A Survey of Mathematics Learning Motivation

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Abstract: - This study draws attention in understanding senior high and vocational school students’ mathematics learning motivation and strategies. While Taiwan students have good mathematics performance in international competition but they have low confidence in learning mathematics well. The questionnaire consisted of two sub-questionnaires: a questionnaire of motivation and a questionnaire of learning strategies, which were developed based on Pintrich and Schrauben’s Motivational Strategies for Learning Questionnaire (MSLQ), and was issued to 1,282 participants. The results show that the students have weak motivation and a less usage rate of learning strategies in learning mathematics.

Key-Words: - Learning motivation, Mathematics learning motivation, Self-efficacy

1 Introduction

According to the report of the Trend in the International Mathematics and Science Study 2003, Taiwan students’ mathematics abilities and performance was in fourth place among the countries joining this program [1]. However, when talking about the affection and confidence of learning mathematics, the report indicated that most of Taiwan 8 graders’ attitudes toward mathematics were negative. Moreover, seventy four percent of them reported they have no confidence in learning mathematics. These results are even worse than Egypt and Jordan whose mathematics grades were lower than Taiwan. The phenomenon of Taiwan students having good performance but low confidence and interest in learning mathematics, therefore, is worth paying close attention to and investigating.

There are numerous factors which may affect students’ learning performance such as teachers’ instructional methods, learning environment, students’ learning strategies, and motivation etc. Among all, it is always believed that the students’ motivation and learning strategies play crucial roles in their learning [2-4]. Motivation and learning strategies, hence, are of particular interests to educational psychologist and researchers.

After educational reformation, senior high schools and vocational schools are facing a lot of challenges such as the inadequacy of teachers, the unequal allocation of educational resources and the lack of the equipment. Especially, in private vocational schools, their situation is worse than the public high schools. Those problems result in a low learning motivation of senior high school and vocational school students and their inferior academic performance. Although senior high and vocational schools have those difficulties, they didn’t gain more attention from the government. Besides, there are few studies about senior high or vocational school students’ mathematics learning. Therefore, in this study, the researcher tried to understand Taiwan’s vocational school students’ real condition of learning mathematics from the aspect of motivation and the students’ learning strategies while up to 2006, in Taiwan there were few studies discussing motivation and learning strategies and few of them focused on mathematics learning. Through this study it may answer why Taiwan students could have good performance with low motivation of learning mathematics and whether that was because their learning strategies were better; if yes, what strategies did they use when learning mathematics? Accordingly, the research questions will include:
1. What is the status of vocational school students’ motivation toward mathematics learning?

2. What is the status of vocational school students’ learning strategies used in mathematic learning?

2 Literature Review

2.1 Learning Mathematics

A widely accepted consensual definition of learning proposed by Atkinson, Atkinson, Smith, and Bem is “a relatively permanent change in behavior that results from practice [5].” Although there are infinite subjects that may be learned and taught in the world, the knowledge that people acquire from learning may include facts, concepts, processes, procedures, and principles [6]. Among these categories, learning mathematics involves the categories of concepts, procedures, and principles. However in Taiwan, because senior high school student need to attend the University Entrance Examination held by College Entrance Examination Center, and the higher score the students get, the better university they can enter. Under pressure of the University Entrance Examination, right now in Taiwan most of the senior high and vocational high schools focus only on skills of correctly answering the questions. Consequently, the students can obtain high scores on test or international competitions, whereas their mathematics learning became repeatedly and robotically operational learning.

2.2 Motivation

It is believed that motivation is an individual’s internal status toward something. It has power to enhance the strength of the relationship between the input and the output of human behavior. Motivation refers to the reasons for directing behavior towards a particular goal, engaging in a certain activity, or increasing energy and effort to achieve the goal. The factors that will influence the extents of an individual’s motivation include the types and intensity of needs and psychological process [7]. Harmony with Kleinginna and Kleinginna, Geen indicated that motivation is a word used to refer to the direction, intensity, initiation and persistence of human behaviors [8].

Pintrich, and De Groot, proposed a motivation model named as social cognitive model of motivation [9]. In this model, they asserted that the intensity of an individual’s motivation will trigger him or her to execute good or bad learning strategies. Both motivation and learning strategies affect student’s learning performance [10-11]. The components of motivation in this model are value, expectation, and affection [12]. The researcher believed that issues of value will be influenced by intrinsic motivation, extrinsic motivation, and the value of the subjects learned; issues of expectation will be affected by learner’s self-efficacy and control-belief. Finally, the issues of the affection will be impacted by anxiety toward tests and the level of the learner’s self-esteem.

3 Methodology

3.1 Motivational Strategies in Learning Questionnaire

The authors intended to probe the status of senior high and vocational school students’ motivation and learning strategies toward mathematics learning in this study. After reviewing existing literature, Pintrich and Schrauben’s MSLQ questionnaire was chosen [12]. However, the MSLQ used for probing the students in the liberal arts field is not perfectly suitable for studying the learners’ motivation and learning strategies of learning mathematics. Therefore the four dimensions were kept but some items were modified in order to match the subject and the participants.

Aside from the questions for gathering student’s background information, there are two main parts in this questionnaire which are the questionnaire of mathematics-learning motivation and the questionnaire of mathematics-learning strategies.

3.2 Questionnaire of Mathematics-Learning Motivation

Three concepts are set in this survey questionnaire: value, expectation, and affection and each of them included two dimensions. This survey adopts a five-point Likert scale: strongly disagree (1), disagree (2), normal (3), agree (4), and strongly agree (5). There are twenty-nine questions in the questionnaire. In the reliability analysis, it shows 0.88 in value, 0.86 in expectation, and 0.71 in affection. The number told that it was a reliable questionnaire.

3.3 Questionnaire of Mathematics-Learning Strategies

Three categories are classified in this survey questionnaire: cognitive strategies, metacognitive strategies, and resources management strategies. In each category, two to four sub-categories are included. This survey also adopts a five-point Likert scale: strongly disagree (1), disagree (2), normal (3),
agree (4), and strongly agree (5). In the reliability analysis, it shows 0.92 in cognitive strategies, 0.89 in metacognitive strategies, and 0.87 in resources management strategies. The questionnaire is reliable according to the reliability analysis.

3.4 Participants

3.4.1 Population
Participants of this study were 1,282 senior high and vocational school students who were enrolled in school between September of 2004 and September, 2006 in Miao-Li County. According the record of the Ministry of Education (2006) there were a total of 16 senior high and vocational schools in Miao-Li County and 17,411 students not including the students in night schools which provide courses for on-job students in the night.

3.4.2 Sample
In this study, the authors first divided Miao-Li County into three strata based on the geographical location. Second, the stratified sampling method is used. The sample of 7.4% from the population of each stratum is then selected separately. Finally, a total 1,502 students were randomly selected and issued the questionnaire of motivation and learning strategies from 16 schools. However, after subtracting 220 invalid questionnaires from 1,502 questionnaires there were 1,282 questionnaires retrieved.

3.5 Statistics Analysis
To study the senior high and vocational school student’s motivation and learning strategies toward mathematics learning in Miao-Li County t test for a single sample was applied to analyze the questions in the questionnaire. Because there is no theoretical criterion for referencing, in this study, the average of 3 was set to be the criteria. The result of t test only express if any two means are statistically significant, but show no enough information about the order between the dimensions. Therefore, when interpreting the data, the practical mean and effect size were adopted to determine the rank between the dimensions.

4 Result

4.1 Students’ Motivation of Learning Mathematics
By using t test analysis, it shows that the students mathematic-learning motivation is statistically significant and more negative whereas \( t=-13.93 \), \( p<.001 \), and the average (M=2.78) is smaller than 3.

The five of six dimensions are statistically significant whereas their \( p<.001 \). Those five dimensions in the questionnaire are the intrinsic motivation and value of the subject, control belief, self-efficacy, cause of anxiety, and phenomenon of anxiety. The intrinsic motivation is significant at the .05 level. Accordingly, the senior high and vocational school students have most motivation in control belief dimension and least motivation in the dimensions of self-efficacy.

4.2 Students’ Learning Strategies toward Mathematics Learning
The results of the t test analysis indicate that the students mathematic-learning strategies is statistically significant and more negative whereas \( t=-39.24 \), \( p<.001 \), and the average (M=2.33) is far smaller than 3.

Seven dimensions including review and organization, practice and deducing, critical thinking, self-regulating, time and learning environment, exploratory behavior on the internet, communication behavior on the internet are statistically significant at the .001 level while seeking help is non-significant. Among all, the highest average comes from the dimension of seeking help (M=2.99) while the lowest one comes from the dimension of communication behavior on the internet (M=1.51).

5 Conclusion
Taiwan’s students usually have good performance in international mathematics competitions; however, their good performance did not enhance their confidence or interest in learning mathematics as a matter of course. Therefore, this study focused on senior high and vocational school students’ real condition of learning mathematics from the aspect of motivation and the students’ learning strategies and find out that senior high and vocational school student slanted to have negative attitude for both their motivation and learning strategies. The participants gave the lowest score to self-efficacy which could be translated into low confidence. Besides, the analysis result of motivation questionnaire shows that the senior high and vocational school students consider mathematics as a difficult subject for them. Although the students viewed mathematics as a difficult subject, they also believe only if they study harder, pay more attention in class, spend more time on practicing, and use appropriate learning approaches, they will have good performance in mathematics.
Moreover, they think they are the only ones who have to be responsible to the learning results.

The most and the least frequent use learning strategies among eight categories are seeking help and communication behavior on the internet respectively. The order from the most to the least are 1. seeking help, 2. self-regulation, 3. review and organization, 4. critical thinking, 5. practice and deducing, 6. time and environment management, 7. exploratory behavior on the internet, and finally 8. communication behavior on the internet.

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References: