

## **LESSON STUDY AS A PROFESSIONAL DEVELOPMENT MODEL FOR IMPROVING TEACHERS' MATHEMATICS INSTRUCTION**

Matseliso L. Mokhele

### **ABSTRACT**

The poor state of mathematics education in South Africa is well documented. Few learners are graduating from the school with high quality passes in mathematics in order to enter university. There has been intervention in mathematics education system in an attempt to improve it. Yet, more than ten years after the first democratic election, South Africa is still grappling with poor performance in mathematics and how to change this situation. Much has been done about this inadequacy. South Africa has developed models to update teacher skills as an attempt to intervene. One of such professional development models is a lesson study. In this study, the researcher employed qualitative case study design to explore mathematics teachers' views on lesson study as a professional development model for improving their instruction. Based on the data collected, lesson study is one of the professional development models that teachers would be happy to enlist in as they (teachers) believe that the lesson study provides opportunity for collaboration hence assisting in the improvement of their mathematics instruction.

**Keywords:** Mathematics education, Lesson study, Professional development, Mathematics instruction, teachers

### **INTRODUCTION**

Mathematics is one of the key areas of knowledge and competence for the development of an individual and social and economic development of South Africa and in a globalising world. Reddy (2005). Reddy (2005) further argues that, performance in mathematics and science is part of human development strategy in South Africa, that mathematics and science performance is one of the indicators of the health of the education system. Unfortunately, South Africa is still grappling with poor performance in mathematics and how to change this situation Reddy, (2006). Much has been said and done about this inadequacy especially with regard to the teachers of this subject. In other words, South Africa still faces the challenge of providing quality mathematics education for its multicultural society of 43 million people. South African pupils wrote mathematics and science in the Third International mathematics and Science Study-Repeat (TIMSS-R) that was conducted in 1998/1999. As Howie (2003:1) puts it, "South Africa was just one of the 38 countries participating in the study, however, the South African pupils performance was significantly below that of all other participating countries including other developing countries such as Morocco, Tunisia, Chile, Indonesia and the Philippines"

In addition to this dilemma, Reddy (2005) further adds that South Africa has participated in a number of large – scale systemic studies conducted by international and national agencies to assess the performance of the county in science and mathematics. As

Mullis et al. (2004) assert, in the Trends in international mathematics and Science Study (TIMSS) that was conducted in 2003, testing mathematics and science proficiency at Grade 8 level, South Africa came last out of the 50 countries participating. A number of reports and articles have also been written on the status of mathematics (and science) education in South Africa. Many of these reports commented on the poor results achieved in the mathematics matriculation examinations. It therefore came as no surprise since 1994 there has been considerable policy-related analysis of and intervention in mathematics education system in an attempt to improve it [DOE (2001) DOE (2002); GDE. (2003)]. The purpose of this article is therefore to explore teachers' experiences on one of the mathematics interventions that they participated in viz. "Instructional Leadership through a lesson study" for improving their classroom practices.

### **Instructional Leadership through a Lesson Study Project**

Instructional leadership through a lesson study is a project that took place over three years – from 2011-2013. The project was organised by one of the local universities in collaboration with the Department of Education. The author was one of the project facilitators. In phase one of the project, sixty mathematics and science teachers were selected to participate. These teachers come together in one workshop and were provided with information on what lesson study is about. The lesson study was described in details and the reading materials were also provided to the participating teachers. These teachers learned about how to conduct a lesson study, in other words, in these workshops the teachers would practically engage in all the four phases of lesson study. The teachers would then be requested to go back to their schools and select teachers either in their own schools or outside their schools to form groups and engage in the lesson study. The facilitators would then visit the teachers as they engage in lesson study groups.

Lesson study is one of the components of a system designed for continual professional development in Japan. The most salient feature of lesson study is that teachers collaboratively engage in action research in order to improve quality of the instruction Ono and Ferreira (2010). In a lesson study, (1) teachers jointly draw up a detailed plan for the study lesson (Research and preparation). (2) A teacher teaches the study lesson in a real classroom while other group members look on (implementation) (3) The group comes together to discuss their observations of the lesson (reflection and improvement). (4) Another teacher teaches the study lesson in a second classroom while group members look on; this is followed by the group coming together again to discuss the observed instruction.

### **LITERATURE UNDERPINNING THE STUDY**

Lesson study is a professional development activity that is characterized as classroom situated, context-based, learner focused, improvement-oriented and teacher owned, Ono and Ferreira (2010). In addition to the above definition White et al. (2011) further defines lesson study as a model of professional development designed to assist teachers to produce quality lesson plans and gain better understanding of student learning. These researchers, White et al. (2011) also argue that lesson study is also perceived as a process in which teachers progressively strive to improve their teaching methods by working with other teachers and critique one another's teaching techniques. To elaborate in detail the process, Punchner and Taylor (2006) emphasise that "Lesson studies can be done by teachers within a school, across a district, or in large public demonstration lessons. First, a topic is chosen by a group of 3–5

teachers. This topic is linked to a larger goal. (For example, as part of a goal to improve children's independent problem solving, teachers may work on a lesson study topic of subtraction with regrouping.). Teachers, usually of the same grade level, meet regularly to collaboratively plan a group of lessons and specifically one "research lesson." They produce a detailed written lesson plan, and then one of them teaches the group's "research lesson" while other teachers observe and take notes. In describing the process further in detail Perry and Lewis (2009: 366) postulates that:

Lesson study is a cycle of instruction improvement in which teachers work together to : formulate goals for students learning and long-term development; collaboratively plan a research lesson designed to bring to life these goals; conduct the lesson in a classroom, with one team member teaching and others gathering evidence on student learning and development; reflect on and discuss the evidence gathered during the lesson, using it to improve the lesson, the unit, and instruction more generally.

According to Ono and Ferreira (2010), Lesson study is a professional development activity that is characterised as classroom-situated, context-based, learner-focused, improvement-oriented and teacher-owned. It is also collaborative. These features of lesson study match the elements or principles which professional development requires Villegas-Remers (2003).

## **METHOD**

To understand teacher's views on the lesson study as a professional development tool, the researcher employed qualitative case study design. Case study was more suited in this study as it is aimed at gaining greater understanding of the dynamics of a specific situation Creswell et al. (2010). To collect the required data for this research study, the researcher conducted face-face semi-structured interviews with the selected ten teachers who took part in the mentioned project "Instructional Leadership Through a lesson study". The researcher therefore interviewed these teachers several times during the data collection process. The researcher also followed up with the telephone interviews to further clarify the issues that emerged during data analysis process. All the participants agreed to sign the consent form, demonstrating their willingness to participate voluntarily in the study.

## **FINDINGS AND DISCUSSIONS**

For the purpose of this article, the researcher focus on a case study of one mathematics teacher, Mr. Smarty who participated in the instructional leadership through a lesson study project from its inception in 2011. In my conversation with Smarty, a number of themes emerged and such themes include Content and pedagogical knowledge, opportunity to understand the learners, collaboration, confidence and self-discovery.

## **Content and Pedagogical Knowledge**

Based on the data collected, Content and pedagogical knowledge is one of the important aspects that lesson study provides opportunity to. To be more specific, Smarty commented on how they (teachers who participated in the said project) would first do research and brainstorm on the topics they would plan together as a group.

*We came together, plan the lesson together and came out with the simplest way that would make learners to understand. We looked at the resources to be used, learners' prior knowledge as well as what kind of assessment we are going to give after.*

Smarty also pointed out that some teachers are not necessarily knowledgeable in the teaching or how to teach mathematics, hence the lesson study become a vehicle in assisting such teachers. In his example, Smarty noted how some of the teachers are not qualified as mathematics teachers, as they were in such positions because of placements.

*You see some of these teachers are not qualified as mathematics teachers, the department just placed them there to get jobs, and they come with a background of economics and all that, they don't know anything about mathematics*

Smarty concluded that lesson study was able to equip such teachers with skills to teach mathematics. He further noted that teaching mathematic is not only about knowing the content knowledge but also knowing how to teach it. To support the data that emerged in this theme Garet et al. (2001) point out that lesson study is one of the form of professional development which attends to dimensions of teacher's mathematical knowledge which is more effective than professional development that focuses only on pedagogy or generic teaching skills. Stepanek et al. (2007) agree that during lesson study process, teachers delve deeply into subject matter and increase their content knowledge.

## **Opportunity to Understand the Learners**

One of the aspects that emerged from our conversation with Smarty is that of how a lesson study assists in understanding the learners.

*Lesson study helped us to have conceptual understanding of the learners, we had to understand and well anticipate the questions from the learners, become aware of what is the level of the learners, whether the learners are getting or not getting what you are saying.*

Smarty noted that the fact that the other lesson study participants came to observe lesson while also focusing on the reaction of the learners as well as what the learners are doing was helpful .

*You see, the other lesson study participants observe and not only the lesson but what the learners are doing, how they are doing it, how they are behaving after every 10 minutes, those that are observing write what they see immediately , this is what is happening with the teacher. This is what is happening with the learner; this is how the atmosphere is.*

In support of the data on the above theme Gorman et al. (2010) demonstrates that lesson study actually keeps the learners at the heart of the professional development activity. These researchers Gorman et al. (2010) argue further that lesson study does this by providing teachers with an opportunity to carefully observe students during the learning process and discuss actual classroom practice by unpacking what learners understand of a particular topic. Lenski and Caskey (2009) conclude that lesson study does improve instruction by deepening teachers' knowledge of how learners think about and learn mathematics.

### **Collaboration**

Smarty commented that the mistake many teachers make is that they remain on their own and that they think they know everything whereas they are not doing things correctly.

*You see, coming together as the people with the same goal is important. That way you smash the walls that surround them so that they see that they are together part of a bigger picture.*

In one of his examples, Smarty pointed out how they would explore and brainstorm how to teach the concepts of 'greater' than and 'less than' (> and <) in mathematics.

*We were brainstorming, and we all came with different ideas, others showed it with their fingers. Others spoke about the mouth of a fish, we also did the angles, acute, obtuse, and teachers demonstrated the different ways of teaching all these in class. It was so interesting to see such. And many other teachers gained from other teachers.*

To conclude the aspect of collaboration, Smarty commented that it also helps them to collaborate and network. In their lesson study group, as he noted, participants were teachers from his school and those from the schools in the vicinity. To further support the importance of collaboration in a lesson study, Buckwalter (2002) argues that many teachers find the collaborative element found in a lesson study to be a welcome change from teaching and planning in isolation as it gives teachers a terrific chance to collaborate, and that they can be on the same page about not only having developed the lesson together but also having seen the lesson taught.

### **Self-Discovery**

In this theme, Smarty commented that teachers who participated in the lesson study began to reflect on their teaching and worked towards their self-improvement. Smarty further noted that teachers began to feel the need to go and do research in order to contribute constructively in their lesson study meetings.

*When participating in a lesson study, you begin to see where you are lacking and where you are strong. And you look at it and say 'what should I do to overcome this'.*

It is at this point that Smarty commented that teachers become honest with themselves and indicated how they were not aware of other issues in the teaching and learning of mathematics.

*How sweet it is when it comes from the horse's mouth. When they admit that they have a problem there and there. That's when a room of improvement opens, because if you think you know, while you don't really know, then that's a problem.*

To support the idea, Takahasi and Yoshida (2004) add that one of the impotencies of lesson study is that it is a powerful source of growth for teachers as it provides opportunities for teachers to make sense of pedagogical ideas as well as to change their perspectives about teaching and learning.

### **Confidence**

Throughout their participation in the lesson study, teachers developed self – confidence. As noted by Mr. Smarty, the teachers who participated in the study felt confident and volunteered to be observed while teaching. This was not a common practice to them before. Many of them felt intimidated and feared to be observed while teaching.

*By knowing the subject matter, you become confident, by knowing how to teach it, you even become more confident. The teachers in our group were not afraid anymore, you see.*

Smarty also noted how teachers have become confident in teaching some of the topics that were tricky, specifically the topics that the teachers would skip and not teach. To support what emerged in the data, Lim et al. (2005) indicates that lesson study improves teacher's confidence by providing them with conducive atmosphere where members of a team collaborate openly without fear of being scrutinized. Lim et al. (2005) further note that lesson study is a tool that provides teachers with more self-confidence through the supporting environment provided by their peers.

### **CONCLUSION**

A number of types and models of teacher professional development have been devised and implemented in different countries. The goal has been to promote and support the professional development of teachers from the beginning of their careers until they retire. Studies found that many of the approaches to teacher development have minimal influence on changing teachers' knowledge and classroom practice.

One of the reasons for this failure is that teachers are most often not involved in the planning of their professional development. Mokhele (2015) argue that teachers are the key actors in continuing professional development and should be involved in the decisions made by the authorities. Mokhele (2015) further asserts that teachers are involved in doing the work and should be allowed to give their opinions on professional development programmes. In the case of the present study, teachers participated in a lesson study which is one of the teacher-led professional development initiatives. These teachers found the lesson study informative and recommended it as a tool to improving their teaching and learning of mathematics. Based on the data collected, lesson study is one of the professional development models that teachers would be happy to enlist in.

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Matseliso L. Mokhele  
Faculty of Education, University of Fort Hare  
[mmokhele@ufh.ac.za](mailto:mmokhele@ufh.ac.za)