Investigating the impact of Non-Profit Organisations (NPO)'s mathematics workshops on learner performance

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Abstract

The purpose of Non Profit Organisations plan of intervention with schools is to assist the Department of Education to improve learner performance in specific subjects. This depends on the focus of that particular organisation. CASME is one of such organisation that supports schools in improving the teaching and learning of mathematics and science with different programmes. This paper reports on the results of an intervention model used by CASME to support primary schools to improve the teaching and learning of mathematics. Teachers in the project are provided with a workshop for each term that focuses on the mathematics concepts planned for the term. These workshops are conducted during the first and second day of school holiday for each term. Towards the end of each year learners from the involved schools are engaged in writing mathematics Olympiad. The data used in this paper is from the CASME Mathematics Olympiad results conducted in the period 2009- 2011. The results indicate that there is a positive effect of CASME workshops in learner performance. This study will be developed in future to research on the actual aspects of the workshop that assisted the teachers to produce positive results in their schools.

1. Introduction

The education proposed shift was to the new system that informs and improves the curriculum and assessment practices of education (Taylor; 1999). The National Education Department measures the level of learner performance in schools with Grade 12 results. The learner performance has and is still a great concern especially in mathematics and science. The education department has recently conducted a number of assessment studies in primary schools which revealed that educational achievement of learners in South African schools is a challenge. These studies are; (1) The Trend in International Mathematics and Science Study (TIMSS); (2) A Grade 4 African Countries Research on Literacy and Numeracy that included Tunisia, Mauritius, Malawi, Zambia and Senegal among others; South Africa ranked fourth with an average literacy score of 48,1% and was rated last with respect to numeracy, scoring 30% (DoE, 2001); (3) Systemic Evaluation for Grade 3 and 6 on Literacy and Numeracy in (2007); and (4) The Annual National Assessment conducted by the Department of Education in all schools from Grade 1 to 6 since 2008. All these studies use learner achievement results to measure the learner performance in schools.

The majority of the projects that seek to address the challenges of poor performance in mathematics and science work closely with the teachers. Nearly half of the teachers surveyed in the TIMSS report feel inadequately prepared to teach mathematics curriculum. An inadequate preparation in terms of content knowledge results in these teachers feeling poorly prepared to teach learners (TIMSS; 1995). Another report released in Gauteng on Grade 6 mathematics lessons (Carnoy and Chishom, 2008) agrees with the TIMSS findings presenting accurate figures and statistics. According to this report, in 2004, more than 50 000 teachers were considered under-qualified as products of the system that did not empower them to teach the new curriculum 2005, therefore only 5,4% of teachers were considered adequately prepared in their teacher training (van der Merwe, and Venter; 2010).

The above scenario creates challenge for support projects in training teachers to effectively implement what was taught in a workshop. The teachers are also expected to make judgement on learners' level of understanding and skills on the basis of explicitly stated "learning outcomes" and "assessment standards" (Department of Education; 2002). The "learning outcomes" and "assessment standards" are now stated as "content areas" and "mathematics topics" in the Curriculum and Assessment Policy Statements (CAPS) (Department of Education; 2010). The Department of Education curriculum challenges are not easy for the department to solve alone; due to inadequate physical and human resources; hence the invitation of other external stakeholders for support to improve the curriculum short falls in schools.

CASME is one of NPO's; that was established in 1985 focusing on different programmes that support teachers in Further Education and Training (FET) Band. In 2008 the organisation extended its services and included the General Education and Training (GET) Band. The extension of CASME's services to the GET band was due to the poor mathematical background of learners at the entry of the FET band. It was discovered that learners lack basic conceptual skills in different mathematics topics. The learners' poor mathematics conceptual background is a causal factor of poor performance in Grade 12 mathematics and science; hence the initial focus of CASME in FET band was later extended.

Research questions

1. What is CASME's intervention model for primary school mathematics?
2. How is learner achievement incorporated in the intervention model?
3. Which content areas of the curriculum are challenging for learners in mathematics?

2. BACKGROUND

This paper reports on one of CASME's GET project that supports Foundation and Intermediate Phase mathematics teachers. These teachers attend CASME's mathematics workshop that provide them with content knowledge and methodology on what they are expected to teach in each term. The teachers and schools discussed in this paper are not part of CASME projects; they are just committed to improve their teaching in mathematics. They have been attending these workshops since 2009; the number of schools and teachers attending is increasing yearly. They are also committed to participate in all project activities even the mathematics Olympiad that evaluates if they have effectively implemented what they learned from the workshops. The number of schools has increased in the Foundation Phase from 11, 20 and 28 in the Intermediate Phase from 15, 21 and 30 for the three successive years since 2009 to 2011. The number of schools that attended and participated in the Maths Olympiad was 6, 10 and 12 in the Foundation Phase and 4, 7 and 10 in the Intermediate Phase. The reason for the drop in the schools that participated in the Olympiad is due to the fact that some of the teachers that attend workshop do not teach Grade 3 and 6 some felt that they are not ready to expose their learners in the Maths challenges.

As the number of school participation in the workshops increases so is the increase in the number of learners that participate. The Grade 3 learner participation in the three years was 17, 23 and 30; the Grade 6 was 12, 15 and 22 which shows an increase commitment in the participating schools. The purpose of these Olympiads is to assess how teachers pass on the workshops information to their learners to improve their performance in mathematics. These mathematics Olympiads are set and administered by CASME facilitator for validity purposes.

This paper focuses on Grade 3 and Grade 6 mathematics Olympiad results from 2009 to 2011; these grades are selected because they give an overview of each phase results. The Olympiad assessments papers are set in two phases and moderated internally by CASME staff. The first phase is conducted and marked by teachers in their schools after a workshop on how to develop a memorandum and allocate marks for each question. Teachers use phase one results to select their top learner(s) to represent the school in phase two assessment. Phase two is written by top performing learners in phase one; a central venue is identified by the participating schools and the CASME facilitator conducts this assessment. The teachers' role in this session is to bring the learners to the venue and take them back to school after the assessment.

After marking and analysing the results an award function is organised for learners that achieved from level four to seven and teacher representatives from all the participating

schools are invited in the celebration. Learners are awarded with trophies, medals and certificates; schools with top achievers also receive trophies written their names as achievers of specific grades in the mathematics Olympiad. The success of the award function is through the generosity of sponsors and donations since this project is not funded.

3. METHODOLOGY

The research methodology of this paper is based on the National Curriculum Statements for Mathematics (NCS) which has five learning outcomes. This structure is also linked to the conceptual framework of the TIMSS report, which was derived from the previous studies conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA) (Howie; 2002). IEA studies recognised the importance of curriculum as a variable for explaining the difference to account for student outcomes that was investigated and compared with teaching practice. The content domains are fairly consistent and found in all curricula, therefore, in this paper it is linked to NCS curriculum content domain. The Olympiad question papers written by the Grade 3 and 6 cover all the learning outcomes in the curriculum.

4. ANALYSIS

The summarised analysis of learner performance in Grade 3 and 6 presented in the table below is based on five learning outcomes as spelled out in the new CAPS documents (DOE; 2010). This will show how learners performed in each content area in the three years of this study. The second section will be an analysis of how learners performed in each year according to seven scale assessment rating. This will give the percentage of learners who achieve a specific level from learners who wrote phase two in each grade. This will assist in comparing learner performance in the two phases involved in the study.

4.1 Grade three average results for 3 years

Year	LO 1	LO 2	LO 3	LO 4	LO 5
2009	50	50	54	41	38
2010	53	52	58	34	76
2011	64	53	75	53	55

Table 1: Grade Three average results according to Learning Outcomes

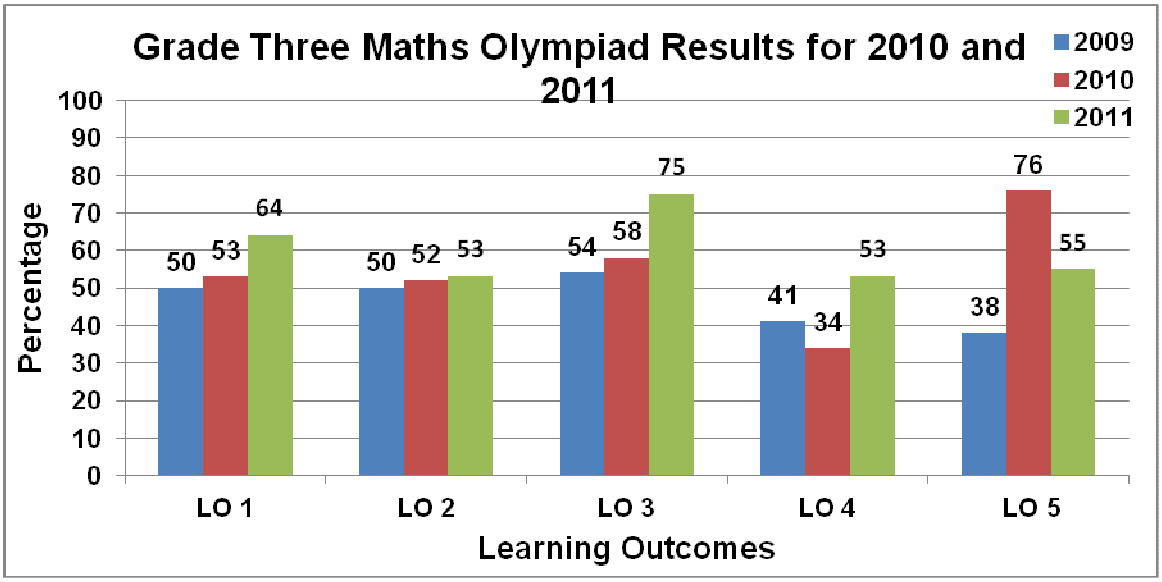

Figure 2: Graph that represents the data on table 4

The above graph indicates that the average performance of Grade three learners is constantly improving in learning outcomes one, two and three. There is a challenge with learning outcome four and five after assuming that they have improved in learning outcome five in 2010 they drop with 21% in 2011. This was because of the type of question that was given; where learners were expected to read and understand the data before representing it. The concept of double and times was not applied by learners in representing the data. Even though the question was a challenge for most learners the drop was not below an average of 50%. The most challenging learning outcome is number four; but it is improving because in the workshops teachers are also showing great commitment in trying to use interesting methods for learners to understand the concepts of measurement. Even though the performance in different learning outcomes is moving up and down, there is a constant improvement in the overall performance of Grade three results. In 2009, 2010 and 2011 the overall performance was 47%, 55% and 60% respectively, the grade teachers are able to set a target on how to improve 2012 results. Schools are greatly motivated by the award functions where they share the success of schools and their learners.

4.2 Grade six average results for 3 years

	LO 1	LO 2	LO 3	LO 4	LO 5
2009	10	41	19	18	36
2010	24	35	28	26	35
2011	48	64	59	43	82

Table 2: Grade Six average results according to Learning Outcomes

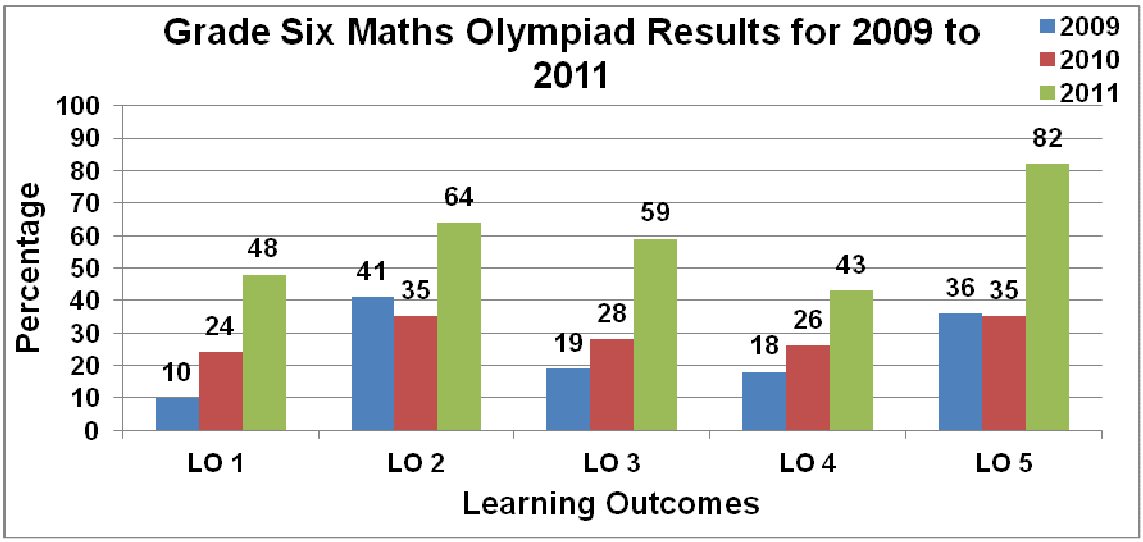

Figure 3: Graph that represents the data on table 5

During the first year of this project it was very difficult to make comments or conclusions of what was really happening in these schools. When these results were shared with the teachers; they had themselves to blame on learners' performance. They identified a number of concepts which they have challenges in teaching. After learning that at the end of the year their learners will be involved in writing the mathematics Olympiad again, they were required to teach all what is expected from the curriculum, hence their commitment in the workshops changed. The performance of Grade six in 2011 was pleasing; it was for the first time to have the bars of their graph feeling greater space in the sheet. Though the performance is not yet that good; what is pleasing is that their results have been improving since they started in 2009. In 2009, 2010 and 2011 the overall performance of Grade six has been improving from 25% to 30% to 59% respectively. The 2011 improvement was almost doubled when compared to 2010. There is a great competition now in schools; teachers have developed confidence in teaching the expected concepts from Grade six mathematics curriculum. The CAPS seven level rating scale was used to analyse learner achievement in three years.

4.3 Percentage of Grade three learners' results in different levels

Years	Level 7	Level 6	Level 5	Level 4	Level 3	Level 2	Level 1	Total
2009	6	6	18	18	18	18	18	**100**
2010	4	13	17	22	13	26	4	**100**
2011	13	30	10	17	17	7	7	**100**

Table 3: Grade Three Achievement levels of learners in 3 years

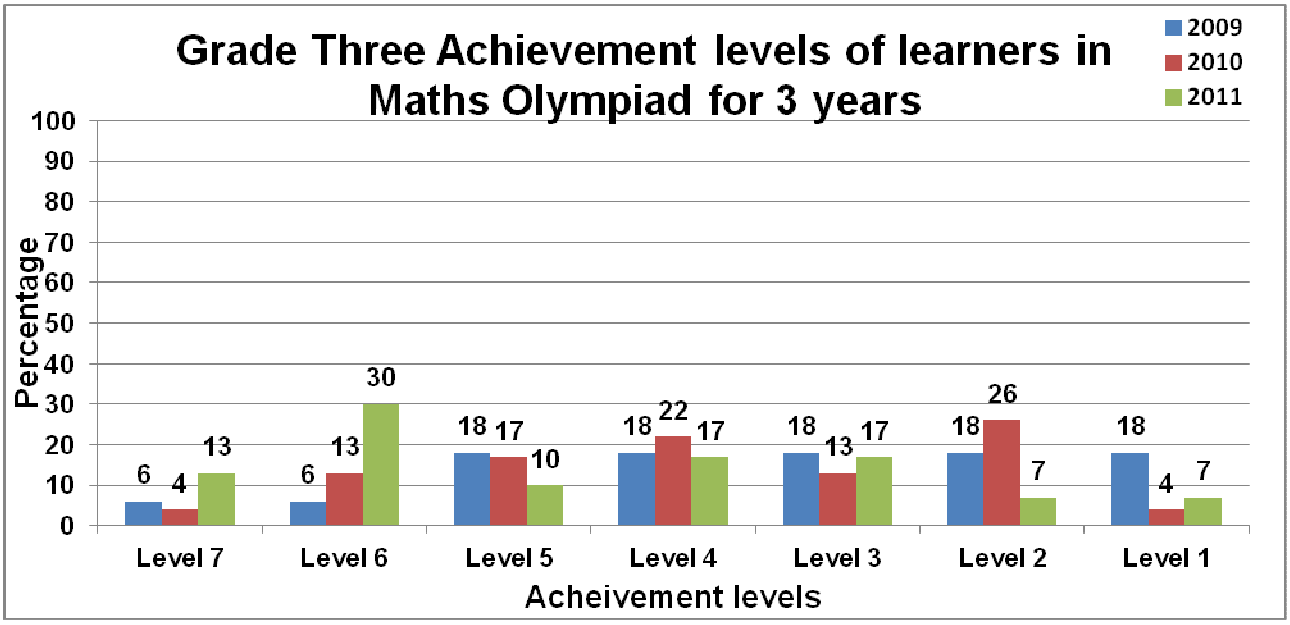

Figure 4: Graph that represents the data on table 6 above

Table 3 and Figure 4 indicate an increase in the number of learners achieving level 7 and 6. This shows that the performance of learners in mathematics Olympiad is improving; this is attributable to the commitment of teachers in improving the teaching and learning of mathematics. The performance of learners from schools that joined the project in 2009 is improving yearly. This results from the positive attitude and willingness of teachers from these schools to change how they have been teaching mathematics. This is an indication that teachers needed the intervention of workshops to improve their content knowledge in mathematics and develop their confidence in the teaching and learning of mathematics.

4.4 Percentage of Grade Six learners' results in different levels

Year	Level 7	Level 6	Level 5	Level 4	Level 3	Level 2	Level 1	Total
2009	0	0	0	0	8	33	58	**100**
2010	0	0	0	9	9	36	45	**100**
2011	0	27	27	14	23	9	0	**100**

Table 4: Grade Six Achievement levels of learners in 3 years

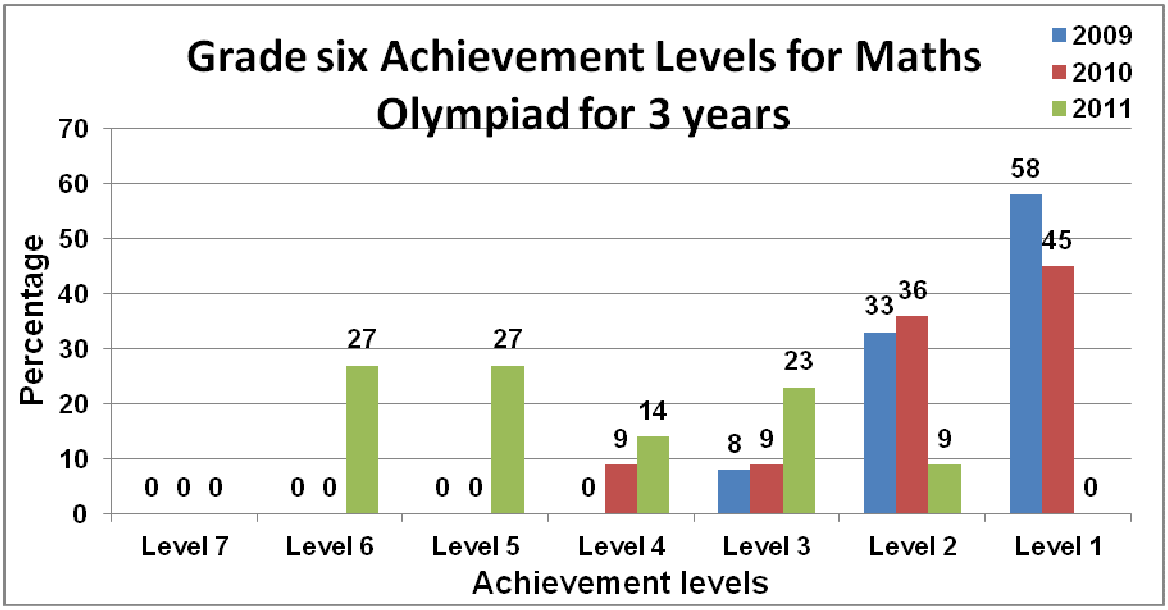

Figure 5: Graph that represents the data on table 7

Table 4 and figure 5 show that in 2009 and 2010 no learner managed to achieve above level four; it was for the first time in 2011 to have learners achieving level 5 and level 6 in Grade six maths Olympiad. These results motivated teachers to make targets on how to improve learner performance each year; by using current year's results as a benchmark. The positive attitude that has developed among teachers involved in the project indicates the impact of CASME's intervention in the teaching and learning of mathematics in schools. There has been a great improvement in learner achievement they were no level ones in 2011.

Conclusion

There is a need to develop this study further and interview the involved teachers in the project and also if possible the learners who participated in the Olympiad. On learner performance aspect of the study; learners have improved on their achievement. They might be able to identify what was special in the teaching and learning approach used by the teachers which resulted in their good performance. This data may supplement the quantitative data that has been analysed in this paper to verify if CASME workshops have a direct impact on the level of learner performance in the Olympiad. The change that has been observed in this study was clearly visible in learner performance during the third year. Involving schools in the award function motivates other staff members to support the mathematics teachers in the process of improving the teaching and learning of mathematics. Grouws and Cebulla (2000) in their report on improving student achievement in mathematics agree with the above statement stating that if schools provide generous opportunities for teacher learning; teachers can and will improve teaching and learning in the manner that benefit their learners. To achieve that they further state that professional development must

be viewed as an essential and indispensable part of school improvement process. In another report on the effect of connected mathematics project 2 on student performance, Eddy and Berry (2008) states that teacher professional development is a critical component to program efficacy and focuses on building teacher understanding of mathematical concepts in addition to developing effective classroom practice. They further state that it takes more than two years of implementing the curriculum to see consequent changes in the student growth, and hence the findings in their project was limited in the first two years. The above statement concurs with Grade six learner achievement results where a visible improvement of learner performance was clearly observable during the third year. Further recommendation for the study should be on stating clearly the concepts which were challenging for teachers and learners in the process; this will be incorporated in the future workshops.

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