MATHEMATICAL SELF-CONCEPT, MOTIVATION TO LEARN MATHEMATICS AND SELF-REGULATED LEARNING STRATEGIES OF UNIVERSITY STUDENTS

Pa Pa Oo[1], Hsu Mon Theint[2]

Abstract

This study was conducted to investigate mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies of university students in Sagaing Region. The descriptive research design and quantitative survey method were taken in the present study. The sample was 500 students (male=250, female=250) from the two universities in Sagaing Region. The research instruments: "Mathematical Self-concept Questionnaire with 20 items, Motivation to Learn Mathematics Questionnaire with 29 items and Self-regulated Learning Strategies Questionnaire with 22 items" were adapted and utilized in this study. Then, the data were analyzed by using descriptive statistics, independent sample *t* test, one way ANOVA, Pearson Product Moment Correlation and multiple regression analysis. According to the data results, there was no significant difference in mathematical self-concept by gender, grade and parents' education. And then, male students are more motivated to learn Mathematics than female students. There was no significant difference in motivation to learn Mathematics by grade and parents' education. Moreover, male students more appropriately applied self-regulated learning strategies than female students. Final year students also applied more self-regulated learning strategies than second year students. There was no significant difference in self-regulated learning strategies by parents' education. Next, there were significant positive correlations among mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies. Additionally, mathematical self-concept and motivation to learn Mathematics can predict 23% of self-regulated learning strategies. Finally, this study highlights the fact that the higher mathematical self-concept and motivation to learn Mathematics, the more self-regulated learning strategies will be applied.

Key words: Mathematical self-concept, Motivation, Self-regulated Learning

Introduction

Importance of the Study

Children of today are the assets of the nation tomorrow. Every child has his own image. They have to be nurtured to harness their potential and use it for future and molded their personality according to their abilities. When the children become adolescents, they want to live in their own world. They build their self-picture according to the circumstances in which they live. Self-image leads to self-prestige, self-esteem and self-believe. All these components of personality are the outcome of self-concept. It is also necessary to assess the self-concept of adolescents.

In assessing the adolescents, there are numerous factors which may affect students' learning performance such as teachers' instructional methods, learning environment, students' learning strategies, self-concept and motivation etc. Among all, it is always believed that the students' motivation and learning strategies play crucial roles in their learning (Schunk, 1990; O'Neil & Drillings, 1994; Pajares & Kranzler, 1995). Self-concept, motivation and learning strategies are of particular interests to educational psychologists and researchers.

Also, Mathematics has been posting poor results despite being a compulsory subject at the basic education level and being a basic requirement to any of the prestigious courses at the

[1] Assistant Lecturer, Department of Educational Psychology, Sagaing University of Education
[2] Senior Teacher, B.E.H.S (Branch) Kinn, Madaya Township, Mandalay Region

university including Medicine and engineering in recent years. Various studies have identified areas of difficulty in the learning of Mathematics at various levels (Cramer, Post &delMas, 2002; Kato Kamii, Ozaki & Nagahiro, 2002; Harries & Suggate, 2006; Harries & Barmby, 2007). Indeed Brown, Brown and Bibby (2008) observed that in many countries, many students do not enjoy school mathematics and seek to avoid it later. Methews and Pepper (2005) noted powerful reasons for not continuing with Mathematics. This includes lack of enjoyment and a belief that the subject is boring, for both high attaining as well as low attaining students.

For all of the above conditions, self-concept, motivation and learning strategies play a crucial role to be a successful learner in Mathematics. Therefore, all these three psychological constructs linked with Mathematics are investigated in the context of this study.

Aims of the Study

The main aim of this study is to investigate mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies of university students who specialize in Mathematics major from selected universities in Sagaing Region (2018-2019) AY.

The specific objectives are:

1. To explore the differences in mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies of university students by gender.
2. To examine the differences in mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies of university students by grade.
3. To examine the differences in mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies of university students by parents' education level.
4. To investigate whether there are relationships or not among mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies of university students.

Methodology

Research Design

In this study, the descriptive survey method and quantitative research design were used to examine the relationship among mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies.

Sampling

By using simple random sampling technique, firstly, the universities were randomly selected in Sagaing Region. Secondly, the participants for this study were chosen from Sagaing University and Monywa University in Sagaing region (2018-2019) AY. A total of 500 students were participated in this study. Among them, 250 were first year students and 250 were third year students and also 250 were males and 250 were females.

Instrumentation

The purpose of this study is to examine mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies of university students from selected universities in Sagaing region (2018-2019) AY. So, in this study, mathematical self-concept

questionnaire, motivation to learn Mathematics questionnaire and self-regulated learning strategies questionnaire were used. Mathematical self-concept questionnaire of 20 items was adapted from Ayodele (2011), motivation to learn Mathematics questionnaire of 36 items was adapted from Liu and Lin (2010) and then self-regulated learning strategies questionnaire of 22 items was adapted from Pintrich and De Groot(1990) in order to be suitable for university students. All these instruments were in the form of four-point Likert scale, "1=strongly agree", "2=agree", "3=disagree" and "4=strongly disagree".

Procedure

For this study, the related literatures were reviewed from many journals, theses, dissertations and reports in education site as much as possible. After reporting the proposal, permissions from authorized persons were requested. In order to validate the instrument, experts' reviews and judgments were requested. After pilot testing, a total of 500 students from Sagaing University and Monywa University were tested using the mathematical self-concept questionnaire, motivation to learn Mathematics and self-regulated learning strategies questionnaire. Then, the collected data was analyzed by using the Statistical Packages for the Social Sciences (SPSS) Programme. Finally, the interpretation and conclusion were drawn altogether with suggestions.

Data Analysis and Findings

Descriptive Statistics for Mathematical Self-concept of Students

In order to find out the students' mathematical self-concept, mathematical self-concept questionnaire was used.

Table 1 Descriptive Statistics for Mathematical Self-concept of Students

Variable	*N*	Minimum	Maximum	Mean	*SD*
Mathematical Self-concept	500	35	77	55.48	6.061

Table 1 indicated that the mean score and standard deviation for the whole sample were 55.48 and 6.061 respectively. The maximum and minimum scores were 35 and 77. Theoretical mean score is 50 and therefore observed value is higher than that of theoretical value. So, the results revealed that the students' mathematical self-concept was satisfactory.

Table 2 Means and Standard Deviations of Mathematical Self-concept by Gender

Variable	Gender	*N*	Mean	*SD*
Mathematical Self-concept	Male	250	55.70	6.180
	Female	250	55.26	5.943

Table 2 showed that the mean score of male students exceeded 0.44 than that of female students.

Table 3 The Result of Independent Sample *t* test for Mathematical Self-concept by Gender

Variable	*t*	*df*	*p*	Mean Difference
Mathematical Self-concept	0.819	498	0.413	0.44

According to Table 3, the result of independent sample *t* test indicated that there was no significant difference between male and female students in the mathematical self-concept but the mean scores of male students were slightly higher than that of female students in the mathematical self-concept. This finding is similar to the study of Sikhwari (2014) and different from the study of Kvedere (2012) which reported that male students have higher mathematical self-concept than female students. Therefore, the results of *t* test confirmed the assumption that there was no significant difference between male and female students in mathematical self-concept (t=0.819, p>0.05).

Table 4 Means and Standard Deviations for Mathematical Self-concept by Grade

Variable	Grade	N	Mean	*SD*	Mean Difference
Mathematical Self-concept	Second Year	250	55.29	6.30	-0.38
	Final Year	250	55.67	5.82	

It was found that the mean scores of mathematical self-concept of final year students were slightly higher than that of second year students.

Table 5 The Result of Independent Sample *t* test for Mathematical Self-concept by Grade

Variable	Grade	*N*	*t*	*df*	*p*
Mathematical Self-concept	Second Year	250	-0.694	498	0.488
	Final Year	250			

According to Table 5, the mean scores of final year students were slightly higher than second year students in the mathematical self-concept but the result of independent sample *t* test indicated that there was no significant difference between second year and final year students in the mathematical self-concept. Therefore, the results of *t* test confirmed the assumption that there was no significant difference between second year and final year students in mathematical self-concept (t=-0.694, p>0.05).

Table 6 Mean Comparison of Mathematical Self-concept by Father's Education

Father's Education Level	*N*	Mean	*SD*
Primary school level	142	54.63	5.662
Middle school level	200	55.83	5.876
High school level	120	55.69	6.830
Graduate level	33	56.00	5.809
Post graduate level	5	56.80	6.216
Total	500	55.48	6.061

According to table 6, the mean score of mathematical self-concept with father's education level of primary school was 54.63 and that of middle school was 55.83. And the mean score of mathematical self-concept with father's education level of high school was 55.69 and that of graduate level was 56.00. Finally, the mean score of mathematical self-concept with father's education level of post-graduated level was 56.80.

Table 7 The Result of ANOVA for Mathematical Self-concept by Father's Education Level

Father's Education Level	Sum of Squares	*df*	Mean Square	*F*	*p*
Between Groups	149.189	4	37.297	1.016	.399
Within Groups	18179.569	495	36.726		
Total	18328.758	499			

According to Table 7, there was no significant difference in mathematical self-concept by father's education level (F=1.016, p>0.05). So, it can be concluded that mathematical self-concept does not depend on father's education level.

Table 8 Mean Comparison of Mathematical Self-concept by Mother's Education

Mother's Education Level	*N*	Mean	*SD*
Primary school level	213	55.26	5.566
Middle school level	176	55.49	6.652
High school level	80	55.60	6.056
Graduate level	26	56.54	6.048
Post graduate level	5	56.80	6.261
Total	500	55.48	6.061

According to table 8, the mean score of mathematical self-concept with mother's education level of primary school was 55.26 and that of middle school was 55.49. And the mean score of mathematical self-concept with mother's education level of high school was 55.60 and that of graduate level was 56.54. Finally, the mean score of mathematical self-concept with mother's education level of post-graduated level was 56.80. Table 8 revealed that there was little difference in mathematical self-concept by mother's education level.

Table 9 Descriptive Statistics of Motivation to Learn Mathematics

Variable	*N*	Maximum	Minimum	Mean	*SD*
Motivation to Learn Mathematics	500	109	58	83.74	7.86

According to Table 9, the minimum score was 58 while the maximum score was 109. The mean score and standard deviation of the whole sample were 83.74 and 7.86. The observed mean score 83.74 was greater than the theoretical mean score 72.5. It was found that the university students' motivation to learn Mathematics was satisfactory.

Table 10 Descriptive Statistics for Motivation to Learn Mathematics by Gender

Variable	Gender	*N*	Mean	*SD*
Motivation to Learn Mathematics	Male	250	84.94	7.399
	Female	250	80.55	9.136

Table 10 showed that the mean score of male students exceeded 4.39 than that of female students.

Table 11 The Result of Independent Sample *t* test for Motivation to Learn Mathematics by Gender

Variable	*t*	*df*	*p*	Mean Difference
Motivation to Learn Mathematics	3.433**	498	.001	4.390

Note: **The mean difference is significant at 0.01 level.

Table 11 showed that there was a significant difference between male and female students in motivation to learn Mathematics (p< .01). So, it can be said that male students had higher motivation to learn Mathematics than female students. This finding is similar to the study of Liu and Lin (2010).

Table 12 Means and Standard Deviations for Motivation to Learn Mathematics by Grade

Variable	Grade	*N*	Mean	*SD*
Motivation to Learn Mathematics	Second Year	250	83.14	7.758
	Final Year	250	84.35	7.930

Table 12 showed that there was slightly difference in the mean scores by grade in motivation to learn Mathematics.

Table 13 The Result of Independent Sample *t* test for Motivation to Learn Mathematics by Grade

Variable	*t*	*df*	*p*	Mean Difference
Motivation to Learn Mathematics	-1.727	498	.085	-1.212

The results in Table 13 showed that there was no significant difference between second year and final year students for motivation to learn Mathematics (p=.085). Motivation to learn Mathematics did not show any performance difference between second year and final year students.

Table 14 Mean Comparison of Motivation to Learn Mathematics by Father's Education

Father's Education Level	*N*	Mean	*SD*
Primary school level	142	82.88	7.406
Middle school level	200	83.88	7.953
High school level	120	84.43	7.993
Graduate level	33	83.36	8.499
Post graduate level	5	89.00	8.456
Total	500	83.74	7.860

According to table 14, the mean score of mathematical self-concept with father's education level of primary school was 82.88 and that of middle school was 83.88. And the mean score of mathematical self-concept with father's education level of high school was 84.43 and that of graduate level was 83.36. Finally, the mean score of mathematical self-concept with father's education level of post-graduated level was 89.

Table 15 Mean Comparison of Motivation to Learn Mathematics by Mother's Education

Mother's Education Level	*N*	Mean	*SD*
Primary school level	213	83.82	7.913
Middle school level	176	83.99	7.716
High school level	80	82.84	7.268
Graduate level	26	83.08	9.777
Post graduate level	5	89.60	8.820
Total	500	83.74	7.760

According to table 15, it was found that there was little difference in mathematical self-concept by mother's education level.

Table 16 Descriptive Statistics for Self-regulated Learning Strategies of University Students

Variable	*N*	Minimum	Maximum	Mean	*SD*
Self-regulated Learning Strategies	500	44	85	64.06	6.405

According to Table 16, the minimum score was 44 and the maximum score was 85. The mean score and standard deviation of the whole sample were 64.06 and 6.405. The observed mean score 64.06 was greater than the theoretical mean score 55. Therefore, it can be concluded that the students' self-regulated learning was satisfactory.

Table 17 Gender Difference in Self-regulated Learning Strategies

Variable	Gender	*N*	Mean	*SD*
Self-regulated Learning	Male	250	64.82	6.783
	Female	250	63.31	5.922

Table 17 showed that there was slightly difference in the mean scores of self-regulated learning strategies by gender.

Table 18 The Result of Independent Sample *t* test for Self-regulated Learning Strategies by Gender

Variable	*t*	*df*	*p*	Mean Difference
Self-regulated Learning Strategies	2.665**	498	.008	1.512

Note:*The mean difference is significant at 0.01level.

Table 18 showed that there was significant difference between male and female students ($p < .01$).

Table 19 The Result of Independent Sample t test for Subscales of Self-regulated Learning Strategies by Gender

Sub-scales	Gender	*N*	Mean	*SD*	*t*	*df*	*p*	*MD*
Cognitive Strategies	Male Female	250 250	39.24 38.74	4.417 3.605	1.387	498	.166	.500
Metacognitive Strategies	Male Female	250 250	25.58 24.56	3.122 3.222	3.566***	498	.000	1.012

Note:***The mean difference is significant at .001 level.

Table 19 revealed that there was significant difference in the usage of metacognitive strategies ($p<.001$). This meant that compared to female students, generally, male students were making more appropriate use of self-regulated learning strategies.

Table 20 Means and Standard Deviations for Self-regulated Learning Strategies by Grade

Variable	Grade	*N*	Mean	*SD*
Self-regulated Learning Strategies	Second Year Final Year	250 250	63.21 64.91	6.335 6.375

Table 20 showed that there was slightly difference in self-regulated learning Strategies between second year and final year students.

Table 21 The Results of Independent Sample t test for Self-regulated Learning by Grade

Variable	*t*	*df*	*p*	Mean Difference
Self-regulated Learning Strategies	-2.983**	498	.003	-1.696

Note:**The mean difference is significant at 0.01 level.

According to the results of *t* test, it was found that there was significant difference between second year and final year students for the usage of self-regulated learning (*p*=.003). Thus, final year students used more self-regulated learning than second year students in this study.

Table 22 Mean Comparison of Self-regulated Learning Strategies by Father's Education

Father's Education Level	*N*	Mean	*SD*
Primary school level	142	62.95	6.403
Middle school level	200	64.33	6.400
High school level	120	64.70	6.542
Graduate level	33	64.36	5.225
Post graduate level	5	67.80	8.106
Total	500	64.06	6.405

Table 22 revealed that there was little difference in mathematical self-concept by father's education level.

Table 23 Mean Comparison of Self-regulated Learning by Mother's Education

Mother's Education Level	*N*	Mean	*SD*
Primary school level	213	63.76	6.573
Middle school level	176	64.24	6.637
High school level	80	63.86	5.884
Graduate level	26	65.15	4.370
Post graduate level	5	68.60	7.570
Total	500	64.06	6.405

Table 23 revealed that there was little difference in self-regulated learning strategies by mother's education level.

Table 24 The Correlation among Mathematical Self-concept, Motivation to learn Mathematics and Self-regulated Learning Strategies

Variables	Mathematical Self-concept	Motivation to Learn Mathematics	Self-regulated Learning Strategies
Mathematical Self-concept	-	.542**	.499**
Motivation to Learn Mathematics	-	-	.473**
Self-regulated Learning Strategies	-	-	-

Note: ** The mean difference is significant at 0.01 level.

The results of table 24 showed that there were significant relationships among mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies. Therefore, it can be concluded that the higher university students' mathematical self-concept and motivation to learn Mathematics, the more self-regulated learning will be.

Table 25 Model Summary for Mathematical Self-concept, Motivation to Learn Mathematics and Self-regulated Learning Strategies

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.482[a]	.232	.226	5.863

Table 25 revealed that the mathematical self-concept and motivation to learn Mathematics significantly predicted self-regulated learning strategies of university students. The simple linear regression correlation coefficient R=.482 and adjusted R square was .226. It can be concluded that 23% of self-regulated learning strategies can be predicted from mathematical self-concept and motivation to learn Mathematics. To see vividly, the explanation can be seen in Table 26.

Table 26 Results of Simple Linear Regression on Mathematical Self-concept, Motivation to Learn Mathematics and Self-regulated Learning Strategies

Model	Unstandardized Coefficient		Standardized Coefficient	*t*	Sig
	B	Std. Error	Beta		
1(constant)	26.122	5.306		4.923	.000
Mathematical Self-concept	.040	.062	.035	.649	.517
Motivation to Learn Mathematics	.430	.048	.480	8.881	.000

a . Dependent Variable :Self-regulated Learning Strategies

The results of Table 26 revealed that the predictors mathematical self-concept and motivation to learn Mathematics significantly predicted self-regulated learning.

SRLS=26.122+.040MSC+.430MTLM

Where,
SRLS = Self-regulated Learning Strategies
MSC = Mathematical Self-concept
MTLM= Motivation to Learn Mathematics

Conclusion

It is important to remember that mathematical self-concept, motivation to learn Mathematics and self-regulated learning strategies cannot be considered as separate entities, but as an interdependent collective. Therefore, it is necessary to give attention to the enhancement of mathematical self-concept and motivation when offering psychological interventions in order to improve self-regulated learning of students.

And then, students should be exposed to positive mathematical self-concept enhancement programs. They should be provided sufficient emotional and academic support. Individual students should reduce or avoid negative self-concept on Mathematics which undermines their motivation to learn.

Most of the research suggests that to raise academic self-concept, parents and teachers need to provide children with specific feedback that focuses on their particular skills or abilities. Learning opportunities should be conducted in groups (both mixed ability and like ability) that downplay social comparisons. Teacher should give positive self-concept that attempts to be creative, original, spontaneous and generous. Teacher should motivate higher level of aspiration and improved academic self-concept. School and classroom environment are important factors of academic self-concept. Increase in academic self-concept lead to increase in subsequent academic achievement and other desirable educational outcomes. Self-concept is an important outcomes variable in itself, it also plays a central role in mediating the effects of other desirable educational outcomes. Academic self-concept is formed and developed through interactions.

Mathematics teachers should focus on motivational strategies that will improve students' engagement in mathematical activities.It is acceptable that success seekers increase motivation for success; but failure avoiders decrease their efforts after failing at a task. In addition, success seekers seem to be most strongly motivated by tasks that have a medium level of difficulty, whereas failure avoiders seem to prefer either very easy or very difficult tasks. Finally, success seekers are more likely to set realistic goals, whereas failure avoiders tend to set goals for themselves that are unrealistically easy or difficult. Teachers often use the term self-motivated to refer to students who become easily motivated to learn, without much external persuasion .It leads to a strongest form of motivation. Self-motivated learners are likely to be the best learners, if their motivation is directed towards productive goals. Self-motivation is not an innate characteristic, but rather is learned in much the same fashion as the Meta cognitive skills. Teachers should be aware that by enabling learners to employ motivational strategies effectively. They can help the students to develop the personality trait of self-motivation. It can be helpful for both academic and non-academic tasks.

Githu and Mangi (2003) reported that mathematical self-concept has direct effect on students' Mathematics achievement and is a powerful predictor for Mathematics academic achievement. They maintained that mathematical self-concept is altered by means of intervening programs of educational material, learning related activities, learning experience, educational methods and suitable evaluation methods.

Today, academic motivation and academic self-concept play a vital role in achieving the goals. Students need to establish and maintain a positive learning environment for attaining success. Students are not sufficiently trained to deal with today's behavioral problems of life. It is a need of the hour for the teachers to learn the effective strategies for enhancing the students' academic achievement.

Moreover, it was revealed that mathematical self-concept has direct influence on motivation to learn Mathematics and self-regulated learning strategies. Therefore, it can be concluded that Mathematics teachers can exploit suitable strategies for reconstruction of mathematical self-concept and fortification of students' beliefs that may result in enhanced mathematical self-concept and elevated motivation to learn Mathematics. Moreover, education of self-regulated learning strategies can be transmitted and educated to the students. More concentration of teachers on self-regulation and proposing lessons effectively emphasizing fortification of students' self-regulation skills can be a helpful practice.

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