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Analysing Scaffolding from Not Knowing to Knowing Numbers and Counting: Classroom Conversations in the Teaching of Numeracy

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ABSTRACT Teaching a Grade R class to comprehend Mathematical concepts though perceived to be easy by others can be daunting to educators. This requires employment of effective teaching strategies as well as a hands-on approach to teaching since this will assist with memory retention and also to keep learners interested in the lesson. A grade R class of a Motheo Education District rural public school comprising 38 learners and their educator was used in this ethnographic study through focus group discussions and observations. The aim was to see how educators encourage learners to problem solve and use reasoning to understand quantities and how counting works rather than simply providing them with counting procedures The use of manipulatives, that is, items used as concrete representatives of a concept, worked very well in assisting learners to comprehend the concept of counting. Also, knowledge of number processing by learners can help an educator with the early identification of at-risk learners. This information can guide appropriate educational interventions at school and teacher training levels.

INTRODUCTION

The concepts of preschool mathematics (Numeracy) are simple, but the responsibilities of actually helping learners to comprehend those concepts can be overwhelming and daunting to teachers. Seefeldt and Wasik (2006) reported that 'to have opportunities to learn math, children need first hand experiences related to math, interaction with other children and adults concerning these experiences and time to reflect on the experiences'. Educational research also shows us that a hands-on approach to teaching mathematics/ numeracy is extremely beneficial, especially in the elementary grade levels because it helps with memory retention and keeps learners interested in the lesson (Seefeldt and Wasik 2006; Smith 2009). Mathematics is based on counting. Counting lets you know how much of something you have. When teaching learners mathematics, one needs to employ effective teaching strategies. These strategies can be used in all areas, such as teaching the fundamentals of arithmetic, using materials to solidify concepts and explaining the utility of calculators. Classrooms should therefore be models of a sustainable community and engage learners in a participatory way (Leslie 2009; Mahlomaholo et al. 2010). To be able to create sustainable, empowering learning environments, issues of social justice should be integral to the curriculum to enable learners to develop a tolerant identity, reciprocity and mutual respect (Singh and Francis 2010).

Background to the Study

This study is grounded in the critical social science paradigm which is not only based on who controls the construction of knowledge but how and why (Lincoln et al. 2011). The focus was on how the educator facilitates and manages classroom conversations in the teaching of counting in the Grade R class.

The classroom environment shapes student's beliefs about mathematics, as do cultural beliefs and interactions with others. 'If we are to understand how people develop their mathematical perspectives, we must look at the issue in terms of the mathematical communities in which students live and the practices that underlies communities' (Schoenfeld 1992). The primary level elementary mathematics is important and 'fundamental' as it contains the rudiments of many key concepts in more advanced branches of the discipline, which must be built from early stages (Ma 2010; Reddy 2000a).

'The foundation for children's mathematical development is established in the early years' (Seefeldt and Wasik 2006). Mathematics, along with reading and writing, is one of the three main content areas that pre-scholars are expected to master. Many learners find mathematics intimidating, difficult to understand, and most difficult to master. As a result mathematics is a challenge to teach. Unlike reading and writing, mathematics is a totally different language for children to learn. Symbols represent operations. Operations are performed in different ways for different formulas. Symbols can be interchangeable and require different operations in different situations. Hence, the reading, writing, and interpreting of mathematical symbols can cause confusion for learners who are struggling to understand new and abstract concepts relating to numbers and operations.

The basic foundation for any pre-school mathematics lesson plan is the knowledge of number names and their order. Also, everyday practical activities provide young children with mathematical experiences in a numerate environment (McManus 2000; Epstein 2003; Greenes 2004). Through such activities, their mathematical language is in turn developed in relevant contexts such as shape, position, size and quantity.

Counting in sequence and understanding cardinality is a skill that not only pre-scholars but each person uses everyday throughout their lives. It is the groundwork upon which addition, subtraction, and other mathematical operations are built and is also an integral part of everyone's daily experiences (Greenes 2004). For example, a pre-scholar might look for her two shoes; hold up four fingers to show how old she is and so on. When teaching mathematics to pre-scholars by talking, they often focus for only a brief amount of time and then wander off into their own thoughts and quickly forget (Burke 2000). However, when the same learners create their own instructional resources, their long-term memory is stimulated (McManus 2000; Raupers 2000-2001). Learners need to acquire some number sense before they can learn how to speak, count and write numbers.

Research Objective

This study intended to find out how the educator assists the grade R class to develop a framework for counting by enabling them to move from the known to the unknown.

Research Question

The following research question guided this study:

How does a preschool educator assist learners to develop a framework for counting and weave within it helpful activities and best practices thus enabling them to move from known to unknown?

RESEARCH METHODOLOGY

In this study an ethnographic method as well observation were used to collect data. A synthesised definition of ethnography is that it is an art, science or process of describing, understanding and interpreting in-depth a group's experiences from the subject's point of view (Fetterman 1997; Cohen et al. 2010). The ethnographic methodology in this study was employed to provide a rich description on how learners learn counting. This research methodology enabled the researcher to observe the patterns of action and interaction (verbal and non-verbal) within the classroom setting where Grade R (reception class) learners were taught how to count, moving from not knowing to knowing.

Participants and Setting

The main participant in this study was the Grade R educator at a rural primary school who was purposely selected as she displays enthusiasm for the profession, dedication and love for young children. This educator was selected for the teaching awards by the Department of Education on numerous occasions not only in the district but also provincially. According to Taylor (2008) 'It's traditionally acknowledged and logically follows that teachers with a good grasp of mathematical knowledge impact positively on learners, exposing them to varied, cognitively challenging maths tasks and adventurous maths encounters. On the other hand teachers with weak concept knowledge are limited for they 'cannot teach what they do not know.' The 38 learners in this educator's class were mainly black coming mostly from under-privileged backgrounds.

Data Collection

Data were collected in three stages. First was an interview with the educator focused mainly on educator's biography and her views about teaching numeracy meaningfully. The educator was asked to relate her story as she saw, felt and experienced it (Corbin and Morse 2003). A courtesy visit to her classroom was also made (prior to the lesson observation) purposely to ensure that the learners will be comfortable when the researcher comes to observe the lesson. Then this was followed by lesson observation wherein the educator was teaching the Grade R learners how to count. Lastly, an interview was held with the educator regarding her classroom practices; how she managed to successfully teach learners how to count.

Data Analysis

The first level of analysis was text-based, focussed on specific references (Carlson 2007) and this gave insight to the way this educator scaffolds the learner's learning. The research question was always borne in mind and the views of the participants were represented authentically as much as possible.

RESULTS

The school used in this study is a rural school accessible to learners from under-privileged backgrounds. South African classrooms are generally characterised by vast inequalities that indicate social class and economic gaps (Reddy 2006a). The Grade R (reception class) educator involved in this study is enthusiastic, dedicated, committed, patient and places a lot of emphasis on academic achievement. She leads by example and is passionate about working with young children. During the initial visit to class, the researcher found learners to be generally cheerful, relaxed and eager to learn. Although not so well resourced, the classroom was inviting and the atmosphere seemed conducive for teaching and learning.

To quote verbatim what the educator said:

'I always encourage my learners to do well. Wherever possible I try to instil the fact that everyone in my class has the potential to achieve academically and that nothing is impossible. To be able to give individual attention to slow learners in my class I occupy the brighter ones with more challenging work and this enables me to assist the slow ones without leaving the bright ones unattended'.

Interview responses revealed that the educator places great emphasis on remediation and scaffold learning to assist the slow learners.

During lesson observation, as the lesson was introduced, the educator established links between the learner's prior knowledge, that is, numbers and new knowledge, counting. The introduction was a number rhyme accompanied by a finger play. The learners existing knowledge regarding numbers was identified so as to guide their understanding towards counting. The striking observation made by the researcher was that most of the teaching and learning resources were things that are familiar to learners such as marbles, straws, counters made of lids of cool drink bottles etc.

The educator encouraged learner participation as it was observed during lesson presentation and confirmed during interviews with the educator. It was evident as the educator was teaching that the learners were actively engaged in the discussions and activities assigned, sharing their understanding on what was taught regarding counting. For example, the following was noted during lesson observation:

When assigned a task to count five (5) colourful marbles that they were each given by the educator, learners often tried to get all the names of the numbers they know in their count as they passed their fingers along the marbles. They also reused numbers. If they had not finished and have used up all their known numbers, then they would begin to use the same numbers again.

For example, Learner B (according to the educator is: 4 years 7 months) who lined up her marbles carefully and then tagged numbers to them pointing as she slid her finger along the marbles, quickly counting out loud: '1, 2, 4, 5, 3,' and then: '1, 2, 3, 4, 5, 1, 2, 3, 4, 5.'

The above captures how concrete objects and manipulatives were used by the educator to scaffold learning how to count. To some extent, critical thinking was involved, learner B at first got the order wrong but went on to decide what was wrong and corrected himself.

As the educator indicated:

'On realising that the learner got the number order wrong, I did not stop him to give the correct answer. I instead let him think and fig-

ure out on his own what the right order was. Critical thinking is embedded within my professional beliefs and pedagogical principles. It is something I always encourage and emphasise in my teaching'.

The excerpt above indicates critical thinking is valued and incorporated in the educator's teaching methodology.

Pre-scholars and young children generally learn best through first hand experiences. This is achieved through observation, exploration, play and conversation in the indoor and outdoor learning environments. It is the way in which children access the curriculum that is important rather than the content, and the process that they go through is more important than the end product. After the learners have explored the manipulatives, 'the materials cease to be toys and assume their rightful place in the curriculum' (Smith 2009). Play therefore has a fundamental role in early years, supplying the foundation upon which learning is built. Spontaneous play offers children the opportunity to follow their own inclinations and draw on their experiences (Babbington 2006). Structured play enabled the learners to gain the maximum learning and development combined with the maximum enjoyment. This improved their understanding (Lyle 2008) and they gain new knowledge (Vosniadou 2008). The use of play was evident during lesson observation right from the introduction.

A follow-up interview was conducted directly after the observed lesson for clarification purposes. It was necessary for validation purposes to ensure that the researcher's perceptions regarding aspects of the incidents observed were in keeping with the educator's outcomes. The interview also used to ask the educator reflective questions relating to pedagogy: what the highlights of the lesson were and what aspects of the lesson particularly pleased and displeased the educator. The educator in response indicated that certain learners could not grasp the concept of counting the first time, so repetition was necessary. At the same time, learners who were already familiar with counting would extend the task themselves, for example, when being asked to count up to three, the brighter learners would count even up to ten. The educator then had to draw the rest of the classes' attention to the task at hand also giving the brighter ones an opportunity for more challenging work.

According to Little (2003) the educator is the primary decision maker in planning specific combination of instructional strategies to accommodate the needs of the learners. The strategies employed by the educator encouraged learners to problem solve and use reasoning to understand quantities and how counting works rather than simply providing them practice with counting procedures. This approach is said to be beneficial for young elementary school learners with special needs too (Clements and Sarama 2000). The educator also made use of questions to check understanding and knowledge as the lesson progressed.

DISCUSSION

It is important that an educator should ensure that learners understand number concepts and how these relate to their everyday experiences and not merely recite them by rote. This could be achieved amongst others by using hands-on models like counters, concrete objects etc. The educator used examples and objects that were familiar and related to the real life experiences of the learners. As a result, meaningful learning took place.

When observing these learners in class, the researcher noticed that they start to count spontaneously and later begin to refine their skills by pointing their finger at the objects they are counting. The use of manipulatives helped improve the environment in their mathematics classroom (Cain-Caston 1996). When learners were working with manipulatives they got a chance to reflect on their experiences, not only was mathematical learning enhanced in the process, but mathematics anxiety was also greatly reduced. The educators using manipulatives in their teaching, need to know 'when and how to use manipulatives to help them and their students think about mathematical ideas more closely' (Puchner et al. 2008). The educator involved in the study knew exactly when it was appropriate to use manupulatives to stimulate critical thinking and understanding. Where critical thinking is stimulated; 'the complexity of the materials provided will increase as children's thinking and understanding of mathematical concepts increase' (Seefeldt and Wasik 2006).

The educator initiated and managed learning conversations structured around the topic counting and used them to facilitate learning. Learners were assigned activities to count us-

ing different manipulatives provided per group; such as marbles, lids of cool drink bottles, straws etc. The conversations within groups, involved understanding as reflected in the learner's responses, see excerpts below:

Learner A: 'Oh! *I understand what you say mam, these marbles represent numbers'*

Learner D: *'Yes, now I know what you mean mam. Can I count again?'*

As learners were responding to questions asked by the educator, their explanation and demonstrations indicated their understanding and knowledge. There were expressions of surprise tokens such as 'oh', 'wow' and those of mutual stance such as 'correct' 'yes' 'that's right' to indicate a shared understanding (Pike 2010). Conversational dimensions of classroom interactions and learning was very eminent. Learners acknowledged and used interactional resources to indicate whether they knew or did not know.

Ethical Considerations

In this study, the researcher complied with ethical issues of confidentiality, anonymity and privacy. The data gathered in this exercise was solely and strictly used for the purpose of this study (McMillan and Schumacher 2010; Neuman 2006). Permission to conduct this study was sought from the Provincial Department of Education, Free State. Also, informed consent was obtained from both the principal of the school and the educator who were fully briefed about the research process and purpose of the study.

CONCLUSION

The study highlighted the importance of providing learners with opportunities to understand and practice problem solving, reasoning and Numeracy in a broad range of contexts in which they can explore, enjoy, learn, practise and talk about their developing understanding and to gain confidence and competence in their use. This was achieved through play, using manipulatives, just to mention a few**.** These strategies enabled the educator to identify at-risk or learners with special needs.

RECOMMENDATIONS

Any child can be successful with mathematics, provided that he or she has opportunities to explore mathematical ideas in ways that make personal sense to him or her and opportunities to develop mathematical concepts and understanding. Reception class educators need to teach mathematics such that it learners can comprehend concepts with ease at the same time the at-risk learners are identified and given attention. The educator has to be passionate about the subject to be able to nurture the love for the subject amongst the learners. It is also very important for the educator to know how to identify learners with special needs in his or her class so that appropriate interventions could be made.

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