The impact of the Primary School Lead Teacher Development Project on grade 4 mathematics classroom learning environments at Eshowe district in Kwazulu-Natal, South Africa

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Abstract

This paper reports on findings of an ongoing study that examines the impact of the Primary School Mathematics and Science Lead Teacher Development Project on the Grade 4 Mathematics classroom learning environments of the lead teachers and their colleagues in cluster schools at Eshowe District. This lead teacher development project responds to lack of skills among primary school mathematics and science teachers, inappropriate models of In-Service Teacher Education and Training (INSET), little teacher development by way of INSET organized by districts, and poor performance in a mathematics and science by students which results from the lack of basic skills in these subjects. The main aim of the project is to establish a clustered-based model of INSET in a district, which is led by a core of primary school lead teachers who are able to demonstrate effective ways of teaching mathematics and science in the intermediate phase (Grade 4 – 6) and to support second-generation teachers in the development of similar skills to convert their traditional classrooms into constructivist classrooms. The base line study results obtained indicated that rote learning, teacher talk and low level questions dominated lessons. The project intervention generally made a good impact on mathematics classroom learning environments in respect of teacher support, involvement, investigation, task orientation and co-operation. However, student cohesiveness needs special attention as it is below the acceptable level.

The Primary School Mathematics Lead Teacher development Project

This project has been implemented in four provinces: KwaZulu Natal, Eastern Cape, western Cape and North West Province. The project will run for at least three years (2000 – 2002). Its focus is on the development of lead teachers in mathematics and science in the intermediate phase (Grade 4 for 2000, Grade 5 for 2000 and Grade 6 for 2002). This project adopted a lead teacher development strategy as a means of facilitating teacher development in a district. For the purpose of this research the focus is on Grade 4 at Eshowe District where the project is being implemented in KwaZulu Natal.

Eshowe District has five areas as Circuits, each of which is divided into three clusters of schools. The number of schools in each cluster ranges from 8 to 12. Within this District there are 108 rural and 10 urban primary schools. There are 7 primary schools (6 rural and 1 urban) that form the sample of the experimental group. There are 3 primary schools (2 rural and 1 urban) which are a control group.

The project intervention

Lead teachers attended in-country workshops and a one month-long summer institute at Western Motana in the US. Lead teachers have conducted a series of workshops in the District as well as in their clusters. Second-generation teachers were also supported by lead teachers to implement the new classroom strategies.

Significance of study

This study is significant for several important reasons. First, this research will reveal whether the lead teachers and their colleagues have made an impact on the mathematics classroom learning environments. Second, it extends classroom learning environments research to a South African context. Third, an isiZulu version of the 'What Is Happening In this Class' (WIHIC) questionnaire was validated in a South African context. Fourth, the results of this study will be used to create a professional development package to improve the existing project to help teachers to improve classroom learning environments. Fifth, findings from the study are most likely to inform educators, particularly teachers about the nature of learning environment of mathematics in primary schools in KwaZulu Natal. It is anticipated that the professional development package could be replicated in the other Districts in the KwaZulu Natal Province and in the country as a whole.

Purpose, and specific research questions

This study seeks to measure the impact of the lead teacher development project on the Grade 4 mathematics classrooms involved in this project. The results of this study will be used to create a professional development package to improve the existing project to develop and support teachers to improve their mathematics classroom learning environments.

More specifically the study addresses the following research questions:

- What perceptions do the pupils in this project have of their mathematics classroom learning environments?
- How do the pupils' perceptions compare with those of the teachers involved in the project?
- How do these perceptions vary with those of the pupils in the and teachers in the (non-intervention) control group?
- To what extent was the project successful in improving the mathematics classroom learning environments?
- In what ways can the project support teachers improve their mathematics classroom learning environments?

Classroom learning environment research

The classroom learning environment can be defined as being more than the physical surroundings, it includes the activities, the messages given to students about what is expected of them, the atmosphere that prevails, what their work is to be, and what counts in the classroom (Lappan, 1997). According to Salomon as quoted by Nishinosomo (1992, p.1) the idea of a learning environment refers to:

> "… a complex mix of variable that are interconnected. An environment is an entire amalgam of roles, activities, goals, relationships, interactions, conditions, circumstances and influences that combine to provide the conditions for growth or learning of the individual."

In the past, research and evaluation in mathematics and science education has focuses much on the assessment of academic achievement and other valued learning outcomes (Fraser, 1998). However, such measures may not portray a complete picture of the educational process. It is worth appreciating that over the past three decades, considerable progress has been made in the field of classroom learning environments since the pioneering work of Walberg (1979) and Moos (1979). Books and several literature reviews (Fraser, 1986, 1994, 1998) have put these developments into historical perspective and explain that learning environment assessments have been used as a source of dependent and independent variable in a variety of research applications in many countries. The study is therefore within the framework of classroom learning environment research.

Methodology

Data Collection

The pre-test was conducted using both quantitative and qualitative research methods. An important accomplishment within the field of learning environments has been the productive combination of quantitative and qualitative research methods (Fraser & Tobin, 1991: Tobin & Fraser, 1998). The project intervention took place from the beginning of August 2000 until the end November 2000. The post-test was conducted as from the end of November 2000 until the end of January 2001 before the pupils got contaminated with new work of the next grade.

Quantitative Data

To collect data I used ‘What Is Happening In this Class’ (WIHIC) questionnaire which was developed by Fraser, Fisher and McRobbie (1996) to bring parsimony to the field of learning environments by combining the most outstanding scales from a wide range of existing questionnaires which are relevant to contemporary educational concerns. However, this instrument was validated for use in the South African context. The personal form of the WIHIC questionnaire was used to measure the perceptions of both pupils and teachers in actual classroom learning environments. I chose the personal form because Fraser, Giddings and McRobbie (1995) and Fraser, Fisher and McRobbie (1996) contend that learning environment can be more accurately assessed by asking pupils for their personal perceptions of their roles in the classroom, rather than their perceptions of the learning environment of the class as a whole. Seven scales of the WIHIC instrument were utilized to measure aspects of the learning environment:

- Student Cohesiveness (extent to which students know, help and are supportive of one another);
- Teacher Support (extent to which teacher helps, befriends, trust and is interested in students);
- Involvement (extent to which students have attentive interest, participate in discussions, do additional work and enjoy class);
- Investigation (emphasis on the skills and processes of inquiry and their use in problem solving and investigation);

- Task Orientation (extent to which it is important to complete activities planned and to stay on the subject matter);
- Cooperation (extent to which students cooperate rather than compete with one another on learning tasks); and
- Equity (extent to which students are treated the same by the teacher).

Each item of the WIHIC instrument was responded to using the five alternatives of Almost Never, Seldom, sometimes, Often, and Almost Always.

The very same instrument was converted to also measure perceptions of teachers of classroom learning environments.

Qualitative Data

Data collected for a pre-test and post-test using the WIHIC instrument was used as a springboard for further data collection involving different qualitative research methods including interviews with participants, observations, and narrative stories. The use of qualitative methods helped to provide a more in-depth understanding of the learning environment which is line with the findings of Tobin, Kahle and Fraser, 1990.

Pilot Study

As part of the pilot study, both an IsiZulu and English version of the WIHIC instrument were administered to one Grade 4mathematics class in April 2000. students were randomly-selected to be in two groups. One group responded to an IsiZulu version and the other group completed an English version of the instrument. In addition, two mathematics teachers in the school and 5% of the students were interviewed regarding the readability and comprehensibility of items and to check whether pupils were responding to questionnaire items on the basis of what was intended by the researcher. It was decided as a result of these interviews that the decision regarding whether the IsiZulu or English version should be left to the discretion of individual teachers. This led to some modification of both versions to include simple words that can be easily understood by pupils. The WIHIC instrument would be further validated and adapted to the South African context on the basis of the large sample being surveyed in the main study.

Results of the main study

Quantitative Data

The pre-test and post-test data collected using the WIHIC questionnaire was used to measure the personal perceptions of pupils and teachers of their actual classroom learning environments in both the experimental and control groups. Data was also analyzed to investigate the reliability of the 42 item version of the WIHIC questionnaire. All scales displayed satisfactory factorial validity, internal consistency reliability and discriminant validity, and I was capable of differentiating between the perceptions of pupils in different classrooms and also those of their teachers. (By the time this paper is presented in January 2001, findings and results of the pre-test will be presented in four sections: reliability and validity of the WIHIC questionnaire; associations between pupils perceptions of the learning environment and their attitudes; differences between pupils' perceptions of the actual learning environment and that of their teachers; differences between males' and females' perceptions of their learning environment).

The pre-test and post-test data collected WIHIC questionnaire was used to measure the perpenal perceptions of pupils and teachers of their actual classroom learning environments in both the experimental and control groups. Data was analysed to investigate the reliability of the 42-item version of the WIHIC questionnaire.

Table I shows the summary results of students perceptions of their actual classroom learning environment.

Table I: Summary Results – pupils reliability

Construct Alpha Standardised Alpha

SC 0,58 0,58

TS 0,74 0,74

IN 0,75 0,74

IV 0,78 0,78

TO 0,62 0,63

CO 0,72 0,72

E 0,76 0,76

Cronbanch's alphas (reliability) for all constructs are within acceptable range except for student cohesiveness (sc). Reliability for constructs TO is also low although it is within acceptance range.

Comparison between control and experimental pupil group

Factor analysis was performed on each construct to find out which items loaded heavily on each construct. The factor scores extracted from this analysis were further used to compare the experimental and control group of pupils and, male and female pupils for each construct through MANOVA. This comparison indicated significant difference in response of the experimental and control groups for each construct. For experimental groups significant difference were observed between males and females students for constructs PC, TO and E. while for control group significant difference were observed between males and females for constructs IV and CO respectively.

Table 2 Summary Results – Teachers Reliability

Construct Alpha Standardised Alpha

SC 0,65 0,70

TS 0,64 0,75

IN 0,86 0,77

IV 0,97 0,98

TO 0,72 0,81

CO 0,90 0,90

E --- ---

Crobanch's alpha for all constructs is within acceptable range. Constructs III, IV, TO and CO show much higher reliability as compared to PC and TS. Alpha value for E could not be calculated due to zero variance of some items.

Comparison between experimental and control teacher's group for each item in the questionnaire

Non-parametric test (Mann Whitney U-test) was used to compare the rating of teachers in the experimental and control group due to small size. The resulting P value for all the comparisons is greater than 0,05, implying that we as not have sufficient evidence at 5% level of significance to conclude that there is difference in the rating of teachers in the experimental and group for each item. The factor analysis of the data also indicated no significant difference between the two groups of each construct.

Qualitative Data

Doing observations and interviews helped to make sense of the questionnaire results. It became clear that pupils tend to exaggerate perceptions of the learning environment in the questionnaire.

Generally each classroom I visited had a teacher's table, charts displayed on the wall (e.g. times tables), charts with class rules and a chalkboard. Much emphasis was placed on order and discipline.

I interviewed three pupils from each of the ten classes of different schools. The interviews were based on items of the WIHIC questionnaire. In each class, one was from the above-average category, one from the average category and on from the below-average category. I interviewed a total of 30 pupils after each test, pre-test and post-test. What I noted is that pupils were very shy and in the eight schools they could not explain in English. This is ascribed to the fact that English is their second language. Hence I used IsiZulu which is their mother tongue. Even their teachers use a bilingual approach. The other two schools had mixed racial groups and pupils in these schools explained themselves eloquently in English.

There were no overt differences between boys and girls in terms of their perception of the mathematic classroom learning environment. However, an observable difference was there when it came to the above-average, the average and the below average. The above-average pupils, when it came to cooperation, felt they were pinned down by others when working as a team. They preferred working independently.

In each classroom, a teacher placed much emphasis on following the same method to solve the assigned problems. For example teacher I said:

> "After getting the correct answers, I hope you can work out those sums. Use the same
>
> method I have shown you and in case you and in case you have a question you can ask."

Much emphasis was placed on correct answers . Pupils were deprived of an opportunity to give reasons for their answers. If the answer was wrong, no follow up was made to find out why the pupils answer that way. In one case teacher 4 asked the pupils what standard of measurement of length should be used to measure the length of a pen. Pupil 2 said a centimeter. Teacher 4 replied: "Wrong, next." The next pupil said: " millimeter" The teacher then said correct. Although pupil 4 was not wring by saying centimeter, he was discouraged by the teacher.

Even in classes where learners were seated in groups, there was very little constructive learner-learner discussion. Discussions were dominated by most able and above average learners. Teachers tended to ignore persuading the less able learners to participate actively in group or class discussion. Our teachers are used to standing in front of the whole class and guiding learners as groups or as individuals. This is evidenced by the results of quantitative data that student cohesiveness is below the acceptable level.

Conclusion

The overall results of the impact research indicate that no much difference existed between experimental and control group students. This could be ascribed to the fact that there are may projects finding place in both the experimental and control group which may have had a great influence on the classroom learning environments.

The results of this study that student cohesiveness in this project needs a special attention. Hence a professional development package is being created to assist teachers in this project and also outside the project to improve mathematics classroom learning environments with a specific focus on students cohesiveness.

It is therefore anticipated that the professional development package that will be created out of the results of this study on Student Cohesiveness will assist teachers in this project and also outside the project to improve the mathematics classroom learning environments.

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