

## **Using scenes of dialogue about mathematics with adult numeracy learners – what it might tell us.**

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The study concerns the use of prepared dialogue scenes involving mathematics with groups of adult learners. It is intended to consider how we might characterise discussion following the reading of scenes of dialogue. The article outlines some examples of scenes and the response from the use of these in an early exploratory phase with some adult learners intending to become teaching assistants. A discussion of the scenes and responses leads to some conclusion about the characteristics of more appropriate scenes for the main study.

**Keywords: adult, numeracy, dialogue, intervention, discussion**

### **Introduction**

The study concerns the use of prepared dialogue scenes involving mathematics with groups of adult learners. It is intended to answer the following question:

*How might we characterise the discussion following reading of scenes of dialogue?*

The idea for this work came from two broad areas, one of which concerns learner-learner interactions and the other concerns the use of participants in verbalising the words of others.

A few years ago, I was involved in a project in which discussion of mathematical concepts by learners was a key part of the learning intervention. What interested me was that learner-learner interactions were at times rather minimal. The reports from the sessions contained very few records of learner-learner interactions. A search around learner interactions in the literature produced more teacher-learner interactions than learner-learner. Indeed most of these were concerned with school learners rather than adults, the area which was of most interest to me.

A second influence for me began in an observation that I made when attending a research seminar. I had noted that in one session participants were asked to read out the parts of dialogue that were collected in the course of the research. I noted that this appeared to be an effective way of presenting the information. The most obvious aspect of this was that a change in voice appeared to produce a positive difference in delivery with participants actively engaged rather than passive observers. From this, I started to use this approach in my teacher training by asking participants to read the dialogue (and at times narrator aspects) when investigating various literature. In particular, this appeared to work effectively when looking at the work of Jean Lave and others (Lave, Murtaugh and de la Rocha 1984) with adults in the supermarket and with the dialogue scenes written by Lakatos (1976) in *Proofs and Refutations* (more below).

This study is an investigation into the use of such dialogue scenes as a learning activity within the classroom. Some proposed scenes have been collected (and constructed) and used in an exploratory stage with adult learners.

### **Who are the participants?**

It is perhaps useful to spend some time exploring the context of this activity and the participants before considering the scenes and their use.

This work will be undertaken with adult numeracy learners. Each of these three words 'adult', 'numeracy' and 'learners' deserves some consideration. The meaning of 'adult' is not necessarily straight forward. There are a number of points that could count as the beginning of adulthood: ages 16, 17, 18, 21 and 25 all have cultural or legal significance. Those writers such as Knowles (1990), who are interested in adult learning, and the notion of androgogy, have argued that the context of people's lives play a significant role in learning. It is fairly clear that all the ages noted above are likely to contain individuals with a range of life stories and histories. The study proposed will run in a further education college with learners who have self-selected to join programmes and who could be any age from 16 upwards although it is most likely that the vast majority will be in their 20s. These are individuals who have not had entirely successful experiences with education in the past but who now are looking for a second chance (see Swain et al. 2005).

Next comes the word 'numeracy'. A contentious word with a range of meanings and connotations and used to contrast with the word 'mathematics'. In the primary National Numeracy Strategy (Department for Education and Employment (DfEE) 1999) it was argued that the subject of study was mathematics and that there was an intent to develop 'numerate' students. In the world of adult education, 'numeracy' has been used to connote the relationship that mathematics has with the context in which it works. In the proposed study, the word will be a description of the learners. That is, the learners that have chosen courses that come under the funding streams for 'adult numeracy'. The subject under study may be called mathematics or numeracy and, while the relationship between the learners and the subject will be important, as will the words that they use, in the proposed research the term 'mathematics' will be used for the subject of study and 'numeracy' for the learner.

And now the third of those words - used quite a lot in the preceding paragraphs - 'learners'. It has become the norm to use this word in the post-compulsory sector. This has been introduced to enable an overarching term for all those involved in learning in the sector, which may include workplace learning where individuals feel that the term 'student' is not a good description. Nevertheless, the participants in this study will be adult learners in a further education college and therefore might equally be described as students.

### **Examples of dialogue scenes**

The following are examples of the type of dialogue that might be used. These scenes have been trialled in an exploratory stage of the work with a small group of three volunteer adult numeracy learners. These learners were studying adult numeracy in order to qualify as school teaching assistants. The scenes were read and discussed in one separate session rather than being embedded in normal classroom activity and, thus, may only be indicative of their intended use.

### *A scene about reverse percentages*

This scene was developed as part of a CPD package for teachers along with associated training resources (Swan 2005). The scene is used here to illustrate what may be achieved although the content is not the most appropriate to the target group of this study. The discussion of such 'reverse percentage' problems will prove difficult to most participant learners. The discussion in the scene follows information stating that fares had increased by 20% in one month then later reduced by 20%, and a character proposing that the fares are "back to what they were" before the increase.

Harriet ; that's wrong, because ... they went up by 20%, say you had £100 that's 5 , no 10.

Andy ; yes, £10 so its 90 quid, no 20% so that's £80. 20% of 100 is 80, ... no, 20.

Harriet : five twenties are in a hundred.

Dan; say the fare was 100 and it went up by 20%, that's 120.

Sara: then it went back down, so that's the same.

Harriet : no, because 20% of £120 is more than 20% of £100. It will go down by more so it will be less. Are you with me?

Andy: Would it go down by more?

Harriet; Yes because 20% of 120 is more than 20% of 100.

Andy: What is 20% of 120?

Dan: 96...

Harriet: It will go down more so it will be less than 100.

Dan: it will go down to 96.

(Swan 2005: 28)

The scene is useful here as it contains some clear mathematical ideas, namely the calculation of percentages, concerns the discussion of the solution to a problem involving the mathematical idea and uses a range of formal and informal language.

### *A scene from Season 1 Episode 8 of The Wire*

The next scene shows how a child (Sarah) is having difficulties with calculations of her school homework, and finds it easier to understand a related problem in the context of drug sales. Sarah discusses her difficulties with Wallace, a drug dealer who is looking after her and asks for help with a text book problem.

**W:** This one here? A bus travelling on Central Avenue begins its route by picking up 8 passengers, at the next stop it picks up 4 more and an additional 2 at the 3<sup>rd</sup> stop while discharging 1. The next to last stop, 3 passengers get off the bus while another 2 get on. How many passengers are still on the bus when the last stop is reached? .... Just do it in your head. [tosses book away]

After a discussion with a third character about a deal the scene returns to Sarah's problem. .

**S:** Eight?

**W:** Damn, Sara. Look. You work in the ground stash, you got twenty tall pinks, two picks come out for you and ask for two each, another one cops 3, then Bodie hands you up 10 more, but some white guy rolls up in a car, waves you down a piece for 8. How many vials you got left?

**S:** [thinks for a bit] fi'teen

**W:** how ... you able to keep The Count but you not able to do the book problem then.

**S:** The Count be wrong, they [cut] you up.

(Simon and Burns 2002)

This interchange – while fictional – can be seen as illustrative of what is sometimes called the ‘transfer problem’ (Evans 1999). Following the work of those investigating ‘real world’ mathematics such as Nunes, Carraher and Schliemann (1993) and Lave, Murtaugh and de la Rocha (1984) it has been noted that moving between contexts is either difficult or impossible. This scene involves some mathematics – addition and subtraction of two digit whole numbers - at relatively low levels of the curriculum combined with a great deal of informal language.

### ***A scene discussing the point of mathematical study***

This is an example of a self-produced scene developed to raise discussion about the point of studying mathematics.

Teacher : mathematics helps us to understand how to build bridges, send submarines to the bottom of the ocean and rockets to the moon.

Jo(e) : didn't the millennium bridge have to be closed down because they hadn't worked out that it would wobble?

Toni/y : and didn't NASA mess up with metres and yards and lost a satellite.

Sam: and I'm not going to build bridges or send people to the moon anyway.

Teacher : aren't there other subjects that you do where you might not use it straight away.

Alex : yeah, I think this is interesting

Many teachers will recognise the questions raised by learners about the purpose of learning mathematics. This scene may help to raise this issue with learners and involves mostly everyday language although it does not contain any mathematical calculations.

### **Some analysis of the scenes**

I take a social constructivist view of learning and situate the study within those that interpret discourse. I am interested in the interactions that follow the reading of given scenes of dialogue that involve mathematics. Sfard (2008) proposes a structure that sees mathematical discourse through four properties: (1) word use, (2) visual mediators, (3) narrative and (4) routines. Other notions such as Engeström's model for activity theory (e.g. Engeström 1999) offer ways of interpreting language use in relation to the backgrounds and experience of the participants concerned.

To illustrate some issues in the choice of scenes I will outline some examples that occurred within the exploratory study of word use within the scenes. This exploratory study allowed some consideration of the scenes' appropriateness for the main study. In particular, I am interested in the ways in which the learners use language to discuss the scenes. For example the extent to which they repeat the language used within the scenes in their discussions is noted.

The following extract comes from the discussion by learners and researcher of the CPD percentage scene. Words and phrases of interest have been italicised.

Learner 1: It's telling you that it is *going up* 20% and then *coming back down* again.

Researcher: So does that take it back to the *same level*, or different?

Learner 1: Um, near enough the *same level*?

Researcher: what do you think?

Learner 2: I think that it is almost the *same level* but the argument of Harriet ... £120 20% and £100 20% will be different.

Learner 1 uses some of the more everyday language from the scene, when discussing the scene 'going up' and 'coming back down'. This learner also adopts the language of the researcher in response to the 'level' which is not included in the scene. Learner 2 directly uses the text to answer the question although the learner is still hedging about the resolution to the problem.

The following interchange relates to the use of the drug scene.

Learner 1 - The child is used to the second calculation ... it's in its everyday life. The first bit probably doesn't happen very often. But the second part is probably like us going to the shops and buying bread every day.

Researcher - a teacher the other day ... said that you can't talk about drugs with a class

Learner 2 - no not really

Learner 3 - you're dealing with adults, you can talk about anything with adults

This discussion shows a possible problem in using this scene in the study. The learners have shown that they draw some meaning from the text but there appears to be less opportunity for developing discussion from a mathematical angle. This may be because the mathematical concepts involved - addition and subtraction of integers - are well understood by these learners. It is possible that for other learners the 'word problem' aspect may produce some interesting discussion.

The following quotation is from one learner responding to the third scene.

It will not come easily in our minds that constructing a bridge needs mathematics ... to build an effective and sound quality bridge that will last for a number of years.

And it will be building bridges between your mental ability as well, ... yes some people believe maths is difficult ... and if they think maths is difficult I want to build a bridge where they can have fun and at the same time learn real maths.

The learner has taken language from the text - 'the bridge' - and used it as a metaphor for her own views. This use of language here does exemplify the type of discussion that was intended during the intervention. The difficulty is that while this is an important discussion about the appreciation of mathematics the scene does not provide an opportunity for much discussion about particular mathematical concepts.

Overall, from the use of these three scenes, some criteria for scene selection is emerging. Scenes should involve:

- (a) a discussion of a mathematical problem;
- (b) an appropriate level of mathematical content; and
- (c) a range of everyday and technical vocabulary.

## Conclusion

The use of such dialogue scenes has potential as a learning intervention. If we see the use of language as a key to learning then the recording of learner-learner interchanges about the scenes should bring insight into learning for the education community.

The three scenes discussed all show that there is a potential for the development of mathematical thinking through the discussion of such scenes. The difficulty is in the selection and/or construction of scenes that address appropriate mathematical concepts while allowing for an appreciation of mathematics at the same time. Nevertheless, criteria are emerging that will help the choice and construction of appropriate scenes.

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