

THE IMPLEMENTATION OF USING ENGLISH IN TEACHING MATHEMATICS AND SCIENCE

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Mathematics and science education has been undergoing major reforms both locally and abroad in recent years. These reforms, with an emphasis on learning challenging content and developing depth of understanding through problem-solving and inquiry, requires students to participate meaningfully in academic discourse and activities that are essential to achieve the mathematics and science standard as expected. The implementation of the use of English in mathematics and science teaching in the Malaysian context has posed a challenge to all parties involved especially in a multicultural country with Malay as its own national language. Even after five years of implementation, the teaching of mathematics and science in English (PPSMI) policy is still being hotly and widely debated in Malaysia. In view of this, a research on the implementation of PPSMI was conducted.

Objectives

The main objective of the study is to explore the implementation of the teaching of mathematics and science in English. Specifically, the study aims to:

1. Investigate the mediation processes in the English science and mathematics classrooms in rural areas;
2. Investigate the teachers' efficacy and students' self-concept that are related to effective teaching of mathematics and science in English;
3. Examine the professional preparation of the Malaysian teachers to teach mathematics/science in English;
4. Investigate the use of instructional courseware in the mathematics and science classrooms;
5. Determine the principal's instructional leadership in implementing the teaching of mathematics and science in English;
6. Determine the level of parental support provided in the implementation of teaching mathematics and science in English;
7. Determine the roles of school counselors in the implementation of teaching mathematics and science in English; and
8. Identify a school that indicates effective and successful implementation of the teaching and learning of mathematics and science in English.

Research Questions

1. What are the mediation processes in the science and mathematics classrooms?
2. What are teachers' self-efficacy and students' self-concept related to the effective teaching of science and mathematics?
3. What are the perceptions of teachers of the mathematics and science courseware?
4. What is the perception of teachers of the pre-service and in-service training in their professional preparation to teach mathematics/science in English?
5. What is the perception of teachers of the principal's instructional leadership in the implementation of the teaching of mathematics and science in English?
6. What is the level of parental support provided in helping the implementation of teaching mathematics and science in English?
7. What are the types of services provided by the counselors in the implementation of teaching mathematics and science in English?
8. To what extent does the counselor provide services to students, teachers and parents in implementing the teaching of mathematics and science in English?
9. What are the key indicators of a school that effectively implemented the teaching and learning of mathematics and science in English?

Methodology

Design of the Study

This study utilizes a mixed-method of qualitative and quantitative approaches, whereby questionnaires, observation, video-taping, interviews and documents were used. The variables measured in this study permit the researchers to explore the level of competency of the participants in terms of their self-efficacy, self-concept, technological skills and mastery of English. The variables also permit the team to observe perceptions, plans and actions as well as implications (progress and problems) from the participants' perspectives.

Location and Sample of the Study

The relevant school administrators, participating science and mathematics teachers, counselors, and Heads of English Departments were contacted to learn about their goals, views, experiences and problems in implementing the teaching of science and mathematics in English. As for the students, only two Form One classes from each selected school were involved.

Duration of the Study

The data collection commenced in August 2005 and ended in October 2005. The researchers traveled to all the states throughout Malaysia as planned.

Instrumentation

The instruments used in this study include questionnaire, observation, interview and document analysis.

A. Questionnaire:

The questionnaires were administered to the mathematics and science teachers, Form One students and their parents, as well as counselors. All in all, there were six sets of questionnaires administered, namely:

- Set A – Teachers' Self-Efficacy
- Set B - Teachers' Use of Courseware
- Set C – Teacher Professionalism

- Set D - Instructional Leadership
- Set E – Counselor
- Set F – Parent
- Set G – Students' Self-Concept Scale

B. Observation

The observation adopted in this study was the non-participant observation. Each researcher worked closely with the teachers, attempting to understand and observe the teaching-learning environment and to gain ideas about the teachers' and students' in-class experiences.

The observation was done in two different classrooms, one being a science lesson and the other a mathematics lesson. Each observation took about 30 minutes and was based on the observation checklist.

C. Interview

Interviews were conducted in order to learn more about participants' plans and programs for change (teaching and learning), their knowledge and experiences, and how their plans are translated into the teaching-learning environment, especially the class attitude and assessment.

Semi-structured interviews were conducted with the school administrators, English master teacher, all mathematics and science teachers, the counselor, and Form One students.

D. Document Analysis

The documents obtained were students' records, test results, daily exercises, assignments for mathematics and science projects, minutes of meetings, system records, time-tables, revision tests, observation notes, monitoring checklist, organizational charts and item analysis of the tests conducted in the schools.

Findings

The results show that the self-efficacy of Mathematics teachers is significantly higher than that of Science teachers. As for the students, the result shows that Mathematics self-concept of the Form One students were significantly higher than their Science self-concept. Apart from that, majority of the teachers agreed that the courseware has been effective for teaching and learning even though few aspects and components of the courseware could be upgraded. There are significant differences in terms of teacher preparation for the pre-service and in-service Science and Mathematics teachers in the aspects of confidence in communicating in English, writing Mathematics/Science teaching materials in English, and presenting Mathematics/Science lessons in English.

The study also found that there are schools which implement the PPSMI successfully, and the school principals concerned played vital role in ensuring the implementation of PPSMI. Their assertiveness had made them the role model for the teachers and students from the schools. The findings also suggest that parents are involved in supporting their children in learning mathematics and science in English and also parents from different socioeconomic background show different level of commitment.

Discussion and Conclusion

Based on the findings, one can discuss that students need to be motivated to learn mathematics and science in English. They should be encouraged to engage more in mathematics-related and science-related tasks in English. Clearly, one of the major needs of the teachers is to have more professional preparation in overcoming students' difficulties in learning mathematics and science

in English. The principals are important leaders and role models to encourage the smooth transition of the implementation of PPSMI.

The success or failure of the implementation of PPSMI requires collaboration from various parties. It is hoped that, through PPSMI, Malaysian students can equip themselves better in terms of knowledge and skills in order to face the challenging globalised world. It is also hoped that through PPSMI, the government can produce young scientists and mathematicians of commendable quality who can compete with those from other parts of the world.

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Semi-structured interviews were conducted with the school administrators, English master teacher, all mathematics and science teachers, the coordinator, and Form One students.

D. Document Analysis

The documents obtained were the lesson plans, daily lesson plans, mathematics and science project reports, minutes of the staff meeting, lesson plans, project reports, mathematics and science project reports, and minutes of the staff meeting.

The results show that the self-efficacy of mathematics teachers is significantly higher than that of science teachers. As for the students, the results show that mathematics self-efficacy of the Form One students was significantly higher than their science self-efficacy. Apart from that, although the teachers agreed that the curriculum has been effective for teaching and learning even though few aspects and components of the curriculum could be improved, there are significant differences in terms of teacher preparation for the pre-service and in-service science and mathematics teachers in the aspects of confidence in communicating in English, setting Mathematics/science teaching materials in English, and preparing Mathematics/science lessons in English.

The study also found that most schools were implementing the PPSMI successfully, and the school principals continued played vital role in ensuring the implementation of PPSMI. Their responsiveness had made them the role model for the teachers and students from the schools. The findings also suggest that parents are involved in supporting their children in learning mathematics and science in English, and the parents from different socioeconomic backgrounds show different level of commitment.

Discussion and Conclusion

Based on the findings, one of the factors that students need to be motivated to learn mathematics and science in English. They should be encouraged to engage more in mathematics-related and science-related tasks in English. One of the major goals of the teachers is to have more professional preparation in overcoming students' difficulty in learning mathematics and science.