessions, was analysed both qualitatively and quantitatively. 15-minute segments from recorded talk in the science classroom, segments that commence at the same time on each group's table, were chosen for analysis.

Additionally, ten recorded segments of ICT classroom discourse of 15 minutes each were analysed. All recorded data from video and audiotape recorders were coded and transcribed. Each transcript averaged about 3 pages per segment, approximately 30 pages for the science classroom talk and 64 pages of ICT classroom talk.

The coding system was created after transcription of the captured data. We agree with Lemke (Lemke, 1999) that visual media such as geometric diagrams or pictures must be portrayed statically, like writing, to allow re-inspection and re-tracking of arguments and body gestures and communicative movement. Visual signs for the observer also help in the representation of topological meaning. We believe that evaluating meaning-making through video recorded discourse can be analysed by an integrated code involving coding by two semiotic systems – speech and gestures. A modified version of McNeill's coding system (McNeill, 1992) was applied for analysing body motions.

Signal:	Meaning:
1. HANDS: DESCRIPTION IN 4 DIMENSIONS a) handedness b) shape of the hand c) palm and finger orientation d) place in gesture space 2. MOTION: DESCRIBE IN 3 DIMENSIONS a) shape of the motion b) place in space c) direction of motion	1. HAND: DESCRIBE ON 2 DIMENSIONS: a) what does the hand represent? b) what viewpoint is the hand representing? 2. MOTION: DESCRIBE ON 2 DIMENSIONS: a) what does the motion represent? b) what viewpoint is the motion representing? 3. BODY: what the body is representing, if it is representing a different entity from the hand or the motion.

Table 1. Code of body motions

Posture shifts were coded with start and end time of occurrence (duration). We divided the body at the waistline and compared upper body vs. lower body shifts. The motions that are a part of a gesture were not coded. The transcription conventions used are line number, indicating activities (1 for Science and 2 for ICT), The second number refers to the class session, the third number – to the table. The last number indicates the number of the utterance (for instance, 1.2.5.48).

Codes	Examples
Reflective talk:	
1. Reflection on goals.	<i>Look. I think that must be done.</i>
2. Reflection on actions.	<i>I can do that, I can do that.</i>
3. Reflection on activities.	<i>I am drawing.</i>
4. Reflection on knowledge	<i>No, my measurement is ok. H-m. At first we have to know how many place got there.</i>
Not reflective talk:	
1. Talk about the task:	
- Idea	<i>How to do that.</i>
- Tools	<i>Miss, this is broken.</i>
- Knowledge	<i>Why do you want me to do that?</i>
- Collaboration	<i>Sam not doing anything.</i>
-	
2. Personal talk	<i>Remember, your dad lost £30.</i>

Table 2. Speech code

3.4. Children's discourse in the Pre-test study

Interaction

Children are sitting on the tables close to each other. Four children – three girls and one boy are moving to other tables to communicate on personal issues. The conversation in the beginning is mostly between two or three of each group. The teachers and the teacher assistants try to animate the discussions and to clarify the task.

During their explanations children do not listen carefully. Their attention is on the material tools – lights, pens. After the first three minutes, children call the teachers for help. Obviously the task is not well understood by many of them. The students, who understand the task, do not describe it to those that ask for help. The task is discussed with short utterances:



Picture 2. A teacher assistant explains the task.

- 1.1.5.61. Flora. **You put it on the top of the stick.**
- 1.1.5.62. Eve. **What are you two doing? No, you don't. You put it on the bottom of the stick.**
- 1.1.5.42. Flora. **Put it there.**

They make some nonspecific short statements that are not related to the task. Generally one child will finish another's speech. The speech is very fast and the sentences often not finished. Usually short exchanges are following by pauses of between 5 seconds to 1 minute.

The cameras and tape-recorders were not hidden and children made comments on the devices in the classroom. The comments are negative, usually make in a whisper.

- 1.1.3.23. Talia. **Hay, there is a tape-recorder.**
- 1.1.3.24. Sam. **We know that.**
- 1.1.3.25. John. **We know. You don't need to tell her ' Thank you'. /'Her' is the researcher/**
- 1.1.3.26. Sam. **Look! There is one there and one there. A-a-nd there is one there.**
- 1.1.3.27. John. **Do you mind!**
- 1.1.3.28. Sam. **There is a tape recorder right next to you.**

The children on the table N 2, all boys, tell each other not to speak loudly because of the tape-recorder. Their conversation is not audible on those occasions when they want to talk about something important for them, out of earshot of adults.

Self-reflection in the pre-test

The results of the pre-test observation show that some students use reflection while others do not. Our finding demonstrates that the collaboration of 7-year-old children does not necessarily provoke self-reflection during explanation of possible ideas, beliefs or actions alongside other participant in the group discussion. These children avoided arguments when taking collaborative decisions. It is possible that, together with the age factor (the possibility that self-reflection is not a well-established cognitive mechanism in young children), the learning task is not challenging enough to engage them in self-reflection. The reflective statements of children are generally very short and not specific. The students mention that they experience interfering thoughts or emotions, but don't describe any action.

- 1.1.3.89. Ann. **I get bored.**

Or:

- 1.1.4.42. Gus. **I know that.**

Nevertheless students can recognize a need or gap in their knowledge about the goal of the project task. They can indicate some critical consideration about the components of the task, which is illustrated with the next example:

- 1.1.2.96. Barney. **I know you have the right number. Finish writing.**
- 1.1.2.97. Mike. **I've finished.**

3.5. Children's discourse in the Post-test study

Interaction

The children are sitting on 6 tables. The number of children per table is: 4,4, 4, 6, 6, 2. Four children are absent from school that day – one from the experimental group and three from the control group. The children in the experimental group are seated amongst

the children in the control group. All children are allowed to discuss the task and to exchange information. Five of them are moving to other tables for a short time during the observation.

The task is a pen and paper test – to review children's knowledge of plants as living things. Children's talk is generally personal. They do not pay much attention to the task and their talk mainly is on issues that are not very close to the test.

There is a significant difference in the way that children of both groups react to the video recording. It is clear that the presence of cameras influences the participants' behaviors and talk. The knowledge that the class is recorded makes the children of group A to behave differently than their classmates of group B. The cameras in the room give them a reason for self-regulation. They play a 'role' in front of the camera of 'good learners'. When the children of the control group wave their hands and say "hello" broadly smiling to the cameras, the participants of the "Filming in my science classroom" project look discretely to the camera possibly for some kind of assurance that it is recording. They try to demonstrate that they are being active when the teacher asks questions and how much they are concentrating on the task. Because all the sessions in the ICT classroom were recorded, as well the two-science sessions, children who participate in the video editing project had the opportunity to understand the features of filmmaking and the way that the video information is created. This "cameras effect" appeared after the second film editing session.

The coding of the discourse shows that the children who are involved in the project interact less than children of group B and their talk is less personal. This is an exchange between a child of group A and a child of group B:

- 1.2.5.72. Flora. **You can do the test.**
- 1.2.5.73. Jack J. **No.**
- 1.2.5.74. Flora. **O, my God!** / *Negative intonation!*

The follow extract illustrates a typical personal talk:

- 1.2.5.42. Hishma. **Hello. Nice to meet you.** / *A girl from table 4 is passing!*
- 1.2.5.43. Sam **Sorry.** / *Putting a small hat on Jack's head. Jack removes the hat /.*
- 1.2.5.44. Nick. **We can't stay all day because I've got to go to a wedding.** / *grinning!*
- 1.2.5.45. David. **What?** / *Gazing the children of the next table /*
- 1.2.5.46. Nick. **She's going to like you.**
- 1.2.5.47. David. **That's not funny.**

Reflection

Children are doing actions without a clear understanding of the task - the purpose of the task and the way to find the answer. They ask each other for help for better

understanding, or they are asking a teacher assistant to help them. The following examples are typical of the way children articulate their knowledge about the action of the task:

- 1.2.3.56 Miriam. **I don't know what I did.**
- 1.2.3.57 Liz. **You don't have to.**
- 1.2.3.58 Miriam. **We already worked this out.**

Their reflection focuses largely on the understanding of the task's actions. They can evaluate their actions but the understanding is not conscious. For example, a child claims in discussion:

- 1.2.4.63 Nick. **I know what I found out.**

When the other children ask him to explain, he can't construct an argument, can't point out what he found out. They can't articulate their reflection more completely and they are not able to share it. These examples do give a sense of the ways in which children reflect in response of questions of the other children.

4. Conclusions

The current body of research is a piece of study in progress. Nevertheless it indicates that making films about one's own learning process provokes changes of behavior in the classroom and may influence the sense of self-as-learners. Children may consider the importance of what they are doing in the class. The fact that the children engage in occasional reflective statements is encouraging.

The findings of the present study demonstrate that the self-reflective statements, which children use in their discussions in a science classroom, are mostly short descriptions of actions / reflection on action/. They avoid giving reasons for their statements despite asking others to do it.

The tasks of the observed science sessions weren't well structured. The coded discourse shows that the task's structure wasn't well understood by the children, and this could be one of the reasons for the lack of effective cooperation in the groups. For example, Webb (1989) proposed that the task structure has a powerful effect on the subsequent interaction. On the other hand, other researchers claim that tasks that are not well understood can motivate students to reflect (e.g. Pintrich & De Groot, 1990). Nevertheless, in the present study we found out that the lack of understanding of the task didn't encourage self-reflective explanation in 7-year old children.

Our next study will seek to examine in more detail the self-explanations during presentations to parents and friends as a prompt for self-reflection.

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