

School-based professional development interventions: The effects of a lesson study approach for mathematics teachers¹

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ABSTRACT

School-based professional development interventions are regarded as one of the most efficient ways to facilitate teacher learning. However, the available evidence supporting their effectiveness is limited. This paper assesses and seeks to understand the effects of a school-based professional development intervention that uses Lesson Study to foster improvements in the teaching and learning of primary and secondary school mathematics. Retrospective pre-testing and semi-structured interviews reveal that teachers perceive changes in their curriculum decisions and instructional practices after participating in the intervention. Furthermore, the findings suggest that collaboration, peer observation and critical reflection are essential components in assisting teachers with the selection and implementation of effective teaching strategies. The findings suggest that school-based professional development interventions can be effective in improving teachers' instructional practices and curriculum decisions. The authors therefore recommend a shift towards more situated, collaborative and school-based professional development approaches for teachers.

Keywords: school-based professional development, instructional practices, curriculum decisions, lesson study, communities of practice

INTRODUCTION

Professional development (PD) is often used in many countries, including South Africa, as a means of improving the quality of teaching and learning. Teachers are exposed to a variety of PD interventions that may take the form of seminars, workshops and conferences. Although these PD approaches are favoured by many in-service training providers, they are often criticised for being incoherent, short and sporadic encounters that do not address the fundamental challenges related to real classroom change (Darling-Hammond & Richardson, 2009). Researchers thus argue that PD interventions should address classroom practice and student achievement more directly if they are to be successful (Desimone, 2009).

It is thus not surprising that South Africa has also experimented with a variety of approaches to PD over the years, but very few of them seem to have made a substantial impact on the classroom practices of many teachers across the country (Botha, 2012). It is in the context of this diversity and multiplicity of innovations

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around PD that one local university adopted Lesson Study as a vehicle to help mathematics teachers reconfigure their classroom practices. Amongst other formulations, Lesson Study can be considered to be a school-based professional development (SBPD) approach where teachers work collaboratively to plan, implement, and reflect on lessons designed to improve student learning on a particular topic (Lewis, 2009). Whether this latest innovation will succeed or not remains an open question at this stage.

This paper seeks to determine whether teachers from the Free State province changed their curriculum decisions and instructional practices after participating in the activities of Lesson Study, which include research and common planning; teaching and peer observation; and post-observation group reflection. The authors also assess how teaching practice is changed as a result of participating in the community of practice (CoP) and then attempt to identify aspects of the CoP that are responsible for the perceived changes in practice. Instructional practices are specific practices that instigate and support efficient and effective classroom interaction with a view to enhance learners' conceptual understanding (Schulman, 2016). Effective instructional practice has to do with the quality of content presented and the manner in which it is presented (pedagogy). Curriculum decisions involve the conceptualisation, planning, implementing and evaluation of curricula (Svanes & Klette, 2018) and in this specific case, mathematics curricula. We specifically seek to assess and understand the effects of a school-based intervention programme that uses Lesson Study on the mathematics teachers, by answering the following questions:

1. What are the effects of Lesson Study on teachers' curriculum decisions?
2. What are the effects of Lesson Study on teachers' instructional practices?
3. How can these effects, or lack thereof, be understood?

REVIEW OF THE RELEVANT LITERATURE

The school as a site for professional development

Numerous PD interventions occur outside the school and while some of them have merit, many questions have often been asked regarding their ability to initiate and sustain changes in teachers' classroom practices. This is because many of these interventions do not seem to address the challenges faced by teachers in their day-to-day teaching and learning of mathematics for example. Consequently, there is a call for researchers and developers to look at schools as possible sites for PD. This call stems from the general concerns with the so-called 'one size fits all' type of PD interventions that occurs mostly in seminars, workshops and conferences (De Clercq & Phiri, 2013). The argument is that the school is the context in which most of the teacher's work occurs, and, therefore, it makes sense that teacher learning should also be deliberately structured to occur within a similar context and space.

SBPD interventions may take many forms: teacher coaching or mentoring, critical friends (knowledgeable teachers who advise on issues of teaching and learning), collaborative action research, COP and teacher clusters, to name but a few. In this context, Vescio, Ross and Adams (2008) explain that these SBPD approaches occur through the formation of professional learning communities (PLCs). Lesson Study therefore represents one form of PLCs in that the teachers who constitute a Lesson Study group become a community who are brought together by the goal of seeking to make changes to their instructional practices. When such PLCs involve teachers in one or more schools, they become another example of a SBPD. Thus, in this paper, we use the terms SBPDs and PLCs interchangeably. Jita, Maree and Ndlalane (2008) contends that the mere formation of these PLCs does not necessarily lead to more effective teaching, and that there are some preconditions that have to be taken into account. The main focus of the PLCs should be to address teacher performance with a view to improve student achievement (Jita et al., 2008).

Communities of practice

One feature that seems to stand out in most SBPD interventions is their ability to create platforms where teachers can collaborate effectively. In fact, numerous researchers posit that SBPD interventions improve teaching and learning by promoting collaboration and reflective dialogue between teachers (Darling-Hammond & Richardson, 2009; Desimone, 2009; Saunders, Goldberg & Gallimore, 2009). This collaboration between teachers approximates what Wenger, McDermott and Snyder (2002) describe as CoPs. A CoP describes a situation where people come together both to share a problem, a concern or their enthusiasm on a certain topic and to improve their expertise and knowledge through frequent and deliberate interaction (Wenger et al., 2002). Therefore, Lesson Study in our case represents a form of CoP where teachers work together to enhance teaching and learning by focusing on the complexities of classroom instruction.

The problem

While the literature on CoPs is encouraging, Saunders et al. (2009) suggest that there is a need to pause and reconsider. Despite the compelling logic of PLC's benefits regarding teaching and learning, the available evidence is too limited to make strong inferences regarding their effectiveness. There are, however, a few promising examples. Andrews and Lewis (2007) found that learning in professional communities not only enhances teachers' knowledge but that their classroom work is also affected. Cordingley, Bell, Evans and Firth (2005) agree that collaborative learning within communities lessens teachers' anxiety about being observed and, consequently, that teachers show a commitment to changing their practices and trying out new things. The results of the two studies indicate that CoPs can have positive effects on teachers' practices.

On the other hand, Bryk, Camburn and Louis (1999) argue that instead of promoting change in classroom practice, some of the communities may emphasise conserving the current ones. This may be brought about by power relations where experienced teachers dominate the community and they resist change based on their past experiences. Furthermore, Vescio et al. (2008) note that most studies concerning CoPs indicate changes in teachers' practices but do not specify how teaching practice is changed as a result of participating in the professional community. Part of the reason is that most of these studies do not present data on pre-intervention practices, and, as a result, the claims that they make regarding teacher changes are somewhat weakened. Additionally, Botha (2012) notes that there is no research-based evidence in South Africa pointing to the effects of CoPs on teaching and learning. This is surprising considering the recent efforts of the Department of Basic Education (DBE) to improve teaching and learning by encouraging the formation of functional CoPs in schools. There is, therefore, a need to study what and how teachers learn in CoPs, and to understand the kinds of conditions and knowledge that instigate changes in teachers' classroom practice. This is essential, in part because this knowledge will enable policy makers and PD providers to make informed decisions regarding appropriate SBPD initiatives.

This study uses teacher perceptions to assess the degree of change, if any, in their instructional practices and curriculum decisions as a result of participating in a Lesson Study intervention over a period of between six and 12 months.

FRAMEWORK FOR THE STUDY

Situated learning and Lesson Study

Whenever teachers are involved in collective inquiry that involves their content knowledge and teaching, the collaborative spaces created provide an effective and efficient form of experiential learning, which fosters the adoption of new instructional practices (Desimone, 2009). If professional learning takes place in the context in which it is applied, it resembles situated learning as described by Lave and Wenger (1990) where learning occurs by participation in a CoP (Wenger et al., 2002).

Lesson Study is premised on the idea that teachers will likely alter and improve their classroom practices by observing other teachers' lessons and critiquing those lessons in a natural setting such as a classroom (Burghes & Robinson, 2010). The three stages of lesson study, which involve research and common planning, teaching and peer observation, and post-observation group reflection, are critical for fostering change in teachers' instructional practices and curriculum decisions.

At the research and common planning stage, the goal of the intervention is set and clarified. The lesson study group collaboratively chooses a research theme to work on during the intervention, and it plans a series of lessons and chooses one research lesson to be presented (Ono & Ferreira, 2010). The teaching and peer observation stage involves the presentation of the planned research lesson by one teacher while other members of the group observe the lesson presentation (Lewis, 2009). The observations focus on the students' learning and their engagement in the lesson (Puchner & Taylor, 2004). In the post-observation group reflection stage, the group comes together after the presentation of the lesson to discuss their lesson observations, including what they identified as strong and weak points of the lesson in terms of learner engagement.

Collaboration, observation and reflection

One of the key features of lesson study is collaboration, which allows teachers to undertake action research with the intention of improving instruction (Ono & Ferreira, 2010). The presence of other teachers observing the lesson provides an opportunity to observe learning without the burden of teaching. Teachers are required to be reflective practitioners; hence numerous opportunities for reflection are required to enhance teachers' capacity for critical reflection (Suh & Fulginiti, 2012). Lesson Study affords the opportunity to collaborate, observe and reflect with other teachers. Therefore, Lesson Study was considered to be an efficient vehicle for supporting teacher change in terms of instructional practices and curriculum decisions.

METHOD

Description of the intervention

The mathematics workshop was a product of a partnership between the University of the Free State (UFS) and the Free State Department of Education (FSDoE). The partnership for PD, which was implemented for six days over a period of six months, sought to provide opportunities for teachers to re-examine their teaching of mathematics topics with a view to improve teaching and learning in the schools. During the implementation of the FSDoE-UFS PD intervention, teachers were expected to initiate and sustain lesson study groups in their respective schools even after the intervention has ended.

Sample

The sample consisted of novice and experienced primary (59%) and secondary (41%) teachers ($n = 85$) from various schools within the Motheo district of the Free State province. The teachers were nominated randomly by their employer from a population of mathematics teachers within said district. Approximately 7% ($n = 6$) of the original sample of the participants were randomly requested to participate in the semi-structured interviews. Two of the participants were from secondary schools and the remaining four were from primary schools. The participants were anonymised through the use of pseudonyms.

Measures

The study used surveys to answer the first and second research questions. For quantitative data (surveys), retrospective pre-testing was used for data collection (see Howard, Schmek & Bray, 1979). Retrospective pre-testing, which addresses a phenomenon known as 'response shift bias', is regarded as a more desirable approach for assessing the effects of PD interventions than traditional pre- and post-test approaches (Hetcher, 2011). A 5-point Likert-scale (1 = strongly agree; 2 = agree; 3 = not sure; 4 = disagree; 5

= strongly disagree) self-administered questionnaire, which contained before- and after-the-intervention sections, was used to collect the data. Items for the questionnaire were developed and modified from sources in the literature that measure changes in teacher practices and instructional decisions. The items were based on Klein's (1991) categories of curriculum decisions and Windschitl et al.'s (2012) ideas regarding instructional practices. The survey was administered six months after the commencement of the intervention (which was on the last day of the workshop).

The semi-structured interview, which assisted in answering the third research question, was designed to understand the nature of teacher changes as a result of participating in the lesson study intervention. The interview protocol endeavoured to understand the changes that were brought about by teachers' participation in the lesson study groups at schools. This was achieved by requesting teachers to talk about the changes they had experienced in the previous interventions they attended. The strategy allowed the researchers to discern the changes that were brought about by other interventions and by lesson study. The interviews were conducted approximately six months after the collection of the quantitative data.

Reliability and validity

The Cronbach alpha for the three subscales (research and common planning, teaching and peer observation, and post-observation group reflection) indicated that items were sufficiently reliable ($\alpha > 0.7$) for both curriculum decisions and instructional practice constructs (Table 1).

Table 1
Cronbach alpha for the subscales

Construct	Subscale	Cronbach's Alpha	Number of Items
Instructional Practices			
	Research and Common Planning	0.72	7
	Teaching and Peer Observation	0.73	5
	Post-observation Group Reflection	0.70	4
Curriculum Decisions			
	Research and Common Planning	0.87	6
	Teaching and Peer Observation	0.72	4
	Post-observation Group Reflection	0.75	3

The semi-structured interview protocol was checked and verified by knowledgeable others to confirm that the qualitative tool will likely elicit responses that will assist the researchers to answer the research questions.

The instruments were subjected to content and construct validity tests. Content validity is established when the instrument fairly and comprehensively covers the domains that it claims to explore (Cohen, Manion & Morrison, 2007). The items in the instruments were compared to the ideas of Klein (1991) and Windschitl et al. (2012) regarding instructional practices and curriculum decisions, and the items were considered to resemble the ideas of the cited researchers. Construct validity is concerned with whether the items or questions in the instruments relate to the recognised theoretical construct of the phenomenon under study (Cohen et al., 2007). To ensure construct validity, different conceptions of instructional practices and

curriculum decisions were sought. They were then compared to our concepts and it was determined that the instruments were sufficiently valid.

Analysis

Percentages, mean ranks and means were calculated to show the differences in teachers' retrospective pre-testing choices. Additionally, the null hypotheses were tested for significance using the Wilcoxon signed rank test, which is the non-parametric equivalent of the paired sample t-test (Cohen et al., 2007). Effect sizes were also calculated to determine the relative size of the effects on teachers.

The recorded interviews were transcribed and the researchers read and re-read the transcripts to understand each participant's point of view. The researchers then identified recurrent and common themes in the data. These themes were coded so that they could be easily fragmented, examined and categorised. The qualitative data from the semi-structured interviews were used to corroborate the quantitative data findings.

FINDINGS

The findings on the first research question are presented first, followed by the second and third research questions.

The first research question sought to determine if there were changes in the teachers' curriculum decisions as a result of participating in Lesson Study. Data indicates that there are differences in teachers' retrospective pre-test scores. There was a general shift in teachers' choices to mostly agree and strongly agree as indicated by the mean of each subscale (Table 2).

Table 2
Means for the summed curriculum decision subscales

Subscale	Mean (Before Lesson Study)	Mean (After Lesson Study)
Research and common planning	2.16	1.47
Teaching and peer observation	2.19	1.47
Post-observation group reflection	2.14	1.41

The first research question was a test of the following hypothesis:

There is no difference in teachers' curriculum decision scores before and after the intervention as a result of research and common planning, teaching and peer observation, and post-observation group reflection

The Wilcoxon test statistic indicated that the hypothesis for the curriculum decisions construct were not supported. The test revealed that there were significant differences in the teachers' curriculum decisions as a result of their participation in research and common planning ($Z = -7.54$; $p < 0.01$), teaching and peer observation ($Z = -7.20$; $p < 0.01$) and post-observation group reflection ($Z = -7.11$; $p < 0.01$). Effect sizes (r) for the subscales revealed that the difference between the pre- and post-test scores was moderately large for all the subscales (Table 3).

Table 3
Wilcoxon test statistics and effect sizes: curriculum decisions

Subscale	Z	p-value	r
Research and common planning	-7.54	0.00	-0.82
Teaching and peer observation	-7.20	0.00	-0.78
Post-observation group reflection	-7.11	0.00	-0.77

The second research question sought to determine if there were changes in teachers' instructional practices as a result of participating in Lesson Study. Similar to the first research question, there was a general shift in teachers' choices to mostly agree and strongly agree as indicated by the means (Table 4).

Table 4
Means for the summed instructional practices subscales

Subscale	Mean (Before Lesson Study)	Mean (After Lesson Study)
Research and common planning	2.27	1.59
Teaching and peer observation	2.04	1.47
Post-observation group reflection	2.26	1.40

The second research question was a test of the following hypothesis:

There is no difference in teachers' instructional practices scores before and after the intervention as a result of research and common planning, teaching and peer observation, and post observation group reflection.

Similarly, the hypotheses for the instructional practice subscales were also not supported. The Wilcoxon test statistic revealed that there were significant differences in teachers' instructional practices as a result of their participation in research and common planning ($Z = -7.41$, $p < 0.01$), teaching and peer observation ($Z = -7.05$, $p < 0.01$) and post-observation group reflection ($Z = -7.50$, $p < 0.01$). The effect sizes indicated that the magnitude of the difference between the pre- and post-test scores was large for the three subscales (Table 5).

Table 5
Wilcoxon test statistics and effect sizes: instructional practices

Subscale	Z	p-value	r
Research and common planning	-7.41	0.00	-0.80
Teaching and peer observation	-7.05	0.00	-0.76
Post-observation group reflection	-7.50	0.00	-0.81

To answer the third research question, which was to understand the perceived effects of Lesson Study, we sought to find out which curriculum decisions and instructional practices changed as well as which elements of the Lesson Study activities instigated and supported these perceived changes.

Collaboration

Collaboration between teachers was an important factor in their attempt to reconfigure their practices. Most teachers suggested that planning collaboratively with their colleagues led to improvements in their content knowledge or, at least, that it assisted them to recall and engage with content they had earlier learnt. This is illustrated when Miss Pitso commented that

I did not imagine probabilities could be so tricky because we teach it to relatively young students and one typically teaches it up to a certain level. ... With the Lesson Study, we learnt exactly how deep we should delve into this concept with the students. Some of these things we did back in teacher education colleges but since we do not teach them now, we sort of forgot about them but now we have renewed interest in these things.

Teachers also indicated that through this collaboration they were able to learn a variety of methods and strategies that enabled them to present content to learners in an understandable way. Mr Selikane explained that

When sitting around a table planning... maybe you have this idea and then the other teacher, when discussing the planning will say 'no, don't do it that way, do it this way, it will be easier'.

Teachers reported meeting more regularly and planning for lessons collaboratively and, in one instance, teachers reported that they started planning for the whole term in advance. Ms Pitso indicated that

Like now when the term ends, we are going to meet and plan together for the next term. We even do the pace setters together and the lesson plans for the next term so that we have all the lesson plans done... it helps a lot.

Interactions and discussions with other teachers presented an opportunity for teachers to increase the breadth of their teaching methods. Mr Mokgadinyana noted that

Initially, I used only my ideas because we did not share ideas; it mattered very little whether they work or not. With Lesson Study, we plan as a group and individuals bring different ideas when we deal with a particular concept and at the end of the day, these ideas will influence the way I will present the lesson.

Teachers even started to engage in common marking and the analysis of assessments. In a sense, teachers started to use student assessment data to gauge student learning. Mr Selikane pointed out that

We even came up with this thing of common marking where we ... sit together as mathematics teachers and assess, let's say grade 4 answer sheets together and each and every one will pick up errors or problems of that class with a particular question. Even when you move to another grade, then you can see that with this class, the problem might be learners or teachers with this concept. So from that point of view, we can even sit down and improve from there.

Observation

All the teachers mentioned that as a result of the intervention, particularly by observing other teachers, they employed more student-centred approaches in their classrooms. In one case, Mr Mahabuke noted that he had attended numerous mathematics interventions but that they did not lead to a change in his classroom practices. While the interventions he had attended, to some extent, increased his mathematics content knowledge, he remained a chalk-and-talk type of teacher. Mr Mahabuke explained that although

they were continually told about student-centred approaches in workshops, as teachers, they often had a difficult time with the implementation of such approaches. He added that observing other teachers helped him make sense of some of the approaches that he always considered too impractical for a secondary school mathematics classroom. Mr Selikane held a similar view as he commented that

I think after the Lesson Study I understood that I have to... guide and allow students to do the work on their own while I monitor the situation. At the end of the day, you show them that you made a mistake here and this is how you should have done it. What is important is that you should encourage the students to work on their own.

Some teachers suggested that participation in peer observation increased their awareness of student interactions and learning. Teachers looked for signs of learning during the lesson and they took appropriate measures if learning was not successful. Mr Masuha mentioned that

When you present a lesson, you can't see where the mistakes are but when you are observing someone, you can see them and you think to yourself 'maybe I could have done it this way'. If the reaction from the students is not satisfactory, you know that this approach is not effective and another approach is required.

Reflection

All the teachers seemed to value constructive criticism from their colleagues in the reflection sessions. Although teachers cited some sort of anxiety regarding being criticised, they also mentioned that their confidence increased because of the positive feedback they received from their colleagues. Mr Selikane commented that

After the lesson, colleagues... will start telling you how your lesson can be improved and then you consider what they said and try to improve on those elements of your lesson the next time you present the lesson.

In one school, the idea of reflection became so popular that it was extended to students as well. Students were afforded the opportunity to reflect on the lesson after tuition hours which led to the establishment of a mathematics centre at the school. Mr Masuha explained that

Maybe I extended the idea we were exposed to at the University; we come here and reflect on what was done in class that day... If we did not get to certain points in class, after school we have something like reflection where we discuss what we learnt on the day and it is more like a summary to determine if the learners understood the concept.

Mr Masuha further explained that, in these sessions, learners are afforded the opportunity to suggest possible ways and strategies that the teacher could have used if learning was not successful in a lesson.

DISCUSSION

The school is a place where knowledge is produced and in which this knowledge is used to ignite conceptual change, which ultimately leads to a change in the way teachers think and act (Katz & Earl, 2010). It is no surprise that Vescio, Ross and Adams (2008) believe that teacher PD should thus be based in the school and its focus should be on teacher learning and on improving teacher practices. This study sought to determine if teacher curriculum decisions and instructional practices changed as a result of their participation in this SBPD as well as the possible reasons for these changes.

The Wilcoxon signed rank test suggested that there were significant changes in teachers' curriculum decisions and instructional practices after participating in Lesson Study. Furthermore, the means suggest that the changes were positive, which suggest that not only did their curriculum decisions and instructional practices change, but that these decisions and practices might have improved as well. The findings therefore suggest that this SBPD where teachers were able to plan collaboratively, observe one another and reflect together provided a conducive learning environment which, in turn, possibly instigated changes in teachers' practices. Similar to our findings, Sandholtz and Ringstaff (2013) find that rural teachers' instructional practices in science improve after participating in a PLC. They attribute the success of their intervention to its ability to create a platform for increasing teachers' knowledge and motivation.

In our attempts to understand the findings, we quickly realised that collaboration was important for teacher learning in PLCs. Teachers appreciated the different ideas in terms of planning and teaching that their colleagues shared with them. Some teachers even began to plan for the entire term together. This supported their perceived changes in practice as a result of different ideas and methods that emerged from such interactions. The support teachers received from their colleagues in such collaborations increased their confidence and lessened their anxiety both when presenting lessons to students and when being observed by their colleagues. This is not unlike what Tam (2015) observes: most teachers shed their conservatism and take an active stance in curricular planning and decision making after participating in PLCs.

Teachers supported one another in their attempts to understand and correctly implement effective strategies. Cordingley et al. (2005) found that teachers' use of inquiry-based methodologies increased together with their ability to correctly implement new teaching strategies when they undertook professional learning collaboratively. Through mutual support and collaboration, teachers were prepared to incorporate useful ideas and strategies that were suggested by their colleagues into their lessons. All the teachers reported a shift towards more student-centred approaches and this was critical because of the known deficiencies of the lecture method in schools (Bland, Sounders & Frisch, 2007). Similarly, Tam (2015) finds that teachers participating in PLCs recognised the value of student-centred approaches and they lessened their use of the transmission of knowledge approach. The different ideas teachers were exposed to led to improvements in teachers' content knowledge and effective teaching strategies for specific topics in mathematics. Teachers had the opportunity to observe the implementation of these student-centred approaches, and, therefore, the subsequent implementation of the approaches in their own classrooms was easier.

One other factor that provided the impetus for change was the student achievement data. It was clear that teachers used student data to diagnose and detect problem areas that students encounter and to discuss possible solutions for such problems. Teachers also thought of the future in that they compared their assessment data with other data from different grades in an attempt to understand the problems faced by learners as they progress through the grades. A spinoff that resulted from the Lesson Study was the reflection session that involved students and teachers. It is important for learners to direct their own learning in line with current practices in teaching and learning (Loyens, Magda & Rikers, 2008).

There was an overall appreciation of the opportunity to observe learners during a lesson. Prolonged interaction between teachers assisted them with a new understanding of student learning, and the teachers' perspectives changed from viewing student learning as static to a more constructive view (Tam, 2015). Through these observations, teachers noticed signs of student learning, and, in cases where the signs from students were not satisfactory, teachers indicated that they were prepared to change and look for better methods to present a topic. Teachers, in this case, indicated that they were more attentive to student needs than before and that they focused mainly on student learning. Strahan (2003) also finds that PLCs become more successful when the focus is on students' needs and learning.

Teachers were very enthusiastic regarding the reflection sessions. This was as a result of the constructive feedback they had received from their peers during reflection. In their review of collaborative PD interventions, Cordingley et al. (2005) found that collaboration increased teachers' awareness of student learning and that teachers reflected more deeply on their lessons as a result.

CONCLUSION

This paper sheds more light on the SBPD's ability to provide a space where teachers reflect on and reconfigure their classroom practices. Additionally, some empirical evidence on the effectiveness of SBPD interventions in South Africa is presented. The data reveal that the SBPD intervention has a positive effect on classroom practices. Moreover, the paper identifies specific classroom practices which change as a result of SBPD, together with the elements of SBPD that support or instigate the changes. The findings therefore suggest that teachers improve their content knowledge, instructional strategies and change their approach if learning has not been successful. Furthermore, teachers are more attentive to their students' needs and they are more aware of how students learn increases. Teachers start to use student data to inform their practices and students engage with the teachers regarding best practices in the teaching of mathematics.

The collaborative nature of the intervention played a major role in ensuring that teachers change and improve their classroom practices. Regular meetings and support from colleagues play a pivotal role in ensuring that teachers are confident regarding teaching some of the problematic sections in the curriculum. Consequently, teachers will not be afraid of trying new things in the classroom which may result in increases in student achievement. If the results of the present study are anything to go by, then we suggest the need for a deliberate shift towards more situated and collaborative SBPD approaches for teachers in South Africa.

In terms of teaching and learning, Lesson Study through the formation of CoPs seems to present opportunities for learning to teachers. The components of Lesson Study (collaboration, observation and reflection), if undertaken in the context of a school-university partnership, may help enhance teachers' curricular decision making and the manner in which they undertake instruction in classrooms. The data therefore suggest that SBPD as a form of CoP may be effective in instigating and fostering a change in teachers' instructional practices and curriculum decisions.

We do realise, however, that the findings of this one study represent just the beginning in the attempts to map out the effects of SBPD on teachers' instructional practices and curriculum decisions. The results should therefore be approached with the necessary caution. For one, the findings are derived from teachers' perceptions and may thus need to be confirmed against what actually occurs in the classroom. There may also be a need to study the effects of this type of intervention on separate groups of teachers, i.e. novice and experienced, primary and secondary school teachers. Retrospective pre-testing also presents some challenges. The participants are required to recall their initial state after six months and they may over- or underestimate their initial states. Some participants may feel the need to make the intervention seem effective by structuring their responses to reflect effectiveness.

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