UNIVERSITI PUTRA MALAYSIA

GOAL ORIENTATIONS, MATHEMATICS SELF-EFFICACY AND COGNITIVE STRATEGIES AS PREDICTORS OF STUDENTS' MATHEMATICS ACHIEVEMENT

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Chairman: **Associate Professor Rahil Mahyuddin, Ph.D.**

Faculty: **Educational Studies**

The purpose of this study is to examine the relationship between students' goal orientations (learning and performance), mathematics self-efficacy, cognitive strategies (deep and shallow) and mathematics achievement. This study also attempts to identify the predictors of deep cognitive strategy, shallow cognitive strategy and mathematics achievement. The sample consisted of 339 Form Four students.

Pearson correlation showed that learning goal and mathematics self-efficacy were significantly correlated with each other ($r = 0.57$, $p < .01$). Deep cognitive strategy was significantly ($p < .01$) correlated with learning goal ($r = 0.49$) and mathematics self-efficacy ($r = 0.54$). The relationship between these three variables was positive and of moderate strength. Performance goal was positively correlated with shallow cognitive strategy ($r = 0.18$, $p < .01$), but the relationship was slight. Mathematics

achievement was significantly ($p < .01$) correlated with learning goal ($r = 0.22$), mathematics self-efficacy ($r = 0.30$) and deep cognitive strategy ($r = 0.20$). In contrast, mathematics achievement was negatively correlated with performance goal ($r = -0.16$, $p < .01$) and shallow cognitive strategy ($r = -0.11$, $p < .05$), but the correlations for all these were considered weak.

Stepwise multiple regression analyses were utilized to identify the predictors of deep cognitive strategy, shallow cognitive strategy and mathematics achievement. Results showed that mathematics self-efficacy and learning goal were significant predictors of deep cognitive strategy. Both learning goal and performance goal were significant predictors of shallow cognitive strategy. Mathematics self-efficacy, performance goal and shallow cognitive strategy served as significant predictors of students' mathematics achievement.

The findings were generally consistent with basic assumptions of goal orientation theory, self-efficacy theory and those of previous studies. These findings supported the view that learning goal and mathematics self-efficacy facilitates the development of cognitive strategies necessary to increase mathematics achievement. This study suggests that students' goal orientations, mathematics self-efficacy and cognitive strategies have a substantial influence on their mathematics achievement.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

ORIENTASI MATLAMAT, KEBERKESANAN KENDIRI DALAM MATEMATIK DAN STRATEGI KOGNITIF SEBAGAI PERAMAL PENCAPAIAN MATEMATIK PELAJAR

Oleh

HOO HEAP KING

Mac 2003

Pengerusi: **Profesor Madya Rahil Mahyuddin, Ph.D.**

Fakulti: **Pengajian Pendidikan**

Tujuan penyelidikan ini adalah untuk mengkaji hubungan antara orientasi matlamat (pembelajaran dan prestasi), keberkesanan kendiri dalam matematik, strategi kognitif (*deep* dan *shallow*) dan pencapaian matematik pelajar. Kajian ini juga ingin menentukan peramal bagi strategi *deep cognitive*, strategi *shallow cognitive* dan pencapaian matematik. Sampel kajian merangkumi 339 pelajar Tingkatan Empat.

Korelasi Pearson menunjukkan bahawa matlamat pembelajaran dan keberkesanan kendiri dalam matematik mempunyai hubungan signifikan antara satu sama lain ($r = 0.57$, $p < .01$). Strategi *deep cognitive* mempunyai perkaitan signifikan ($p < .01$) dengan matlamat pembelajaran ($r = 0.49$) dan keberkesanan kendiri dalam matematik ($r = 0.54$). Perkaitan antara tiga pembolehubah ini adalah positif and sederhana. Matlamat prestasi mempunyai hubungan yang positif dengan strategi *shallow cognitive* ($r = 0.18$, $p < .01$), tetapi perhubungan tersebut adalah lemah.

Pencapaian matematik berkait secara signifikan ($p < .01$) dengan matlamat pembelajaran ($r = 0.22$), keberkesanan kendiri dalam matematik ($r = 0.30$) dan strategi *deep cognitive* ($r = 0.20$). Sebaliknya, pencapaian matematik berkait secara negatif dengan matlamat prestasi ($r = -0.16$, $p < .01$) dan strategi *shallow cognitive* ($r = -0.11$, $p < .05$), tetapi perkaitan tersebut adalah lemah.

Analisis regresi linear berganda kaedah *stepwise* digunakan untuk menentukan peramal-peramal bagi strategi *deep cognitive*, strategi *shallow cognitive* dan pencapaian matematik. Keputusan menunjukkan bahawa keberkesanan kendiri dalam matematik dan matlamat pembelajaran merupakan peramal yang signifikan bagi strategi *deep cognitive*. Kedua-dua orientasi matlamat pembelajaran dan matlamat prestasi merupakan peramal yang signifikan bagi strategi *shallow cognitive*. Keberkesanan kendiri dalam matematik, matlamat prestasi dan strategi *shallow cognitive* merupakan peramal yang signifikan bagi pencapaian matematik pelajar.

Secara umum, dapatan kajian adalah selaras dengan andaian asas teori orientasi matlamat, teori keberkesanan kendiri dan kajian-kajian lepas. Keputusan kajian ini menyokong bahawa matlamat pembelajaran dan keberkesanan kendiri dalam matematik memajukan kemahiran kognitif yang diperlukan untuk meningkatkan pencapaian matematik. Kajian ini mencadangkan bahawa orientasi matlamat, keberkesanan kendiri dalam matematik dan strategi kognitif pelajar mempunyai pengaruh yang besar kepada pencapaian matematik mereka.

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Special thanks to my parents and family members, who have given me love, support, patience, encouragement and being there for me. I would like to express my appreciation and thanks towards Mr. Paul Raj and Mr. Pang Chee Genn, who despite their busy schedules, have helped to edit the thesis.

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Hoo Heap King

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MSE	Mathematics self-efficacy

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Learning and success in education has always been of special interest and concern among students, educators, educational psychologists, parents and society at large. Finding ways to enhance the effectiveness of students' learning is of perennial interest to researchers. When discussing factors influencing students' learning and academic achievement, individual differences in intelligence, demographic variables, parental involvement, school facilities, study methods, teaching methods and motivational beliefs are adduced.

Currently, the roles of various motivational beliefs in student learning have become an important topic in education and psychology. Aspects of motivational beliefs which include goal orientation and self-efficacy have provided a better view on students' cognition and motivational factors that influence their learning. Recent work in the psychology of motivation has examined the links between these two motivational variables and academic achievement (Greene and Miller, 1996; Miller, Greene, Montalvo, Ravindran and Nichols, 1996; Pajares and Kranzler, 1995).

There are two types of goals that people adhere to learning: learning goal and performance goal (Dweck, 1986). These two types of goals lead to somewhat different cognitions, beliefs, attitudes, learning strategies and behaviours. Individual with learning goal tends to increase his competence and improve his knowledge or skills. Individual with performance goal seeks to gain positive judgement with regard to their competence and avoid negative judgement (Dweck, 1986).

Researchers in goal orientation theory suggest that student's goal orientations affect the kinds of cognitive strategies used (Nolen and Haladyna, 1990; Dweck, 1986). Goal orientation theory (Dweck, 1986) states that if one possess learning goal, one will adopt meaningful cognitive strategies and self-regulation (Albaili, 1998; Greene and Miller, 1996; Nolen and Haladyna, 1990). In addition, previous researches have shown that learning goal influences meaningful cognitive strategies, which in turn, influences academic achievement (Greene and Miller, 1996). In contrast, performance goal is unrelated or negatively related to cognitive strategies (Albaili, 1998; Greene and Miller, 1996; Nolen and Haladyna, 1990).

Students employ different strategies, tactics, skills and processes in their learning and studying situations. When students gain new information, they use various cognitive strategies to help them to encode, organize and retrieve new information (Somuncuoglu and Yildirim, 1999). Cognitive strategies are

classified into shallow and deep cognitive strategies (Craik and Lockhart, 1972 in Terry, 2000). Students who employ shallow cognitive strategy process the information at a surface level. They encode new information into short-term memory only (Solso, 1998). Deep cognitive strategy refers to elaboration and organization, which facilitate long-term retention of the information (Nolen and Haladyna, 1990). Those who employ deep cognitive strategy are able to recall the information easily at a later date as more elaborate encoding of information produces better learning and recall (Rogers, 1994).

Although students' goals clearly have a major influence on their use of cognitive strategies and academic achievement, their self-efficacy also influences the degree of involvement in their academic work. In a more theoretical perspective, confidence is usually described as the self-efficacy (self-belief) that an individual has regarding his or her capability to organize actions and perform a particular task successfully (Cassidy, 2000). In academic settings, a student's self-efficacy helps determine what he can accomplish with his knowledge and skills.

According to Bandura's (1986) self-efficacy theory, self-efficacy belief is a good predictor of academic achievement. Self-efficacy refers to individuals' judgement of their abilities to perform a task. It explains why some individuals are unable or unwilling to execute behaviours that are clearly within their abilities. As Bandura (1986) pointed out, there is an obvious difference between possessing skills and being able to use them well in diverse circumstances.

Individual opinion concerning his academic competence is important for many reasons, which include self-evaluation is related with behaviours that are critical for academic success. Self-efficacy theorists hypothesize that self-efficacy mediates the influence of other determinants of academic outcome (Bandura, 1986). Self-efficacy theorists also maintain that a student's academic achievement is largely determined by his confidence with which he approaches an academic task. Student's efficacy belief has been shown to contribute to his motivation and academic attainments.

Self-efficacy plays an important role in influencing human motivation and behaviour (Bandura, 1986). It is suggested that self-belief in ones capability to accomplish a task, will increase the likelihood that the task will be completed successfully. A student's self-efficacy for his schoolwork (academic efficacy) has been shown to be related with many important academic components, such as cognitive strategy, persistence, motivation and achievement (Miller et al., 1996; Pintrich, Roeser and De Groot, 1994). Ultimately, student who feel efficacious about his academic ability tend to attain higher achievement in school (Jinks and Morgan, 1999).

Among all subjects, success in a mathematics course is necessary for further studies in many academic disciplines such as science and engineering (Cajete, 1988 in House, 2001). Mathematics achievement is a critical indicator of success. Mathematics skill is required for work in science and engineering, lowered

mathematics self-efficacy is a possible contributor to a low number of people in those fields. Therefore, it is important to understand students' goal orientations and self-efficacy when learning mathematics. Considerable research has shown that these two motivational variables give impact on students' mathematics achievement (Pajares, 1996; Pajares and Kranzler, 1995).

In general, Young (1997) found that students focus on their test scores and comparison to peers when learning mathematics. This is due to the mathematics classroom environment and its instructional characteristics that influenced students' thinking in this subject area (Young, 1997). They tend to perceive mathematics in terms of ease or hardship and in term of success or failure. Such cues have an obvious connection with students' motivational beliefs. They may develop inaccurate mathematical beliefs, and these beliefs may negatively affect their mathematical behaviour (Frank, 1988 in Whang and Hancock, 1994). For example, a student believes that understanding a mathematical concept means to answer a question in a short period. When he takes a longer time to answer a question, it may result in a feeling that he is not good in mathematics, thus causing a low confidence in this subject area.

When a student studies for a mathematics exam, his confidence level determines the amount of effort and time he uses in solving mathematical problems. Confidence level mediates the influence of other determinants such as mathematics background, mathematics anxiety, prior mathematics achievement

and gender (Pajares, 1996). When one has high confidence, the chances of successful mathematics achievement are enhanced. Considerable studies have demonstrated that self-efficacy has indirect influence on academic achievements, especially in the domain of mathematics (Pajares, 1996; Pajares and Kranzler, 1995).

Based on results of previous studies as stated above, this study focuses on goal orientations and mathematics self-efficacy as factors that should be thought of as two of the many antecedents to mathematics achievement. Although they are factors that may work subtly, they can have a significant impact on learning, and therefore deserve attention from both researcher and educator.

1.2 Theoretical Background

1.2.1 Goal Orientation Theory

A theory that has provided a useful ground for this research is Dweck's (1986) goal orientation theory. Dweck's goal orientation theory was chosen because it is the most appropriate theory to describe the variables (namely goal orientations) in this study. This study fits this theory very well.

A primary focus of goal orientation theory is on how students think, how they think about themselves, their tasks and their performance. This theory posits that students pursue two seemingly mutually exclusive goals: learning goal and

performance goal. These two types of goals lead to somewhat different cognitions, beliefs, attitudes, learning strategies and behaviours in learning.

Dweck (1986) hypothesized that students' engagement in academic work, persistence and achievement can be explained by different goal orientations. The research within goal orientation theory also supported that goal orientations are related with motivational behaviours such as persistence, effort, task choice and cognitive strategies (Young, 1997). Different goal orientations can lead students qualitatively different directions as they engage in academic work.

Individuals with learning goal have the desire to increase their competence by either acquiring additional knowledge or mastering new skills (Ormrod, 1999). A student with learning goal is more likely to increase his effort when faced with obstacles, which often result in improved achievement (Dweck, 1986). In short, students with learning goal tend to engage in activities that will help them learn, and they have a healthy outlook about learning, effort and failure.

In contrast, individuals with performance goal are primarily concerned in gaining positive evaluations on their abilities and trying to avoid negative judgement (Dweck, 2000). They are more likely to avoid challenge or to show impaired achievement when faced with challenges. The avoidance of challenging tasks may result in drops in achievement and lead to "cumulative skill deficits" (Dweck, 1986).

With respect to cognitive strategies, goal orientation theory assumes a unidirectional influence from motivational goals to cognitive strategies. Goal will influence the quality of cognitive performance (Dweck, 1986). Students with learning goal are more likely to employ deep cognitive strategies (Pintrich et al., 1994) and value cognitive strategies that require a deep level of encoding (Nolen and Haladyna, 1990). In contrast, students with performance goal are more likely to use shallow cognitive strategy such as memorization in order to complete the work quickly (Nolen and Haladyna, 1990).

To sum up, students with learning goal focus on efforts to increase their abilities. The adoption of learning goal thus encourages them to pursue tasks that promote intellectual growth and deep cognitive strategy. In contrast, students with performance goal emphasize the favourable judgement on their competence. A strong orientation toward this goal can form a tendency to avoid and withdraw from challenge as well as to use shallow cognitive strategy.

1.2.2 Levels of Processing Theory (LOP)

Levels of processing theory by Craik and Lockhart (1972) was chosen because it is the most suitable theory for explaining cognitive strategies. Craik and Lockhart (1972) in Terry (2000) viewed memory as having different levels of processing depth. They classified cognitive strategies into deep and shallow cognitive strategies. This theory is based on the assumption that the extent on which