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JUDUL: **STUDENTS' PERCEPTIONS OF MATHEMATICS CLASSROOM ENVIRONMENT, MATHEMATICS EFFICACY, AND MATHEMATICS ACHIEVEMENT: A STUDY IN KENINGAU, SABAH, MALAYSIA**

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STUDENTS' PERCEPTIONS OF MATHEMATICS CLASSROOM ENVIRONMENT, MATHEMATICS EFFICACY, AND MATHEMATICS ACHIEVEMENT: A STUDY IN KENINGAU, SABAH, MALAYSIA

MURUGAN A/L RAJOO

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FOR THE DEGREE OF MASTER OF EDUCATION

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2011

DECLARATION

All materials in this research are original except for quotations, excerpts and references, which have been duly acknowledged.

(15 OCTOBER 2011)

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ABSTRACT

STUDENTS' PERCEPTIONS OF MATHEMATICS CLASSROOM ENVIRONMENT, MATHEMATICS EFFICACY, AND MATHEMATICS ACHIEVEMENT: A STUDY IN KENINGAU, SABAH, MALAYSIA

Mathematics classroom environment, mathematics efficacy and mathematics achievement are some of the important mathematical constructs in teaching and learning of Mathematics in the classroom. This study compared such constructs between rural and urban schools in Keningau, Sabah as well as between genders. This study also focused on determining the relationship between these three constructs. Two urban and two rural secondary schools with sample sizes of 235 and 210 each and total sample size of 445 were selected to participate in this study. Three research instruments were used in this study. A 76-item mathematics classroom environment questionnaire based on "What is Happening in This Classroom" (WIHIS) and the Constructivist Learning Environment Survey (CLES) were used to determine the mathematics classroom environment. Another questionnaire to determine mathematics efficacy with 10 items adapted from PISA (2004) was also used. The students' mathematics achievement was determined using a test comprising of 20 multiple choice questions and 5 subjective questions based on the first five chapters in Mathematics Form 4 syllabus. Data from the study was analyzed with SPSS 17.0 using both descriptive and inferential statistical analyses. Findings showed the students had a moderate perception of their mathematics classroom environment and mathematics efficacy. Mathematics achievement was low, with female students achieving better than males in their mathematics assessment while urban students did better than rural students. There was no significant difference in perception of mathematic learning environment based on school location and gender. However, differences in perception of mathematics efficacy were insignificant based on school location but significant for gender with female has better mathematics efficacy compared to male. Significant of weak correlations were found between mathematics classroom learning environment, mathematics efficacy and mathematics achievement. The research findings bring some meaningful implications to the teaching and learning of mathematics at urban and rural secondary school as well as the training of mathematics teachers in Malaysia.

ABSTRAK

Persekitaran bilik darjah, efikasi kendiri dan pencapaian matematik merupakan antara konstruk matematik yang penting dalam pengajaran dan pembelajaran matematik di bilik darjah. Kajian ini membandingkan konstruk-konstruk ini di antara sekolah menengah bandar dan luar Bandar di Keningau, Sabah, dan juga di antara jantina. Kajian ini juga memberi fokus untuk menentukan hubungan antara ketiga-tiga konstruk ini. Dua sekolah menengah masing-masing di bandar dan luar bandar dengan saiz sampel 235 dan 210 dan saiz sampel keseluruhan sebanyak 445 dipilih untuk terlibat dalam kajian ini. Tiga instrumen kajian digunakan dalam kajian ini. Soal selidik persekitaran bilik darjah matematik dengan 76-item berdasarkan What is Happening in This Classroom (WIHIS) dan Constructivist Learning Environment Survey (CLES) digunakan untuk menentukan persekitaran bilik darjah matematik. Satu lagi soal selidik untuk menentukan efikasi kendiri matematik dengan 10 item diadaptasi daripada PISA (2004) juga digunakan. Pencapaian matematik pelajar ditentukan menggunakan ujian yang mempunyai 20 soalan pelbagai pilihan dan 5 soalan subjektif berdasarkan lima bab pertama dalam sukatan pelajaran Matematik Tingkatan 4. Data daripada kajian ini dianalisa dengan SPSS 17.0 menggunakan analisis statistik deskriptif dan inferensi. Dapatan kajian menunjukkan persepsi sederhana terhadap persekitaran bilik darjah Matematik dan efikasi Matematik. Pencapaian Matematik pula rendah dengan pelajar perempuan mempunyai pencapaian lebih baik daripada pelajar lelaki dalam penilaian matematik mereka manakala pelajar di sekolah bandar lebih baik daripada pelajar luar bandar. Tidak terdapat perbezaan yang signifikan dalam persepsi terhadap persekitaran bilik darjah Matematik lokasi sekolah dan jantina. Walau bagaimanapun, perbezaan dalam persepsi terhadap efikasi matematik adalah tidak signifikan berdasarkan lokasi sekolah tetapi signifikan bagi jantina di mana pelajar perempuan mempunyai persepsi terhadap efikasi Matematik yang lebih tinggi. Korelasi yang signifikan didapati antara persekitaran bilik darjah Matematik, efikasi Matematik dan pencapaian Matematik. Dapatan kajian memberikan implikasi yang bermakna kepada pengajaran dan pembelajaran Matematik di sekolah bandar dan luar bandar di samping latihan kepada guru-guru Matematik di Malaysia.

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INTRODUCTION

1.1 Background of the Study

School is the place for students to gain knowledge in terms of theory and practice. Since the introduction of eTEMS (English for teaching Mathematics and Science) in 2003, use of ICT-based approaches in the teaching and learning of mathematics was initiated and emphasized by the Malaysian Ministry of Education in order to create a new learning environment for students to learn mathematics. The Education Development Master Plan (PIPP, 2006) indicated that rural and urban school students are equally treated in order to produce quality workforce as envisioned under Vision 2020. Although numerous programs were carried out by the Education Ministry to improve the facilities in the rural schools, rural students' performance in Mathematics of public examination indicated that rural students were not performing as good as urban students (Robiah Sidin, 1994). Cox (2000) stated that the school locale is a significant determinant of students' performance in mathematics with rural students at a disadvantage compared to urban students.

There have been a lot of researches carried out to investigate trends in mathematics achievement and the factors influencing mathematics learning and performance (Ma & Klinger, 2000; Papanastasiou, 2000; Al Khateeb, 2001; Tsao, 2004; Mulis, Martin, Gonzalez & Chrostowski, 2004; House & Telese, 2008). Mathematics achievement and its relationship with students' gender, age, ethnicity, family socio-economic status and school characteristics were explored by Ma and Klinger (2000). Papanastasiou (2000) focused his research on the effects of school, students' attitudes and beliefs in mathematics learning on students' performance while mathematics beliefs and self-concept were studied by House and Telese (2008) and Wang (2007). In Al Khateeb (2001) study, he examined gender differences in mathematics achievement among high school students.

In this study, three aspects of mathematics teaching and learning namely; mathematics classroom environment, mathematical efficacy and mathematics achievement were investigated. Two demographic elements; gender and school location are also investigated in relation to these mathematics attributes.

Classroom environment refers to the circumstances of the classroom. The concept of classroom environment has existed since the 1930s (Goh & Fraser, 1998). Research conducted over the past few decades showed that the quality of classroom circumstances in schools is a significant determinant of learning (Fraser, 1994, 1998). Students perform better when they perceive the classroom environment positively. The Lewinian Model implied that classroom environment is related and influenced the students' attitudes while they are in the classroom (Lewin, 1943).

Mathematical efficacy refers to the personal judgments of one's capabilities to organize and execute mathematics courses of actions to attain designated types of educational performance (Zimmerman, 1995). According to Bandura (1997), there are four sources of mathematics efficacy: enactive mastery experiences, experiences, verbal persuasion and physiological and affective states. Academic efficacy which is consistent with mathematics efficacy theory, involves judgments on capabilities to perform tasks in specific academic domains. In a classroom learning environment, measures of academic efficacy must assess students' perceptions of their competence to perform specific activities. There are many academic efficacy researches that focused on specific areas of the formal school curriculum. For example, Pajares (1996) investigated on academic efficacy of mathematics related tasks. Recently, Zeldin and Pajares (2000) explored the mathematics efficacy of women in mathematical, scientific and technological careers.

1.2 Problem Statement

Researchers in the field of mathematics education had proposed that there are many factors with significant relationships with mathematics achievement. There are also many educational researches which focused on the relations between learning environment and student motivation and cognition. Such studies showed that students' perception of their abilities to succeed on academic tasks and intrinsic interest in these tasks are positively associated with their academic performance, choice and persistence (Ames & Archer,1988; Pajares, 1996; Paris & Paris, 2001; Pintrich, Smith, Garcia, McKeachie, 1993; Pintrich & De Groot 1990; Schunk & Pajares, 2001, Wigfield & Eccles, 2000).

Past studies such as Lay (2009) studied the logical thinking abilities namely conservational reasoning, proportional reasoning, controlling variables, combinational reasoning, probabilistic reasoning and correlation reasoning among Form 4 students in the Interior Division of Sabah. The study also ascertained whether there is any significant difference in students' logical thinking abilities based on their gender and science achievement at lower secondary level. The study revealed a low level of students' logical thinking abilities with 98% of the respondents in the concrete operational stage as well as no significant difference in the mean of logical thinking abilities based on students' gender but a significant difference based on their science achievement at lower secondary level.

Another study by Khoo and Lay (2009) focusing on rural secondary students from the interior division of Sabah examined the direct and indirect effects of basic concepts of mathematics, mathematics problem solving abilities, prior knowledge of mathematics and attitudes towards mathematics on students' mathematics achievement.

Malaysia in general, and Sabah particularly, research on gender differences and its relationship with mathematics efficacy and performance is not widely carried out among students from the interior districts. However, it is important to know the impact of gender differences with regards to mathematics efficacy and performance

as this will enables mathematics educators to use suitable teaching and learning strategies that address the differential issues and thus ensure high mathematical performance in both boys and girls.

In addition, comparison of mathematics classroom environment, mathematics efficacy and achievement between rural and urban secondary schools will enables educators to reduce the gap between rural and urban students. The Education Development Master Plan (PIPP, 2006) specifically focused on providing equality in education suggesting that there should be no rural and urban divide, and that students irrespective of school location should be given the best facilities, environment and support to fulfill the workforce requirement as prescribed in the National Philosophy of Education.

As teaching and learning mainly take place in the classroom and according to Haladnya, Shaughnessy and Shaughnessy (1983), classroom environment is among the most powerful indicators of students' performance. Fraser and Fisher (1983) stated that students are supported by certain elements in the secondary school classroom environment. These were found to help students to become more socially and academically confident (Ryan & Patrick, 2001). In other studies, supportive elements related to classroom were investigated including students' perception of performance (Dart, Burnett, Purdie, Boulton-Lewis, Camphell & Smith, 2000; Fisher & Richards, 1996). It becomes imperative to create an ideal classroom, one where the elements support academic and psychosocial growth. Simmons, Burgeson, Carlton-Ford and Blyth (1987, p. 1231) describes the ideal classroom as an area where the students are comfortable, especially with role relationships and challenged and to which s/he can withdraw to be invigorated.

Expectancy for success or mathematics efficacy involves beliefs about how well one can perform academic activities. Mathematics efficacy refers to the judgments we make about our potential to learn successfully and the belief in our own capabilities (Tait-McCutcheon, 2008). Mathematics efficacy influences the choices we make, the effort we put forth, and how long we persist (Bandura, 1997; Schunk, 1996). According to Bandura (1977), mathematics efficacy impacts on a

learner are potential to succeed. In general, self-efficacious students tend to out greater effort to succeed on a task, do not give up easily when facing difficulties, use meaningful learning strategies and show intrinsic interest in the academic tasks. Studies showed that mathematics efficacy beliefs affect students' academic goal orientations, attributions and career choices (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Bandura, 1993, Hoy, 2004; Linnenbrink & Pintrich, 2003, Pajares, 1996, Usher & Pajares, 2006).

Thus, knowing about mathematics efficacy is a valuable tool for mathematics educators. It is important that educators identifies how their learners feel, think and act about, within and toward mathematics. Yates (2002) stated that the influence of attitudes, values and personality characteristics on achievement outcomes and later participation in the learning of mathematics are important consideration for mathematics educators (p. 4).

In relation to mathematics learning such as arithmetical problems, problem solving and problem posing, positive results were obtained. Pajares and Miller (1994) stated that efficacy in problem solving contributed positively to students' performance. Various researches indicated that high achieving in mathematics students are correlated to higher and more accurate efficacy beliefs (Pajares & Kranzler, 1995).

Gender and its relationship with mathematics performance and mathematics efficacy has also been extensively researched (Hyde, Fennema & Lamon, 1990). Research efforts (Fierros, 1999; Zhang & Manon, 2000; Johnson, 2000; Leahey & Guo, 2001; Ericikan, McCreith, & Lapointe, 2005) showed no significant differences in achievement between boys and girls as they get acquainted with mathematics. However, differences in favor of male students begin to emerge with time (Campbell, 1995; Mullis & Stemler, 2002). Meanwhile, recent studies have challenged this trend indicating a decline in this gap (Barker, 1997; Hyde, Fennema, & Lamon, 1990; Knodel, 1997).

Some studies even showed that there is no gender difference in mathematics achievement (Bronholt, Goodnow, & Conney, 1994). In Ma's and Klinger's (2000) study of a sample of high school seniors in four education systems (British Columbia, Ontario, Hong Kong, and Japan) from the Second International Mathematics Study, there was no gender differences in algebra but males were better in geometry compared to females. In another study by Baya'a (1990), there is a significant difference between the achievement in mathematics by males and females at the low socio-economic level, but no significant difference at higher socio-economic levels. Mittelberg and Lev-Ari (1999) showed in their study that girls have a higher perceived achievement and mathematics efficacy than boys.

Thus, the literature tend to show that mathematics classroom environment and mathematics efficacy were directly influenced the mathematics achievement of a students in school.

Therefore, this study focused on exploring the mathematics classroom environment, mathematics efficacy and performance of students in the rural and urban areas as well as different genders in Keningau, Sabah.

1.3 Research Objectives

The purpose of this research was to explore the students' perception of mathematics classroom environment, mathematics efficacy and performance in rural and urban secondary schools in Sabah, particularly in the Keningau district. The specific objectives were:

(a) To determine students' perception of mathematics classroom environment;

(b) To determine students' perception of mathematics efficacy;

(c) To determine students' mathematics achievement in the five chapters of Form 4 Mathematics Syllabus ;

(d) To compare students' perception of mathematics classroom environment between rural and urban schools;

(e) To compare students' perception of mathematics classroom environment between male and female students;

(f) To compare students' perception of mathematics efficacy between rural and urban schools;

(g) To compare students' perception of mathematics efficacy between male and female students;

(h) To compare students' mathematics achievement between rural and urban schools;

(i) To compare students' mathematics achievement between male and female students; and

(j) To determine the relationship between mathematics classroom environment, mathematics efficacy and achievement

1.4 Research Questions

The research questions were:

RQ1: What was the students' perception of mathematics classroom environment?

RQ2: What was the students' perception of mathematics efficacy?

RQ3: What was the students' mathematics achievement?

RQ4: Was there any significant difference in students' perception of mathematics classroom environment based on school location?

RQ5: Was there any significant difference in students' perception of mathematics classroom environment based on gender?

RQ6: Was there any significant difference in students' perception of mathematics efficacy based on school location?

RQ7: Was there any significant difference in students' perception of mathematics efficacy based on gender?

RQ8: Was there any significant difference in students' mathematics achievement based on school location?

RQ9: Was there any significant difference in students' mathematics achievement based on gender?

RQ10: Was there any significant relationship among mathematics classroom environment, mathematics efficacy and achievement?

1.5 Research Hypothesis

The following hypotheses were stated:

H_{O1}: There was no significant difference in students' perception of mathematics classroom environment based on school location

H_{O2}: There was no significant difference in students' perception of mathematics classroom environment based on gender

H_{O3}: There was no significant difference in students' perception of mathematics efficacy based on school location

H_{O4}: There was no significant difference in students' perception of mathematics efficacy based on gender

H_{O5}: There was no significant difference in students' mathematics achievement based on school location

H_{O6}: There was no significant difference in students' mathematics achievement based on gender

H_{O7}: There was no significant relationship among mathematics classroom environment, mathematics efficacy and achievement

1.6 Definition of Terms

Some of the key terms that were used in this study have specific scope of meanings. The key terms were explained specifically in order to give a uniform meaning in the context of this study.

1.6.1 Mathematics Classroom Environment

The classroom environment comprises of a number of elements and dimensions. According to Fraser (1994), classroom environment includes the students' perception and experiences within that environment as well as their relationships with each other. The concept of environment refers to the atmosphere, ambience, tone or climate that pervades the particular setting. Classroom environment refers to the overall psychological and social context of the classroom (Fraser, 1991) and is the net result of numerous cognitive, affective and social elements to which teachers and students alike contribute (Shuel, 1996). Thus, a mathematics classroom environment specifically refers to the psychosocial aspects of an environment where teaching and learning mathematics take place. Based on "What is Happening in This Classroom" (WIHIC) (Chionh & Fraser, 1998; Fraser, Fisher, & McRobbie, 1996) and the Constructivist Environment Survey (CLES) [Taylor, Dawson, & Fraser, 1995), ten dimensions of the mathematics classroom environment were determined. These dimensions are: student cohesiveness, cooperation, equity, investigation, involvement, task orientation, teacher support, personal relevance, shared control and student negotiation. Description of these ten dimensions is presented in Table 1.1 below.

Table 1.1: Description of the Ten Dimensions in the Mathematics Classroom Environment Questionnaire

No	Dimension	Description
1	Student Cohesiveness	The extent to which students know, help and are supportive of one another.
2	Co-operation	The extent to which students co-operate rather than compete with one another on learning tasks.
3	Equity	The extent to which students are treated equally by the teacher and the Ministry of Education.
4	Investigation	The extent to which skills and processes of inquiry and their use in problem solving and investigation are emphasized.
5	involvement	The extents, to which students have attentive interest, participate in discussions, do additional work and enjoy the learning environment.
6	Task orientation	The extent to which it is important to complete activities planned and stays on the subject matter.
7	Teacher support	The extent, to which the teacher helps, befriends truths and is interested in students.
8	Personal relevance	The extent to which school mathematics connects with students' out of school experiences.
9	Shared control	The extent to which students are invited to share with the teacher control of the learning environment.
10	Student negotiation	The extent to which opportunities exist for students to explain and justify to other students their newly developing ideas.