To what extent might role play be a useful tool for learning mathematics?

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The work discussed here forms the beginnings of my PhD research, investigating the mathematical potential of role play in a primary school where a role play area is chosen by the children from Reception to Year 6, and is assigned for mathematics. Currently I am collecting and analysing video- and audio-taped data collected as a non-participant observer in a Y4 classroom with two groups of childen of eight years of age. Susequent to each observation, selected video clips are reviewed with the children. The focus of my research is currently 1) whether there is there any identifiable mathematics happening; 2) the level of involvement of the participants; and 3) how what is happening relates to what else is going on in the classroom. Some broader educational themes are arising from the data and are outlined here, including the benefits and disadvantages of using video, reproposal, exploratory talk and the role of metacognition in learning mathematics.

Keywords: role play; visually stimulated recall; reproposal; metacognition; exploratory talk.

Introduction

I have been carrying out observations in a classroom in the town primary school within which I currently work, of seven 8-year-old children in the Autumn term of their Year 4, whilst engaged in dramatic role play designed to engage them in an independent mathematics task. The seven children have been identified by the class teacher as slightly below average in their mathematical attainment, as defined by National Curriculum attainment levels (DfEE 2000). For one hour each week, each mathematics group is divided into two smaller groups and timetabled for half an hour on a computer mathematics programme and half an hour in the role play area. In this way, every child in the class has an opportunity to work in a smaller group on the independent role play task.

Initially, potential mathematics tasks are discussed with the class and subsequently designed by the teacher as open-ended, with the opportunity to be differentiated by outcome. The task is often returned to later that week, or the following week, thus allowing the children to tackle some mathematics over an extended period, or engage in the task with the benefit of thinking or 'review' time, built in by the teacher each week.

The term 'role play' can encompass socio-dramatic play and fantasy play and incorporate plot and story lines. Garvey calls this play type 'play with social materials' (Garvey 1977, 79) and sees it as a reflection of a child's growing notions of their world. My working definition of role play is 'walking in another's shoes'. The subject area of my research straddles the pedagogy of mathematics teaching and that of early years. My area of focus is how play and mathematics might interact in a classroom. The mathematics curriculum as experienced by a group of children in a

primary school classroom at a particular point in time – what they do, what they say, their identities and perceptions. I am speaking from a social constructivist viewpoint, where learning is understood as social activity. This resonates with the approach to teaching mathematics integral to the Mathematics in the City initiative, a professional development collaboration between the Freudenthal Institute in the Netherlands and New York schools (Twomey Fosnot et al 2001a) where mathematics is taught by engaging children in active investigation of what they term 'realistic' problems.

Some methodological issues

Before recording these sessions on videotape I explained to the class that I was involved in some research to see if role play helped them do and understand mathematics. A couple of the children (C and Sc) have been particularly interested in what I am doing and have questioned me about what happens to the video tapes, who sees them and why I am writing down everything they say:

(In all excerpts that follow contributions are numbered consecutively from the beginning of the observation; [...] indicates missing or unheard speech; / a pause; and // a longer pause)

EXCERPT OF REVIEW TRANSCRIPT: GROUP 2, OBSERVATION 1

179	Sc	How did you get all that there?!
180	HW	I typed it all up there! It took me ages!

Subsequent to my transcription of each observation, themes are identified using a grounded theory approach (Glaser and Strauss 1967). I identify film snippets for the class teacher to use with the whole class to reflect on the mathematics taking place and for myself to use with my sample of seven children. These selected video extracts of themselves in the role play area form the basis of an in-depth, semi-structured interview. These 'review sessions' are audio-recorded and subsequently transcribed they take place approximately one week after each observation.

The aim of these diagnostic interviews are for me to get a better picture of what might be going on in the children's heads and to help unpick what they perceive as having learned from the role play. This approach, of presenting something the child has done or said for them to comment on, draws on stimulated recall (Lyle 2003, in Griffiths 2011) and reproposal (Parker 2001). Lyle (in Griffiths 2011, 64) describes stimulated recall as:

> ... an introspection procedure in which (normally) videotaped passages of behaviour are replayed to individuals to stimulate recall of their concurrent cognitive activity.

This has echoes of the structure of observe, document and *re-propose* approach used in the pre-schools of Reggio Emilia, Italy (Abbott and Nutbrown 2001). In reproposal adult observers note a short piece of child's speech, choosing a time to read this back for the child to enlarge on with no adult interpretation or additional comment. Parker (2001) describes reproposal as:

> Reproposing children's talk enables children to expand on their theories and extend them. This process often shows children that their ideas and thoughts are valued and can be shared and discussed. It reinforces their previous learning and develops them further. (p 91)

It is within these review sessions that children have made statements about how they learn, as well as what they are learning in their role play. Reproposal and stimulated recall appear to be fruitful in provoking meta-cognition in these children.

Benefits and disadvantages of using video-recording in general and a *FlipVideo* in particular

The *FlipVideo* recorder is the size of a mobile telephone and can be set up unobtrusively on a small tripod. I sit near the role play with a note book for the duration of the play. An *iPod Nano* is used to record the sound from a different position in order to catch speech when the children move. Both of these pieces of equipment make it easy to transfer recordings to my laptop for transcription and subsequent viewing with the children. The children have seen *FlipVideo* cameras in use in school, and were fascinated by the *iPod*. It became obvious affected what happened, but this could be interpreted as a distraction for the better, as on a number of occasions, a child drew another child's attention to the camera and pulled them back on task. In addition, they seemed on occasions to be 'in role' for the camera – performing the mathematics! This raises the question of whether, and in what ways, role play, or indeed any mathematical activity, is different when an adult is near, or children perceive they are being observed. Sylva et al (1980) found that having an adult nearby increased complexity of nursery children's play.

EXCERPT OF VIDEO TRANSCRIPT: GROUP 2, OBSERVATION 2

2 Sc *[to HW]* Give me thumbs up when it's on

3 HW No, that's OK, it's all right

4 Sc Give me thumbs up [...]! S, S!

EXCERPT OF VIDEO TRANSCRIPT: GROUP 2, OBSERVATION 1

124 S Is this gold?

125 Sc Yeah! Of course it is. Be sensible now. Be sensible and don't mess around

EXCERPT OF VIDEO TRANSCRIPT: GROUP 2, OBSERVATION 2

58 Sc Go on, let's not mess around

59 S OK *[both turn back to sheet]*

60 Sc Of course, of course. Now then, what's seven times five?

Metacognition: Layers of learning

One advantage of using and reviewing the film that emerged, was evidence of children making meta-cognitive statements as they viewed the film of the role-play. For example:

EXCERPT OF REVIEW TRANSCRIPT: GROUP 2, OBSERVATION 1

14 HW What were you working out?

15 F 'Cos, and like, 'cos Sc said we needed to be back at that time so I was getting the clock ready for that time, so when it

16 HW You were trying to find 21 on the clock?

17 F Yeah and I'd go like that

18 Sc Because before we did that we doing our fives round the clock and we were going earlier, then we realised that it went in fives, so we had to realise that one of those in the middle must have been it, so we had to work out the exact one

19 HW Hmm. Because 21 doesn't come when you are counting in fives?

20 Sc No, so we had to really work it out as a group

And later in that interview:

47 S It's quite good to do it again, and you can't, and you can like do the stuff you, like, mistaked *(sic)*

48 Sc Yeah, it's a lot better if you don't make a mistake a second time, so then you learn something from the first time

49 HW I think you were quicker the second time

50 F Hmm, because we knew what to do

Here both boys, Sc and S, make statements about what they understand about how they learn (as a group) and the role of mistakes, based on observing themselves working on setting an analogue clock for the time 15.21. The class teacher reviewed the same clip with the class and asked the question "What good learning can you identify?" In addition to responses identifying the content of the mathematics, the children's replies included the following: "Working like a proper group and listening to each other", "Asking questions to find out if they were right", and "Figuring out and talking to each other".

Perhaps it is the case that visual reproposal helps reflection on how they learn.

Some findings: when should Hemy put to sea?

The role play setting, a floating artist's studio, was decided by the children, based on the class focus for the term, a local history topic. Charles Napier Hemy (1841-1917) was a local artist considered to be one of the finest marine artists of his generation. He had a boat fitted out as a studio, where he could observe and make studies of the sea at first hand. For the first task I observed, the children were given a section from a tide timetable and were asked to use this to decide when it would be best for Hemy to put to sea. Immediately there was evidence of the children engaged in jointly making sense of the task, interpreting data by reading charts and graphs, comparing and estimating times, switching between 24-hour to 12-hour clock, as well as communicating information and ideas. This task seemed mathematically rich.

EXCERPT OF VIDEO TRANSCRIPT: GROUP 2, OBSERVATION 1

10 F So, we have to leave at high tide

11 Sc By 8.36, by 8.36

12 F Yeah, but why would you want to go out at night? Is that p.m.?

13 S No

14 F Is that a.m.?

15 Sc 8.37 I think, 8.36

16 F 8.36, 8.35

17 Sc 8.30

18 F Yeah

And a little later:

33 Sc So do you know when 15.21 shows up? At 15.20 / we have to leave before 15.21 otherwise we'll get stuck

32 F *[with tide chart]* No, 15.21

33 Sc Yes, we have to leave *before* then *[points to time on chart]* see, 15.21 low tide

34 F We have to leave, we have to get back by [....]

35 S For the fishes. When I go out at high tide that's when the fish come in. So if you want to go fishing, so if you have to be back by high tide

36 F Wait, wait, I need to see when 15 is *[head in hands, counts on her fingers]*

37 Sc I *know*, it's high tide now, let's get going S, S, S, you're ready enough to leave yet?
38 S No
39 Sc No, I know, we're sailing on the sea
40 F 3!
41 S *[pointing to chart]* No! 15
42 F Yes I *know*, but that's 3.21 in the afternoon

As I have accumulated my observations, it appears that not all tasks appear immediately mathematically rich, however whatever the task, every review session has evidence of children vocalizing their awarenesses of how they are learning. In addition, all tasks observed have demonstrated their potential for exploratory talk as described by Barnes (2008). Barnes describes this type of 'learning talk' as hesitant, used by the speakers to sort out their ideas, which is what appears to be happening in the transcribed observations.

If there does not appear to be much mathematics occurring in the observed role play even when this is planned as a mathematical task, then what can we do about this? Maybe there is some mathematics related to what takes place in the play, that can happen a step away. Can we identify this and can we make some mathematics take place by tweaking something? This is a theme I am currently exploring. For example, using a shared resource or information as well as a recording sheet seems key in forcing the children to make sense together of the task and to reach some sort of joint conclusion.

Role play?

Viewing the video footage it is debatable whether the children are engaging in 'role play' or simply in a task that is linked to the role play theme. Perhaps it is the case that the role play scenario offers an opportunity for children to tackle some mathematics that is accessible and that "makes human sense" (Donaldson 1978). This is one theme I wish to pursue further - role or pretend play as releasing children to take part in mathematics without fear of failure or exposure. On the other hand, maybe the focus on problem solving temporarily overrides the imaginative play? There is certainly some evidence of the mathematics and the play occurring at different times. On this occasion, after deciding jointly on the best time to set to sea, the three children then played out roles of being at sea:

EXCERPT OF VIDEO TRANSCRIPT: GROUP 2, OBSERVATION 1

177 S Is that all you want to write Sc?
178 Sc That's all we need to. [....] F, shall we go out to sea?
179 S I'll lower the anchor
180 Sc No higher, bring the anchor up. Lowering the anchor stops us
181 S Does it?
182 Sc Yes
183 S Ok, ok, rulers are anchors *[they mime together pulling anchor – a ruler – up. F watches]*
184 S *[hopping on one foot]* Oh! My toe! Ow! Oh my toe!
185 Sc Did you hurt your toe? *[hops too]*
[S mimes moving anchor, re-drops it and some hopping resumes by both boys]
186 S Ow, that hurt my toe! *[All laughing]*
187 Sc Right! Let's go. Are we ready? Let's go fishing, let's go fishing

188 S Ok. *[S casts imaginary rod]* I've caught a pike [...] it's a massive one

Some further themes: the role of a story

Further themes emerging are how a child's identity and how they feel about mathematics, affects how they use the role play opportunity – to opt out or engage? And whether activities need to be returned to in order for the mathematics to emerge. Watson and Mason have referred to asking students for three examples of something as it is often only by the third that they will be pushing the boundaries (Watson and Mason 2005). Rogers and Evans write of the necessity of extended, periods of role play in order for Reception children to develop narratives (Rogers and Evans 2007). The three role play tasks I observed culminated in a class auction of Hemy's paintings (seascapes painted by each member of the class). There is a sense that the previous role play activities prepared for the auction, where children acted in role as treasurers, bank tellers, auctioneers and bidding customers with a set amount of money to spend. With a story linking the mathematical activities, the class teacher has felt the mathematics work has been centered, the auction tying all the separate activities together into a final performance.

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