

TEACHERS AND LEARNERS' PERCEPTIONS ABOUT TEACHER-OUTSOURCING AS A COMPLIMENTARY STRATEGY IN GRADE 12 MATHEMATICS CLASSROOMS

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Abstract—The study reported in this paper sought to explore outsourcing as a strategy to influence the 12th grade learners' academic performances in the under-performing schools. The study followed a descriptive framework as it is qualitative in nature. Data collection strategies included semi-structured interviews and focused groups, as well as classroom observations throughout the outsourcing process. Ten teachers were purposefully selected from ten secondary schools. An average sample of 8 learners per school participated in the semi-structured interviews and later was engaged about their perceptions regarding outsourcing as a strategy via the focused group discussions. The findings indicated that outsourcing as strategy used appeared to have benefits towards improving learners' academic achievements on topics that were taught. Furthermore, both the teachers and learners in the host schools identified outsourcing as having a value in influencing their practice positively.

Keywords: Outsourcing, mathematics achievement, mathematics teaching; learning.

INTRODUCTION

South African high school learners have been underperforming in mathematics for many years now (Department of Basic Education [DBE], 2011). The schools that do not exceed the standard pass rate of 50% are classified as under-performing (Department of Education, 2001). Research has demonstrated that the poor academic achievement in Mathematics appeared to be connected to factors such as: teachers' subject matter knowledge; classroom assessment for learners; learners' socio-economic status; overcrowded classrooms; lack of resources; low motivation and attitude (Mbungua, Kibet, Muthaa, & Nkonke, 2012;). Geldenhuys (2000) argued that learners' poor academic achievement may be caused by absenteeism as well as mathematics anxiety. Some other factors that affect poor performance in mathematics are teacher workload, school discipline and time management (Musasia, Nakhunu, & Wekesa, 2012). However, it was observed that most of the schools in one of the district in Limpopo Province performed poorly whereas some produced poor results in Mathematics. The cause(s) of poor academic performance in those schools were unknown and the district office intervened by inviting teachers who produced good results to the underperforming schools to conduct lessons with the aim of sharing best practices. Such an intervention was termed *outsourcing*.

It is for the rationale discussed above that this study sought to explore *outsourcing* as a strategy to influence academic performances in the underperforming schools. According to Smith and Smith (2012), *outsourcing* is any task or operation that can be performed by an expert from institution in which the teachers in the institution lack expertise to carry out those duties effectively. Hima (2006) defined outsourcing as a business process term for hiring an external expert to provide services for the institution to do a specific task or tasks in which the institution does not have an expert to do on its own. Moreover, Pescheck and Schneider (2001) confirmed that *outsourcing* is when an organisation gets help from outside to perform specific task that cannot be performed in-house.

The intervention used in the study's design was in a form of sourcing (or inviting) performing schools' teachers to assist the teachers in the under-performing schools by sharing and demonstrating their best practices. In other words, experts (performing teachers) were invited in the institution that lacked the expertise in (effective teaching and learning of mathematics) of executing a particular task (Pescheck & Schneider, 2001). In this regards, teachers from other schools were

invited by the district office to teach mathematical concepts that seemed difficult to the host teachers to teach.

These processes of *outsourcing* had prompted our curiosity to evaluate and explore it by establishing how effective this model of intervention is. The effectiveness of *outsourcing* was measured by Fischer's (2000) model for evaluating the process. In the evaluation process, we have interviewed teachers, the host and guests' teachers about the process of outsourcing. The guest teachers' lessons on the specific aspects of mathematics were observed. Focus groups were used to draw information from learners about outsourcing and how effective (or not) it was. This article starts by providing an overview of related literature, presents Fischer's model within the contexts of *outsourcing*, then it discusses methodological issues, and then finally presents conclusions and recommendations.

THEORETICAL ISSUES

As noted earlier, the research reported in this article is framed by Fischer's (2000) fields of competence to evaluate outsourcing, its impact on learners' learning of mathematics. Fischer's fields of competence of expert teachers' outlines basic knowledge and skills, operations and reflections. It provides an understanding of what constitute(s) an expert teacher in the field of mathematics. The expertise of teachers is discussed in accordance with the three attributes of the expert teacher. Invarson, Beavies, Bishop, Peek & Elsworth (2004) is of a view that expert teachers are those who teach mathematics effectively and have coherent beliefs and understanding of mathematical concepts. Such expertise of the guest teachers made it possible for the host schools to learn how to teach concepts that appeared to be difficult to teach.

Outsourcing is defined as a process in which one delegate the expertise of others to execute tasks that are challenging to others to execute (Pescheck & Schneider, 2001). Other scholars defined it as a process of hiring external employees/teachers to perform a specific task for an institution in which the institution does not have the expertise to perform on their own (Smith & Smith, 2012; Hima, 2006). Lazarus and McCullough (2005) describe outsourcing as a way to improve service, and reduce costs. They argued that little is known about whether outsourcing impact schools in rural areas differently to those in non-rural areas. Outsourcing consists of two teachers, the guest teacher who renders the service in the host school and the host teacher who is assisted in the difficult concepts. Outsourcing is characterised a process whereby the host teachers invite the guest teachers to teach topics that are perceived as difficult to teach in their schools. The guest teachers' skills and expertise are outsourced in order to improve learners' academic performances in the host schools.

For the purposes of the study discussed in this article, Fischer's (2000) description of what constitute(s) a 'good teacher' in the teaching and learning of mathematics was adopted. In actual fact, Fischer identified the following fields of competence that teachers of each subject should acquire in order to teach their contents: *basic knowledge* (notions, concepts, and forms of representations); *operative knowledge and skills* (solving problems, proofs in general, generating new know knowledge); and *reflections* (possibilities, limits and meaning of concepts). The expert teachers in particular should be competent in the first two fields of competence to teach the mathematics content effectively. Fischer also considers the fields of basic knowledge and reflection as being particularly important for the generally educated laypersons (referring to novice teachers). Basic knowledge "is a prerequisite for communicating with experts, reflection is necessary for judging their expertise" (p.5).

The expert teachers are regarded as the ones who are effective and competence in teaching mathematics (Invarson et al, 2004). Such teachers should be creative and innovative and follow a learner-centred approach in their teaching (Miranda & Adler, 2010). They should also display adequate experience of mathematics teaching that meet learners' needs. Teachers' experiences in effective teaching of mathematics are important to improve learners' academic performances (Mogari et al., 2009). A solid body of research has demonstrated teachers' experience influences learners' academic performances in school Mathematics (Betts, Zau & Rice, 2003; Center for Public

Education, 2005; Greenwald et al., 1996; Rivkin, Hanushek & Kain, 2005). Moreover, expert teachers display a good background of subject content knowledge (SCK) and pedagogical content knowledge (PCK) in teaching and learning of mathematics (Shulman, 1986).

The teaching and learning of school mathematics basically requires teachers to have good command of subject content knowledge (Sepeng, 2014). Teacher subject content knowledge (SCK) is regarded as mathematical knowledge for teaching (Shulman, 1986; Hill et al., 2008; Hill, Rowan, & Ball, 2005). According to Hill (2010), teacher mathematical knowledge is related to classroom teaching and is bound to influence learners' academic achievement. Teachers with poor mathematical knowledge are less likely to present materials clearly and provide error-free content to the learners (Ball, 1990a; Borko et al., 1992; Cohen, 1990; Heaton, 1992; Putnam, Heaton, Prawat & Remilhard, 1992; Stein, Baxter, & Leinhardt, 1990). In the study discussed in this article, teachers who participated in host schools needed to have acquired the skills and knowledge of an 'expert' or a 'good' teacher within the framework of SCK in order to improve learners' performance in mathematics. The guest teachers' services in this process complemented the normal classroom practice in mathematics for the betterment of learners' achievement. These teachers can interpret and respond to learners' problems in mathematical concepts and produce more conceptually grounded lessons (Lloyd & Wilson, 1998).

Teachers' SCK and PCK may be an ingredient for and integrated parts of effective mathematics instruction (Shulman, 1986). In other words, in order to construct mathematical concept in learners' mind, SCK and PCK are needed. The manner in which teachers relate their subject matter to their pedagogical knowledge and how subject knowledge is a part of a process of pedagogical reasoning are seen as integrant of PCK. PCK is knowledge of how to learn content of mathematics or approaches used in the teaching of a mathematical topic (Shulman, 1986; Wilson, Shulman, & Richert, 1987; Speer & Wagner, 2009). It requires teachers to have knowledge of learners' understanding of mathematical thinking, such as how learners process, store, retain and recall information learnt (Shulman, 1987; Romberg, 1988). The host teachers attended the lessons presented by expert teachers in order to improve both their PCK and SCK.

RESEARCH METHODOLOGY

The study reported in this article followed a descriptive framework. The qualitative data were collected via classroom observations, interviews and focus groups. The data analyses were descriptive in nature (Johnson & Christensen, 2004). The interview questions at both learner and teacher levels assisted us to understand how they perceived the notion of *outsourcing* in relation to mathematics academic performances. The observation schedule (adapted from Luneta, 2006) was used in order to make sense of pedagogies that are employed by the guest (or expert) teachers in the teaching and learning of mathematics during outsourcing process. In addition, the focus groups in the 10 schools assisted us to have a reliable data on the effectiveness (or lack thereof) of *outsourcing* as an intervention model at learner level.

The study was conducted in ten resource constrained secondary schools in one of five cluster circuits in Polokwane. The questionnaires were distributed by us to the 10 participating teachers before and after the *outsourcing* intervention. The classroom observations were conducted in five consecutive days to each guest teacher. On average, eight learners were randomly selected to participate in the focus group discussions from each participating schools.

DATA ANALYSIS

Data collected from teachers and learners were analysed separately as the study included both teachers' and learners' perspectives about the intervention. The analysis of data was based on teachers' observation lessons in the five schools and the conducted interviews. The learners' perspectives were analysed which was collected through focus group interviews. The teachers' classroom observations were analysed within the contexts of theories used in this study.

RESULTS AND DISCUSSIONS

This section provides selected data for purposes of this article and is presented at both teacher and learner levels within the contexts of *outsourcing* as a strategy to improve academic performances in teaching and learning mathematics. The data are presented separately according to the instruments used in the study reported in this article.

Classroom observations

Data obtained from classroom observations revealed that most of the teachers had introduced their lessons by engaging learners with questions in order to link learners' current knowledge (or prior-knowledge) with new knowledge on concepts to be taught before they could start with their topic of discussion (Fischer, 2000). These introductions were sometimes in line with what learners knew to enable them to start with the concepts that had to be taught. The concepts taught by the guest teachers were clearly presented for learners to understand. The concepts involved were financial mathematics, height and distances in trigonometry, data handling and probability. Guest teachers and learners in host schools interacted through a questioning and answering method, to actively involve learners in the lessons. The lessons involved discussions between teachers and learners and learners and learners through questioning and answers. It was therefore not a traditional type of one-way traffic. The four teachers A, C, D, E, H, I and J did not ask questions to get correct answers but involved those who seemed to be passive during the lesson. Teacher B sometimes asked learners to get correct answers because she pointed those who put up their hands. Learners who did not raise their hands were sometimes not given chance to answer questions in Teacher B's class.

Group discussion was used as another approach to teach the stated concepts in the host schools. Learners were given problems to solve in groups and then followed by whole class discussion. The guest teachers attended them by walking around visiting each individual group to clarify misconceptions learners had. After every group discussion, learners were given an opportunity to write the answers on the chalkboard. The teachers A, B, E, F, H, I and J gave learners to engage amongst themselves before they could give them feedback. Only teachers C and D had mostly just gave learners feedback without engaging the whole class for peers to rectify their peers.

From the teachers' interview perspective, eight of the teachers confirmed that the concepts taught by the guest teachers were difficult for learners to cope with. The other two teachers highlighted the point of teaching approaches they used to teach those concepts and confirmed that they are not so good in those concepts. Seven teachers suggested that maybe they organise workshops for them to develop them in those difficult concepts. The host teachers were satisfied the way their cluster circuit organised these guest teachers to assist in teaching the stated concepts. Mostly, they showed their satisfaction with the intervention as contributed to their work and helped their learners. Some of the host teachers asserted that the instructional approaches used by the guest teachers were effective as it enhanced their teaching skills in teaching the difficult concepts. Guest teachers used different teaching approaches and strategies such as group discussions which catered for all slow learners.

Learners' Perspectives

In this study, 260 learners from ten host schools participated in interviews, 100 participated in-person interviews and 160 in focus groups. Interview sessions were conducted on two different occasions before and after the implementation of the intervention as indicated earlier on. Learners in the ten schools appreciated the intervention as it played a significant role in their mathematics achievement. Most of them confirmed that the instructional approaches used by the guest teachers were effective and different from the ones used by the host teachers. And also, teachers proved themselves to have a good background of SCK according to learners' perspectives, they presented their lessons well. Hill et al. (2008) say that there is a relation between the teachers' subject content knowledge and pedagogical skill and the work done in the classroom and the outcomes achieved by the learners. The guest teachers had mostly taught topics that were difficult to learners and host teachers as has been requested (Hill, 2010).

The learners in the focus groups also showed their satisfaction with outsourcing process, they concurred that topics were made much easier for them to understand. Most of them also confirmed that the guest teachers gave them chance to ask questions and most of them are clarified. Unlike, with some of their teachers that they were not giving learners chance to ask questions, in short, some of the host teachers are impatient to learners. This indicated that guest teachers used approaches that differed from the ones used by their own teachers. Some of the learners cited examples regarding height and distance, where they initially had difficulties in understanding the concepts, but after it was taught by the guest teachers, they understood it. Some other mathematical concepts were made easier to learn by the guest teachers according to the learners perspectives. For an example, the concepts of financial mathematics were problematic where some of the learners struggled to differentiate between the annuities, scrap values, bond repayments and sinking funds. They claimed that such concepts were not taught well enough for them to understand. However, they demonstrated the opposite after the concepts were taught by the guest teachers during the intervention.

As noted earlier and indicated in the extract below, the intervention appeared to be effective. Most of the learners in host schools were convinced that they had a better understanding of the concepts that were taught by the guest teachers in their schools. The following extract is used as an example to illustrate learners' perceptions about the intervention:

Extract 1

Researcher: Is this outsourcing beneficial to you?

L10S3S2: Yes Sir, re ithutile se sengwe ka mathitjere a (*We have learned a lot from these teachers*).

Researcher: Why do you say this?

L10S3S2: They made concepts easier for us, such as probability, the topic was not taught well before this intervention by our teacher.

According to learner 10 in school 3 (L10S3S2), the guest teacher made the data handling topic look much easier for their understanding. Probability was one of the topics which were viewed as difficult by the participating. As a result of the intervention, most of the learners indicated that guest teachers' approaches to teaching this topics put emphasis on conceptual understanding and less on procedural knowledge (Sepeng, 2014). The learners also learned more from the teachers as some of them in the focus groups indicated that the guest teachers were mostly ready to respond to their problems. Some of the learners revealed that their teachers are not patient with them especially when they ask for clarity during mathematics lessons. This had shown that the guest teachers in host school displayed good content knowledge of the subject and managed to blend it with its pedagogy during teaching and learning of the stated concepts (Invarson et al., 2004; Shulman, 1986; Wilson, Shulman, & Richert, 1987 and Speer & Wagner, 2009). Therefore it appeared that the strategies used by the guest teachers influenced better understand the concepts that were viewed as difficult before the intervention. This was supported by learners' focus groups, interviews and classroom observations. It is therefore suggested that the host schools develop their teachers by giving them opportunities to attend teacher professional development programs in mathematics.

Teachers' perspectives

Host teachers identified the challenging mathematical concepts in grade 12 which were taught by the guest teachers. They learned and gained more knowledge about the approaches and strategies used in the teaching of the identified concepts (TSCK and TPCK). The extract below is used as an example to demonstrate the host teachers' perceptions and views about the outsourcing process (R-researcher and T1-teacher):

Extract 2

Researcher: How does outsourcing help you and your learners?

Teacher 1: It helps us a lot as other teachers teach concepts that are challenging to us. Our learners will have an opportunity to be taught differently by a new teacher.

Researcher: What do you mean by being taught differently?

Teacher 1: I mean they have to be taught using different approaches from other teachers.

The teacher was confident that the guest teachers would assist in improving their grade 12 mathematics results. Some of the teachers said that the instructional approaches used by the guest teachers were effective as they enhanced the host teachers' teaching skills of those concepts and other mathematical concepts. The teachers A, D, E, F, H I and J cited one concept, height and distances in grade 12 trigonometry. The learners in their schools struggled to solve problems in this topic and the guest teachers made it easy for learners for them and their learners. One of them said that the teacher had used the corner of a tent to explain the angles and triangles on the ropes and a corner pole of the tent. She further said that the learners enjoyed the lesson as they indicated that they experienced difficulties in identifying different triangles from a three dimensional figures. Miranda and Adler (2010) indicate that teachers should be creative and innovative in teaching mathematical concepts. The guest teachers did their best to assist the host schools according to the host teachers. They also concurred that even their learners improved academically, this was proven them when the learners were given class tests on those topics. Most of the host teachers complimented the guest teachers about the support they gave to their learners and they also gained some skills in teaching concepts that were difficult. It was only two schools that their learners struggled with probability even when taught by the guest teachers. This revealed that the learners in the two schools still struggled to solve probability problems and needed assistance. The responses from all the host teachers therefore support that guest teachers' content knowledge and pedagogical skills complemented the teaching and learning of mathematics in the host schools (Hill, 2010; Hill et al., 2008).

Comparative Grade 12 Results Analysis

The final Grade 12 mathematics examination results from 2008 to 2012 are presented in table below.

Table: 2008 -2012 Grade 12 final mathematics results in %

Schools	2008	2009	2010	2011	2012	2013
A	32.3	40.1	36.5	59.2	63.8	68.6
B	25.3	33.7	37.1	62.4	61.4	69.8
C	29.0	36.2	25.2	56.8	59.1	63.5
D	30.1	34.9	28.6	54.3	60.7	71.1
E	31.2	38.1	34.4	59.2	66.2	68.8
F	33.4	35.6	40.4	56.0	59.3	61.7
G	35.0	38.1	43.2	59.4	63.0	66.2
H	37.7	39.0	40.9	60.2	61.9	67.3
I	30.6	41.5	43.3	56.3	62.6	59.3
J	31.1	36.7	45.5	57.1	60.8	62.9

From the table, the 2011 and 2012 final examination results were also compared and contrasted with the 2008-2010 ones. The results were much better in the final examinations of 2011 and 2012 as compared with 2008-2010 examination results in mathematics. The results above showed that the schools were not performing well. These poor results had changed after the interventions were made by the circuit to introduce the outsourcing model. The final examination results for 2011 and 2012 were much more improved by more than 20% as compared to the 2008-2010. The results in the ten schools were grouped in interval 50% - 55% and 60% and above as per school. All the schools in 2011 had obtained 55% and above except D which obtained 54.3% but improved its performance by 6.4% in 2012 and obtained the mean percentage of 60.7%. Those schools that obtained between

55.0% - 59.9 were seven; A, C, E, F, G, I and J; and those obtained between 60.0% - 69.9% were only two, B and H. the academic achievement in 2011 were in contrary to the 2012 once, the final results in all the schools were above 55.0% and none of them obtained less than 55.0%. The schools which obtained between 55.0% – 59.9% were only two, C and F and those which obtained between 60.0% - 69.9% were eight and none of them went beyond 69.9%. The results concurred with the satisfaction of teachers and learners about the intervention strategies used in their schools. The results therefore revealed that most of the learners improved academically in grade 12 mathematics. The 2008 and 2010 examination results were used as a referral point to confirm the poor performance of learners in mathematics. The two examination results were also used to measure the impact of outsourcing in the five schools.

CONCLUSION

The outsourced teachers showed good background knowledge and skills of mathematics, operations and reflections, as learners and teachers perspectives had proven (Fischer, 2000). The guest teachers displayed the attributes of Fischer's (2000) model that played a role in outsourcing process. These teachers also have good subject content knowledge and pedagogical content knowledge which are in line with learners' academic achievement (Shulman, 1986; Wilson, Shulman, & Richert, 1987 and Speer & Wagner, 2009). The teachers who were used as guest teachers in the host schools showed most attributes of the Fischer's model and also good SCK and PCK. The guest teachers used approaches that met learners' needs as shown in the learners' interviews and focus groups. The host teachers had also appreciated the implemented intervention in their schools and were satisfied with the way in which the guest teachers taught their learners. They also learned teaching approaches, how to effectively engage with learners, and were informed about resources that can be used to teach mathematical concepts from their guest teacher. This therefore had shown that outsourcing process had played an important role in complementing normal teaching and learning of grade 12 mathematics. It had complemented the normal teaching of mathematics in the five schools as the learners had performed much better in 2011 and 2012 final year examinations. All the schools obtained the expected standard pass rate of more than 50% in mathematics for these two years of the study. The responses of learners in the interviews implicated that this type of intervention used complemented the teaching and learning in mathematics. Teachers and learners of the host schools appreciated the efforts of the circuit and the guest teachers for the support they gave in improving their grade 12 mathematics results.

Learners should also be informed that this intervention is implemented for their own benefit, not for comparing teachers. They should know that teachers use different approaches in teaching mathematical concepts. The 2011 and 2012 final year results had revealed that this outsourcing had complemented the normal teaching and learning of mathematics. This happened because of the guest teachers who were sourced as the host schools could not properly teach other mathematical topics. It was also due to the lack of necessary resources in the host schools. They outsourced the job, by inviting competent teachers from other schools to teach the difficult topics. Learners will also learn more from their teachers as they will have good background knowledge and skills of mathematics which will promote their content and pedagogy in the classroom. The host teachers should be encouraged to have mathematics teacher professional development initiatives in their schools. The research has to be done on the host teachers teaching mathematics in their schools to understand how they teach and learners learn mathematics. The results of the visiting teachers' teaching methods and approaches will enable the teachers in the host schools to identify the challenges they have in teaching mathematics in their schools. This will make them to change and use different approaches in teaching mathematics, and therefore enhance learners' learning of mathematics.

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