

## The Value of Mentoring For Mathematical Literacy Teachers in the South African School System

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**ABSTRACT** The objective of the paper is to examine the value of mentoring as a professional development for mathematical literacy teachers. A qualitative research approach through questionnaires and interviews was used. The research found that mentoring could be employed in improving the content knowledge as well as the instructional skills of mathematical literacy teachers. However, it was found that there are no formal mentoring programmes for these teachers. They usually seek help from their experienced and knowledgeable colleagues who were approachable and trustworthy. The paper therefore concludes that a well-designed and supported mentoring program is needed to improve the content as well as pedagogical knowledge of mathematical literacy teachers.

### INTRODUCTION

Mathematical literacy was introduced in South African schools during 2006 academic year. Before that the study of mathematics was optional in the school curriculum. The students who were deemed to have the potential to study mathematics were encouraged to do so at school. A student would then complete school without any basic knowledge in mathematics. The inclusion of mathematical literacy as a school subject was therefore to allow all school leavers to acquire some basic skills in mathematics. The introduction of mathematical literacy as a school subject in South Africa was based on the principle of social transformation by the democratic government that came to power in 1994. This principle gives every learner, irrespective of race, gender, or socio-economic background, the opportunity to be mathematically literate (South Africa Department of Education 2003: 9). The challenge though, with the introduction of mathematical literacy, was getting qualified teachers to teach this new subject. In order to get teachers for this new subject, the South Africa Department of Education had to rely on the existing teachers, particularly those who have a pass in mathematics at matric level. Unfortunately, none of the existing teachers (with the exception of those teaching mathematics and physical science) could meet that requirement. Teachers who were not teaching mathematics or phys-

ical sciences were then encouraged to consider teaching mathematical literacy. Among those teachers who “volunteered” to teach this new subject were Afrikaans, Setswana, Geography or History teachers.

To prepare these teachers to get them ready to teach mathematical literacy, the South Africa Department of Education organized training courses for them. These courses were facilitated by mathematics subject specialists and the focus was mainly on mathematics content. The teachers attended training sessions during school holidays in 2004 and 2005. During these years they had been teaching the subjects in which they were initially trained.

Given these teachers’ limited mathematics background, the researcher believes that it is highly unlikely that they would have acquired the much needed mathematical content, as well as the necessary pedagogical knowledge, through these training programmes. Therefore these teachers would not have acquired the expected level of competency to be effective in the teaching of mathematical literacy. In view of this, the researcher is of the view that these mathematical literacy teachers could be developed further, through mentoring. Mentoring, in this context, may be described as the establishment of a personal relationship for the purpose of professional growth and guidance. Bullough (2012) affirms that mentoring plays a key role in developing highly effective teachers.

### Conceptual Framework

This paper is grounded in the situated learning theory. Situated learning was first proposed by Jean Lave and Etienne Wenger as a model of learning in a community of practice. Lave and Wenger (1991) indicate that learning should not be viewed simply as the transmission of abstract and de-contextualized knowledge from one individual to another, but as a social process in which knowledge is co-constructed. They also suggest that such learning is situated in a specific context and embedded within a particular social and physical environment. Hence, situated learning becomes highly relevant in a study on mentoring. At its simplest, situated learning is learning that takes place in the same context in which it is applied. It should also be noted that situated learning is a broader term that covers social learning theories. Mentoring, which is the focus of this paper, is also a learning process that takes place within a given social context. In contrast to formal classroom settings which often involve abstract concepts and a discussion of dry facts presented out of context, situated learning theory proposes that knowledge is best acquired through doing (Lave 1988).

Thus, situated learning theory is a general theory of knowledge acquisition that recognises the critical importance of the social setting to knowledge construction. The theory represents a major shift in learning theory from psychological views of learning as mechanistic and individualistic, to perspectives of learning as emergent and social (Brill 2001). Lave and Wenger (1991) concur that situated learning is primarily social rather than psychological, and this is also the essence of mentoring. In place of viewing learning as the acquisition of certain forms of knowledge, Lave and Wenger tried to position learning within the context of social relationships and situations of participation. Social learning theory is based on the principles that knowledge needs to be presented in authentic context, and that learning requires social interaction and collaboration (Lave 1988: 3).

In harmony with the principles of situated learning theory, the researcher argues that mathematical literacy teachers could learn better from practical situations through mentoring. They are also more likely to engage in the discovery of solutions to real problems, and even to more general matters requiring problem-solving skills,

as a consequence of their interactions with their mentors. Through the situated learning environment, mathematical literacy teachers could see the implications of acquired knowledge in a real context. A situated learning environment also supports learners to structure knowledge in ways appropriate to later use, by gaining and working with such knowledge in context (Brill 2001).

### Mentoring of Mathematical Literacy Teachers

It is important that the teachers have some basic mathematical knowledge and skills that will make them effective. This can be inferred from the definition of mathematical literacy as stated by the South African Department of Education (2003: 9). The Department of Education defines mathematical literacy as follows:

Mathematical literacy is a subject driven by life-related applications of mathematics. It provides learners with an awareness and understanding of the role that mathematics plays in the modern world. It enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations to solve problems (South Africa Department of Education 2003: 9).

The above definition clearly indicates that there is a relationship between mathematical literacy and mathematics. The relationship between the two subjects is further emphasised by the Association of Mathematics Educators of South Africa (AMESA) (2003: 1). This is what AMESA had to say:

*“Although mathematical literacy and mathematics are quite clearly related, they are also different. In the conceptualisation of mathematical literacy as presented in the subject statement it remains too much of a watered down version of mathematics. The outcomes are essentially the same as those of mathematics. It may be that this is done intentionally, to address matters of portability and mobility between mathematics and mathematical literacy, but we argue that the two subjects are so dissimilar in philosophy and purpose that such portability and mobility should not be a consideration”.*

The Program for International Student Assessment (PISA 2000), defines mathematical literacy as an individual’s capacity to identify and understand the role that mathematics plays in the world, to make well-founded mathematical

judgements and to engage in mathematics in ways that meet the needs of that individual's current and future life as a constructive, concerned and reflective citizen. According to Mthethwa (2007: 27), teachers view mathematical literacy as that kind of mathematics that finds application in peoples' lives, and view it as a simplified or easier version of the mathematics that learners do at school.

The above perceptions of mathematical literacy confirm that mathematical literacy teachers need sound knowledge of mathematics in order to be effective. Considering mathematical literacy teachers' limited background in mathematics, they would need a programme that exposes them on a regular basis to mathematical content, as well as pedagogical knowledge. It is for this reason why the researcher argues that a proper mentoring programme is required to enhance the mathematical content knowledge of the mathematical literacy teachers.

Bullough (2012) describes mentoring as a highly professional relationship involving a journey for both the beginning teacher and the mentor. In this paper, the mathematical literacy teachers are not beginning teachers; however they now teach a subject which they were not initially trained for. The mentors provide information, assistance, support and guidance to the mentees in order to advance the professional development of the latter. In mentoring there is usually an intimate relationship between the mentor and the mentee. This relationship creates a favourable atmosphere for the mentee to learn from the mentor.

Mathematical literacy teachers would learn a variety of mathematical skills from their experienced and knowledgeable colleagues when they interact with one another. Furthermore, through mentoring, mathematical literacy teachers' learning is more likely to take place in the immediate context in which the knowledge gained would be applied. Mentoring will therefore serve as means for mathematical literacy teachers to learn from practical situations. According to Quan-Baffour (2010: 100) one form of learning from practical situations is collaborative teaching. Through collaborative teaching, the confidence level of the mentee may be improved because of the support from the mentor. Furthermore learning through mentoring is all embracing. Mathematical literacy teachers would not merely acquire content knowledge, but they will also learn

how to impart such knowledge to learners effectively. Learning through mentoring provides a non-intimidating environment that supports the collaborative construction of knowledge. Bullough (2012) contends that mentors need to learn to be helpfully and kindly critical without undermining the confidence of their mentees or the quality of their relationship.

Mentoring as a professional development programme creates learning structures that allow newly trained mathematical literacy teachers to align their experiences with the styles and discourses of the settings in which they are expected to function. Mathematical literacy teachers would also become more effective in teaching the subject as a result of their improved content knowledge, and that, in turn, should enhance their confidence. However, Owusu-Mensah (2013: 125) asserts that the success of mentoring as a professional development initiative depends on the cordial relationship between the mentor and mentee, and how the mentoring process has been planned.

## METHODOLOGY

The study comprises teachers who are currently teaching mathematical literacy in various schools in the Taung district, in the North West Province of South Africa. They are all practicing teachers who have taught subjects such as Afrikaans, Setswana, Geography or History on average between eight and twelve years. They attended short courses for two years (from 2004 to 2005) in mathematical literacy. A sample of 16 mathematical literacy teachers was selected for the study. A purposive sampling technique was used to select the sample. Purposive sampling starts with a purpose in mind and the sample is thus selected to include people of interest and exclude those who do not suit the purpose (Leedy and Ormrod 2005: 207). Participants were therefore selected based on the principles of purposive sampling. This allows the researcher to select participants who exhibit some features or processes that are of interest to a particular study.

There are a total of twenty-five secondary/high schools in the Greater Taung area. Since the researcher have lived and worked in the Greater Taung area for the past fifteen years as a mathematics teacher, he is quite familiar with these schools and the mathematical literacy

teachers in the area. The schools from which the teachers were selected displayed the characteristics or typical attributes of the target population to the largest degree. The mathematical literacy teachers in these schools have weak mathematics background and were previously teaching non-mathematical subjects such as Setswana, Afrikaans, Geography or History. The relatively small sample size of sixteen was not a major concern given the nature of the study and investigation.

### Research Design

This paper employs a descriptive survey design. The choice of a qualitative approach coheres with the various philosophical and epistemological assumptions inherent in mentoring and the chosen conceptual framework. It is further informed by the following statement taken from De Vos (2002: 272):

*The qualitative research strategy differs inherently from a quantitative research design in that it does not usually provide the researcher with a step-by-step plan or a fixed recipe to follow. In quantitative research the design determines the researcher's choice and actions, while in qualitative research the researcher's choices and actions will determine the strategy.*

### Data Collection

In this paper, interviews and questionnaires were employed to collect the required data. The interviews gave the researcher the opportunity to interact with the teachers and to get their views first-hand. The questionnaire was developed based on the five-factor mentoring model proposed by Hudson (2007: 203), and on Lave and Wenger's (1991) situated learning theory. Interviewing is the predominant mode of data collection in qualitative research. In-depth, semi-structured interview was used to collect data. The use of in-depth interviews enabled the researcher to get closer to the participants, all of whom were mathematical literacy teachers. The interaction afforded the researcher the opportunity to meet with them, listen to them and note their views, their level of knowledge and their feelings about the subject matter of this study (that is, the value of mentoring). Six of the teachers who completed the questionnaire were interviewed. Generally, the responses by the participants were largely similar. As a consequence

the researcher ended up interviewing only six teachers.

## RESULTS AND DISCUSSION

All the participants indicated in the questionnaire that they have, in fact, received or are currently receiving some form of professional support from their colleagues at their workplaces. From the responses of the participants it appears that they all have someone to assist them in the execution of their professional duties as mathematical literacy teachers. However, these teachers usually sought help from those they found approachable and could trust. The key areas where assistance and support were received included content areas to be taught, developing learner assessments, classroom management and teaching strategies to meet learner needs.

Twelve of the sixteen participants indicated that they received regular assistance on key content areas to be taught as far as the teaching and learning of mathematical literacy is concerned. This number represents about 75 percent of the participants. Three of the participants, however, indicated that they were not certain about having received any assistance on key content areas, and none of them claimed not to have received any form of assistance on the key content areas to be taught in mathematical literacy.

The content areas mentioned here, refer to the mathematical literacy topics to be taught as indicated in the assessment standards. The assessment standards reflect the key areas which are supposed to be taught under a given topic. Twelve out of the sixteen respondents (that is, 75 percent) claimed to have received assistance on the mathematical content areas which they are supposed to teach. This affirms the claim by Bullough (2012) that mentoring role should extend beginning teacher's thinking and teach specific content and practices. In addition to improving the professional skills of early career teachers, Marker et al. (2014) add that mentoring also has a positive impact on teacher retention.

The mathematical literacy teachers' problems with mathematical content knowledge seemed to be varied and may have a negative effect on their confidence in teaching the subject. The researcher is therefore of the opinion that if the mathematical literacy teachers are effectively

mentored, they could improve their knowledge and the skills required to teach the subject.

All six teachers who were interviewed indicated that they approached their colleagues for help whenever they encountered any difficulties. All of the participants also said that whenever they needed help, their colleagues were prepared to help them. This confirms what Norman et al. (2005) found, namely that mentees usually approached the mentor with a particular problem to which they expected to receive a solution.

Teachers generally sought assistance from their colleagues on topics they found challenging. They usually needed assistance in financial calculations, particularly with calculations involving compound interest and percentages, as well as with shapes and measurements. The mathematical literacy teachers unanimously agreed that their colleagues, who teach mathematics, were prepared to help them, especially with content knowledge.

During the interview, participant B said that:

*My colleague, who teaches mathematics, has been helping me whenever I have difficulties in solving some of the problems in mathematical literacy, especially financial mathematics and percentages.*

The participants further mentioned that their colleagues who teach mathematics are very patient with them when they (mathematical literacy teachers) ask for assistance. In fact one (participant A) of them remarked as follows:

*Whenever I approach Mr X (real name withheld) who teaches mathematics, he is always ready to help me even if I repeatedly approach him with the same problem because he knows that I am not good at mathematics and am a slow learner.*

One of the teachers (Participant C) mentioned that:

*I can say that I have gained so much from my colleague who is teaching mathematics. For example, I now understand how to apply the "BODMAS" rule and understand the Pythagoras theorem very well. I now feel confident in teaching mathematical literacy.*

Four of them, however, expressed the concern that some of the mathematics teachers, who usually helped them, often had too much school work, such as attending to their classes, and marking students' assignments and tests, and could therefore not always help them. They com-

plained that the workload of these mathematics teachers did not allow them enough time to attend to some of their problems. This situation impacts on the regularity they were able to ask for assistance from such teachers.

During the interview, the teachers were asked to suggest how they thought the assistance they received could be improved. The responses from the teachers suggested that they valued the assistance and support from their experienced colleagues. They therefore wanted such support to be recognised by the schools' authorities so that the workloads of "their mentors" could be reduced.

For example, participant B said:

*If the School Management Team (SMT) could reduce the workload of our experienced colleagues by giving them fewer classes or by taking away some of their responsibilities, they would have enough time to spend with us.*

What these teachers are saying confirms what Lee and Feng (2007: 243-263) noted, namely that mentoring is likely to be effective only if mentors are provided with additional free time or non-contact time. Bullough (2012) stresses the importance of release time for mentors and beginning teachers to meet, provision for extra pay or special training for mentors and the acknowledgement of the importance and value of the mentor's work.

The social interaction between the mentor and the mentee contributes significantly to the professional development of the mentee. In the study, it was established that mathematical literacy teachers generally do engage with their experienced colleagues. Through such engagement, they also learn from their colleagues. During the interview, some of the participants expressed how they have benefitted from their interactions with their experienced colleagues. One of them said that:

*I learned a lot from some of the informal discussions with my colleagues on teaching and managing a class effectively. I have been using some of their ideas in teaching mathematical literacy, especially that of assessing learners during and after the lesson (Participant B).*

The current study noted that experienced teachers provided considerable assistance and support to their newly trained colleagues who were also required to teach mathematical literacy. These included solving mathematical problems, explaining how some topics could be

taught and how to assess learners during and after a lesson.

The teachers noted that assessment cannot be separated from teaching and learning in mathematical literacy. Therefore, while improving both the content and pedagogical knowledge, it is also necessary for mathematical literacy teachers to be guided on lesson preparation and presentation. Moreover, they need to understand the importance of assessment in mathematical literacy.

The mentor plays a key role in a professional development of the mentee. Barlin (2010) affirms that the mentor's effectiveness ultimately determines the kind of support given to new teachers to make them effective in their professional duties. Barlin (2010) further identifies some of the roles of a mentor as that of an advisor, a teacher, a role model and a friend. Some of these roles were mentioned by the participants. For example, during the interview, one of the participants (Participant C) confirmed that they viewed their experienced colleagues as friends and role models. This is how he expressed himself on this matter:

*Some of the informal conversations or discussions we sometimes have made it possible for me to reflect on my teaching practices. I really learnt a lot from our experienced colleagues (Participant C).*

This agrees with other studies on the mentoring of novice or early-career teachers. For example, Stanulis and Floden (2009: 112-122) conducted a study on intensive mentoring as a way of helping beginning teachers to develop balanced instruction skills. The expression "intensive mentoring" suggests that the beginning teachers had regular interaction with their mentors. Such regular interaction with their mentors helped them to improve their instructional skills. Lave and Wenger's (1991) situated, or social learning theory is based largely on social interaction and collaboration. This means that the mathematical literacy teachers need to view their experienced colleagues as friends and advisors, and more importantly, as role models. This could facilitate their regular social interaction. Thus, the mathematical literacy teachers learned from their experienced and knowledgeable colleagues as they interacted with them. Such interaction helped the mathematical literacy teachers to get advice on the topics they were required to teach.

The study resulted that there are no formal mentoring programmes for the mathematical literacy teachers. These teachers usually sought help from their experienced colleagues who they found approachable and could trust. The following also came out of the study:

i) The experienced and knowledgeable mathematics teachers are prepared to assist the mathematical literacy teachers as far as the teaching of the subject is concerned.

ii) The mathematical literacy teachers have learned some mathematical content and teaching strategies from their experienced colleagues through regular interactions.

iii) The social interactions between the experienced and knowledgeable mathematics teachers and the mathematical literacy teachers have contributed significantly to the professional development of the later.

## CONCLUSION

The study attempted to look at the value of mentoring of mathematical literacy teachers. Through the process of mentoring, highly experienced mathematics teachers could play a leadership role in guiding the activities of mathematical literacy teachers. Such guidance could improve the mathematics content knowledge of the mathematical literacy teachers who generally lack in this respect. Based on the above findings, this paper concludes that a well-designed and supported mentoring program could help in improving the content as well as pedagogical knowledge of mathematical literacy teachers.

## RECOMMENDATIONS

Mentoring in the teaching profession has been effective, not only in giving early career teachers confidence in teaching abilities, but also improve their content knowledge. The process of mentoring also gives experienced teachers who serve as mentors the opportunity to reflect on, and assess their own teaching practices.

The paper therefore recommends a collaborative form of mentoring. This form of mentoring is also known as collaborative partnership, where both mentors and mentees are considered as partners, rather than the mentor holding a more authoritative position.

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