

The Effects of Staff Development on Pedagogical Practices of Mathematics Teachers in Gokwe South District in Zimbabwe

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ABSTRACT Mathematics is one of the key subjects of the school curriculum and yet people continue to perform badly in the subject in public examinations. Good learning by students reflects good teaching by the teachers and as such several initiatives have been put in place to conduct staff development workshops with teachers so as to capacitate them in the pedagogy of mathematics education. This study was, therefore, set up to investigate the effects that staff development have on pedagogical practices of mathematics teachers in the Gokwe Central Secondary Schools (GCSS) cluster of Gokwe South district in Zimbabwe. This study adopted a case study design in which purposive sampling was used to select one cluster from the population of seven clusters in the Gokwe South district. Data pertinent to the study were allocated through questionnaires and interviews. The study sample comprised of the mathematics Education Officer (EO) in the midlands region, 16 mathematics teachers and 8 Heads of Departments (HODs) from 8 schools. Data gathered were presented and analysed at the descriptive level. The study established that as a result of staff development programmes, there were significant changes in the way teachers in the cluster schemed and planned their work, organised their teaching content, organised their classroom environment and assessed their pupils.

INTRODUCTION

Mathematics is a very important subject that facilitates the study of other subjects in the school curriculum. It is a tool which forms the basis for specialised occupations like science, engineering, economics and computing, among others. In other words, mathematics is the core of technological development in a rapidly growing world of science. It is for this reason that mathematics is given a central place in virtually all school curriculums and in the world of work. In fact, in Zimbabwe most institutions and the employment sector require a minimum of five ordinary level subjects which must include mathematics. To this end, the Ministry of Education, Sports and Culture made mathematics a compulsory subject right from primary education through the Zimbabwe Junior Certificate (ZJC) at secondary level.

Mathematics educators and scholars, the world over have stressed the need to teach mathematics well so that it is well understood and applied (Hanfi 2008; Adeyemi 2008). In support of this view the President of Zimbabwe Cde R.G Mugabe, speaking on the 14th independence anniversary said that there was need to intensify the teaching of mathematics. Such sentiments call for teachers to be well equipped in order to meet the challenges of teaching mathematics well. The Ministry of Higher Education and Technology has got very

‘large arms’ which deal with the training and inservicing of teachers. This shows that the government places a lot of emphasis on improving the quality of teachers in the country because teachers are key figures in changing the ways in which mathematics is taught and learned in schools. Such change requires that teachers have long term support and adequate resources. In view of this, it has been found necessary that practicing teachers have to be involved in regular staff development activities that would assist them to keep abreast with the new technological changes in the teaching of subjects like mathematics.

Several initiatives have been put in place to staff develop mathematics teachers by the government of Zimbabwe and other interested organisations. Government-funded programmes include staff development workshops for EOs and HODs run by the Standards Control Unit. Government initiated programmes funded by donors include the Gender Equity in Mathematics and Science education workshops for mathematics teachers funded by United Nations Children’s Fund (UNICEF), the Better Schools Programme in Zimbabwe (BSPZ) through cluster workshops, among others. Other initiatives were put in place by The National Mathematics Association of Zimbabwe, the Mathematics Curriculum Development Project funded by the Austrian government and ZIMTA which emphasized the use of study circles. Despite all these efforts, records

reviewed indicate that the subject still lags behind other subjects of the curriculum.

However, sight should not be lost on the fact that low pupil achievement can also be attributed to other factors such as the shortage of suitable textbooks, lack of materials and equipment, negative attitudes of pupils or even strict standards set. It is such issues which should form the focus of staff development efforts so as to bring about positive change in the way teachers execute their duties in the classroom. In other words, staff development efforts have to be geared towards improved teacher competence and teacher performance, which in turn is expected to culminate in better achievement by pupils in mathematics.

Although these issues raised in the foregoing discussions and other pupil performance related issues could have formed the core of the numerous staff development efforts in mathematics education, the situation pertaining to pupil achievement has not changed significantly. It is against such a background that the current study was set out to determine the effects of staff development on performance of mathematics teachers.

RESEARCH METHODOLOGY

This study adopted a qualitative interpretive methodology because it allowed the researcher to get the data directly from the subjects themselves by sitting with the respondents and listening to their views, voices, perceptions and expectations in detail. This strategy contends that knowledge is subjective and ideographic, and truth is context-dependent and can only be obtained after entry into participants' reality (Patton 1990). The researchers recognised several nuances of attitude and behaviour that could not have been noticed if other methods had been used. This study adopted a case-study research design. A case study is described as a form of descriptor research that gathers a large amount of information about one or a few participants and thus investigates a few cases in considerable depth (Thomas and Nelson 2001).

Purposive convenience sampling was adopted in the selection of participants for this study.

This type of non-probability sampling method seeks information-rich cases which can be studied in depth (Patton 1990). A sample of 1 Education Officer, 16 secondary school teachers and 8 HODs constituted the study. Since school teachers were scattered all over the district, convenience purposive sampling was employed in order to come

up with the actual participants for this study from the 8 sampled schools.

Data Collection Instruments and Procedure

Interviews were held with all the respondents/participants at their respective schools. An audio recorder was used to ensure accuracy and trustworthiness of data. A questionnaire was also distributed to gather more information on the subject at hand. This allowed for triangulation of data by providing a variety of perspectives on the issue at hand.

RESULTS

Staff Development in Mathematics

The researcher asked teachers and HODs on the availability of a departmental policy regarding the professional development of teachers in their departments and the responses are shown in Table 1.

Table 1: Availability of departmental policy on the professional development of teachers

<i>Departmental policy availability</i>	<i>Teachers</i>		<i>H.D.O.</i>	
	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>
Available	6	37.5	7	87.5
Not available	8	50.0	1	12.5
I don't know	2	12.5	0	0.0
Total	16	100.0	8	100.0

Responses given indicate that 50% of the teachers said that there was no staff developmental policy in their departments whilst all HODs except for one said that their departments had staff development policies well laid out.

Table 2: Staff development activities that have taken place in the schools for the past 3 years

<i>Staff development activities responses</i>	<i>Teachers</i>		<i>H.O.Ds</i>	
	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>
Departmental meetings	16	100.0	8	100.0
Demonstration lessons	6	37.5	6	75.0
Peer coaching	2	12.5	2	25.0
Mentoring	3	18.8	2	25.5
Seminars	8	50.0	7	87.5
Clinical supervision	3	18.8	1	12.5

Asked to indicate those staff development activities that have taken place in the schools

in the past three years, the teachers and H.O.Ds cited departmental meetings as the most common followed by seminar presentations and demonstration lessons as shown in Table 2.

Table 3: Rate of attendance at cluster-organised mathematics workshops

Degree of attendance	Teachers		H.O.Ds	
	No.	%	No.	%
Always	4	25.0	3	37.5
Frequently	2	12.5	4	50.0
Sometimes	5	31.3	1	12.5
Rarely	3	18.7	0	0.0
Never	2	12.5	0	0.0
Total	16	100.0	8	100.0
Mean Rating	2.9(3)		1.8 (2)	

Respondents were asked how often they attended workshops organised by their clusters and their responses are shown in Table 3. The teachers' rate of attendance is somewhat varied. Their mean rating is 3 meaning that on average teachers sometimes attend cluster workshops while HODs attend these workshops frequently (mean rating=2)

Table 4 (a): Perceived usefulness of school based staff development activities by teachers

Usefulness of staff development programme	Very use-ful	Use-ful	Some what use-ful	Of little use	Not use-ful	Total
Gaining skills	6	5	1	4	0	16
Gaining subject content knowledge	6	2	3	3	2	16
Change in teaching behaviour	5	5	2	4	0	16
Change in attitudes	7	3	3	3	0	16

Asked on the extent to which the staff development activities have been helpful to them, the majority of teachers (Table 4a) and HODs (Table 4b) indicated that school based activities were most useful to them in gaining skills, in changing their teaching behaviour and changing their attitudes towards the teaching of mathematics and towards pupils.

Tables 5 and 6 show that teachers and HODs value the usefulness of cluster-based staff development the same as school based acti-

Table 4(b): Perceived usefulness of school-based staff development by HODs

Usefulness of staff development programme	Very use-ful	Use-ful	Some what use-ful	Of little use	Not use-ful	Total
Gaining skills	3	3	1	0	1	8
Gaining subject content knowledge	2	2	2	1	1	8
Change in teaching behaviour	2	3	2	0	1	8
Change in attitudes	1	4	2	0	1	8

Table 5: Perceived usefulness of cluster-based development by teachers

Usefulness of staff development programme	Very use-ful	Use-ful	Some what use-ful	Of little use	Not use-ful	Total
Gaining skills	8	4	1	0	1	14
Gaining subject content knowledge	6	2	3	1	2	14
Change in teaching behaviour	6	5	1	0	2	14
Change in attitudes	6	4	1	1	2	14

Table 6: Perceived usefulness of cluster-based staff development by HODs

Usefulness of staff development programme	Very use-ful	Use-ful	Some what use-ful	Of little use	Not use-ful	Total
Gaining skills	2	4	1	1	0	8
Gaining subject content knowledge	2	2	2	1	1	8
Change in teaching behaviour	2	3	2	0	1	8
Change in attitudes	1	4	1	1	1	8

vities. However, the usefulness of workshops in enhancing grasp of subject content received lower ratings, generally.

Table 7 shows that generally, HODs felt support was given to teachers in 3 of the 4 areas assessed. However, only about half of the teachers agreed with this. There was general unanimity among both teachers and HODs that refresher courses and

updating meetings were the least frequently used form of post staff development support.

Table 7: Type of support given to teachers

Type of support	Teachers			HODs		
	Agree	Un-decided	Dis-agree	Agree	Un-decided	Dis-agree
Opportunity to practise knowledge and skills given	8	1	7	7	0	1
Resources were availed to facilitate the implementation of new knowledge and skills	7	1	8	7	0	1
The HOD provided follow-up advisory support	8	3	5	6	0	2
Refresher courses/updates	1	2	13	4	0	4

Table 8(a): Consultation of other teachers

Consultation of other teachers from	Responses from teachers				
	Always	Frequently	Some-times	Rarely	Never
Within the department	5	6	3	1	1
Other departments in the school	1	0	6	5	4
Other schools in the cluster	0	0	4	4	8

Table 8(b): Consultation of other teachers by HODs

Consultation of other	Responses from H.O.D.				
	Always	Frequently	Some-times	Rarely	Never
Within the department	1	4	2	0	1
Other departments in the school	0	0	2	4	2
Other schools in the cluster	0	1	2	3	2

The ratings from Tables 8(a) and 8(b) indicate that in their scheming and planning, most of the teachers (11) in the cluster frequently consult other members of their departments when scheming and planning. On the other hand, the degree of consultation of teachers from other departments and from

other schools is very low. HODs responses generally agree with teachers' sentiments.

Table 9 shows that teachers and HODs are in agreement that weekly plans are divided into lesson units with objectives, methods and pupil activities. Both teachers and HODs did not agree with the use of other various scheming formats in the same department and the use of only a school syllabus without schemes of work.

Table 9: Scheming practice

Scheming practice	Teachers			H.O.D.		
	Agree	Un-decided	Dis-agree	Agree	Un-decided	Dis-agree
Weekly plans are divided into lesson units with objectives, methods and pupil activities	15	0	1	8	0	0
Teachers are free to use any scheming method	1	0	15	0	0	8
It is better to use the school syllabus only without the scheme of work	4	0	12	0	0	8

On lesson planning (Table 10), most teachers (13) said that they don't present their lesson plans in written form, which was supported by 4 of the HODs. Answering the question on when to plan, 6 (75%) of the HODs and 9 (56.25%) of the teachers said they planned well in advance of teaching time. Most teachers and HODs agreed that they cater for individual differences in their planning and that they use various textbooks in their planning. 9 (56.25%) of the teachers supported the notion that daily lesson planning should be done by inexperienced teachers only while on the contrary, 5 (62.5%) of the HODs disagreed with this notion.

DISCUSSION

There were conflicting views between the teachers and the HODs on the availability of a staff development policy on staff development in the schools as shown in Table 2. The reason could be that some of these issues are not discussed with ordinary teachers and they won't be aware of what will be going on in their schools. However, in

Table 10: Planning practices

<i>Scheming practice</i>	<i>Teachers</i>			<i>H.O.D.</i>		
	<i>Agree</i>	<i>Un-decided</i>	<i>Dis-agree</i>	<i>Agree</i>	<i>Un-decided</i>	<i>Dis-agree</i>
Lesson plans are not presented in written form	13	0	3	4	0	4
Lessons are usually planned a few minutes before teaching time	7	0	9	2	0	6
Provisions cater for individual differences are made in planning	15	0	1	7	0	1
Only the basic textbook (New General Mathematics) is used for planning lessons	4	0	12	2	0	6
Daily lesson planning should be done by inexperienced teachers only	9	0	7	3	0	5

all the schools visited there was a clause on staff development in the departmental policies contained in the departmental files. Termly schedules of department meetings, presentations, class visits, exercise book inspection and scheme book submissions were available in most of the departmental files seen. Perhaps, those teachers who said there was no staff developmental policy in their departments expected to see an explicit document entitled as such. Bearing in mind that a policy must be participatory in its making, it might also be that the departmental file is not accessible to some of the members of staff or that teachers were not involved in the current formulation of the current policy, which makes them unaware of its presence in the department.

Asked on the same issue the EO mathematics said that there was a staff developmental policy in the region because their main function was the control of professional standards in the schools. However, the EO could neither explain whether it was an explicit document nor produce the document. Instead there was a well laid out programme of school visits and intended workshops for the whole region for the term one to three. Such a scenario reflects that the region places great emphasis on the professional development of teachers. However, on a sad note the EO

mentioned that some of these targets were not met and others for the previous years were not met due to financial constraints in the region.

Requested to outline the main focus of staff development in the past three years, the EO simply said that “iron sharpens iron”. By this he meant that teachers should enrich each other in their pedagogical practices through school based and cluster based activities. The common school-based activities cited by teachers and HODs were departmental meetings, seminars and demonstration lessons. Peer coaching, mentoring and clinical supervision were rarely done despite their usefulness in the professional development of teachers. This might imply that “iron sharpens iron” is not fully met as it still has to become part of the teachers’ development culture. Of the two teachers who never attended any cluster based activities in the past two years, one said that he was on study leave and the other said that he was not a full time mathematics teacher since his main subject was Building sciences. This scenario serve to show that all teachers need staff development exposure for them to improve, that is, to grow and develop on the job (Bath 1987; Grimes and Schaltz 2002; Hanfi 2008).

The EO said that he visited Gokwe South District twice in the past three years and his itinerary included visiting schools, holding workshops with the HODs and assessing cluster activities. The main activities that have taken place in the cluster as cited by the teachers, HODs and the EOs are as follows:

- ♦ Establishing common syllabus for ZJC and ‘O’ level mathematics.
- ♦ Setting common examinations for ‘O’ level classes
- ♦ Development of a marking scheme and marking of common examinations at a central venue (assisted by the trained ZIMSEC markers on the cluster)
- ♦ Development of teaching materials (teaching notes)
- ♦ Effective scheming and effective teaching methods.
- ♦ Mathematics competition (mini Olympiad) for both ZJC and ‘O’ level was held in March 2000

These activities and others not stated were done in an endeavour to improve the teaching and learning of mathematics in the GCSS cluster. This assertion is supported by Pounder (1987) and Estes (2004) who postulate that the aim of staff development is to improve the teachers’ classroom milieu

that supports academic achievement by students. Generally, teachers and HODs stressed that both school-based and cluster-based activities were useful to them in the areas outlined in Table 5 and Table 6. However those teachers who found these activities as of little use and not useful were mainly those with degree qualifications. Perhaps because of their qualification they take these activities to be too basic or elementary for them, possibly because they think they have all it takes to be a competent mathematics teacher.

Scheming and Planning

The main thrust of staff development on scheming and planning in the GCSS cluster was on promoting teamwork among teachers; uniformity in scheming; use of the cluster syllabus especially for forms 4 and 5; breaking lesson plans into identifiable lesson units with specific objectives, methods and activities. Preparation of lesson notes, comprehensive general and individual comments in the evaluation section of the schemes were also emphasized.

The study revealed that there was a high degree of consultation within departments (Table 8). This confirms information collected through interviews with teachers and HODs and from analysing schemes of work which revealed common scheming formats within departments, scheming same topics for the same form of level and team teaching in some cases. This would seem to suggest that the respondents might have not benefited from the recommendations made from staff development sessions in as far as consultation pertaining to the above mentioned issues is concerned.

However, there seems to be some limitations to the degree of consultation because a closer look at the evaluation section of the schemes of work from the same school revealed some notable variations. Some teachers evaluated lesson by lesson, some class by class and yet others put blanket comments for the whole week in both individual and general comments. Such variations were acute at three schools. These variations might have been caused by certain teachers who resent changing from their traditional practices to conform with the current trends or through failure by departments to enforce recommendations from staff development workshops.

Table 8 also shows that teachers and HODs rarely consult teachers from other departments in their scheming and planning. This might mean that

teachers and HODs failed to take heed of recommendations by Ale (2002) and Capel et al. (1995) who said that there are increasing efforts to coordinate the teaching of mathematics with other subjects because it has an ever increasing importance and influence in many subjects of the school curriculum. Furthermore, consultation of teachers from other schools was reported to be very rare. However, teachers explained there was low consultation from other teaching departments and other schools because they had a heavy teaching load and that left them with very little free time.

Both teachers and HODs indicated that planning should be done well in advance of teaching time but lesson plans need not be presented in written form. When interviewed, most of the teachers said that they used lesson notes instead. In support of this view the EO indicated that daily lesson plans were not mandatory but there must be some evidence of planning in the lesson delivery. Other views given by mainly experienced teachers (6years of teaching or more) were that daily lesson plans should be done by inexperienced teachers only (Table 10). This trend of thinking is most likely the situation obtained in most schools, although HODs stressed that everyone regardless of experience should plan for their daily lessons.

It was interesting to note that of the 5 lessons observed, only 2 teachers had lesson notes. As for the other 3 teachers there was evidence of planning in their presentation but all the documentation they had on hand were their scheme books only. This might imply that teachers still want to rely on their experience rather than writing down on paper the main concepts that are going to be taught, examples and exercises to be given in the lesson as recommended from staff development workshops.

With regard to catering for individual differences, teachers and HODs supported this in the interviews in that since most of the classes are streamed, they teach and set different exercises for the different classes according to their ability. This is in agreement with Hanfi (2008) and Estes (2004) observation that one of the keys to successful instruction is effective planning in which a lesson is adapted to the needs of the learners. A scrutiny of the scheme books did not reveal this kind of planning in most schools but actual exercises written by pupils reflected some form of differentiated activities in 5 of the schools where more work was given to the brighter students. In this regard, it might be said that there was some degree

of change in the way teachers planned their work in line with recommendations from staff development received. Scheming and Planning are very integral if objectives of the lesson are to be realised. This is supported by Chivore's (1995) study carried out in Zimbabwe on teacher effectiveness. His findings point out that it was disturbing to note that secondary school teachers were found ineffective in scheming and planning. Teachers were not adequately prepared for their lessons and this according to Chivore affected content delivery. Adeyemi (2008) also emphasises the need for staff development efforts in mathematics to focus on proper scheming and planning techniques that will facilitate effective teaching.

Although various sources were said to be used in the cluster for planning, this was not evident from several scheme books, exercise books and textbook inventories seen. Several textbooks other than the basic textbook (New General Mathematics) were cited in the sources section of the scheme books but most of the written work was set from the basic textbook. Perhaps this was due to the fact that this was the only textbook that the schools could afford to buy for the students considering the meagre financial background. Only 2 schools, had some teachers who alternated from the basic textbook with other problems from other sources depending on the topic, not because they had an ample of textbooks but because of their creativity. The implication here is that there is an over dependence on the basic textbook in scheming and planning in the GCSS cluster.

Organisation of Teaching Content

Staff development in the cluster emphasized on organising teaching content based on the school syllabus and the other cluster syllabus, sequencing topics according to their level of abstraction and maintenance of lesson to lesson continuity. Information collected from teachers and HODs revealed that their teaching content was not presented in the other order in which they appear in the basic textbook. Instead, teaching content is broken down basing on the school syllabuses. Seven of the schools designed their topic order at "O" level in line with the cluster syllabus, according to evidence from departmental files and scheme books. Such an arrangement would enable the schools to write common cluster examinations in July and November of every year as recommended by the cluster.

Topic sequencing according to the teachers and the HODs should be done according to the level of abstraction of the topics. The topics and the mathematics content should be structured in such a way as to ensure continuity within the topics and between different topics. In the scheme books seen, school syllabuses and cluster syllabuses fairly addressed the issue of sequencing and continuity between different topics. This is in line with the findings of an imperial research by Grimes and Schaltz (2002) who maintained that the performance of complex behaviours is facilitated by experience with simpler subordinate behaviours. Such good organisational skills should enhance pupils opportunity to learn.

The teachers and HODs indicated that they are always reviewing previous work before introducing new work. This was confirmed in the lessons that were observed by the researcher. All the teachers began their lessons by having a brief recap of the previous work. They delved into new knowledge. This is in line with Skemp's (1997) view that all teaching needs to begin with a review of what has gone on before as this makes learning better coordinated. Also supporting the idea of review of previous work in teaching a new concept are Costello (2000) and Faybamiye (2004). Both posit that this enables the teacher to discover weakness and omissions of previous teaching.

CONCLUSION

The study established that, as a result of staff development sessions held at cluster and school levels, there has been beneficial standardisation in scheming and planning formats. This ensures that certain minimum standards are met by all mathematics teachers in the GCSS cluster. However, there were some variations on how teachers from the same department present their individual and general evaluation comments although staff development stressed on proper consultation within departments. Research evidence has also shown that the majority of teachers teach their lessons without lesson notes yet these are emphasized at cluster workshops as evidence for lesson planning. Findings from the study revealed that as a result of staff development at the cluster, teachers organise their teaching content according to the school syllabus and cluster syllabus. Topic sequencing was done according to the level of abstraction of the topics especially at ZJC level.

The mathematics content was structured in such a way that continuity within topics was to be realised.

Evidence from the study seem to suggest that staff development in the cluster helped teachers to employ the use of variety of teaching methods in a single lesson so as to create an environment that is conducive to the effective learning of mathematics. However, effective peer learning was limited in large classes, according to the Teachers. This means that staff development in the cluster might have fallen short on addressing issues pertaining to organising large classes for effective learning.

RECOMMENDATIONS

- ♦ The Ministry of Education, Sports and Culture should embark on rigorous staff development to conscientise teachers on its benefits in enhancing their professional growth on the job. Explicit policies on staff development should therefore, be put in place, more so, to cover school-based and cluster-based activities.
- ♦ The school and the cluster are very important units in which staff development deals with teachers in their own environment. In view of this, staff development should therefore, be designed in such a way that it addresses practical realities faced by teachers and not just superficial issues. Issues such as dealing with large classes, dealing with students from different cultural capitals among others should form the core of staff development programmes in rural areas.
- ♦ There is need for greater commitment to staff development as part of their professional life by teachers.

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