THE RELATIONSHIP BETWEEN METACOGNITION, SELF-EFFICACY AND PHYSICS ACHIEVEMENT AMONG GRADE 9 STUDENTS

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Abstract

This study investigated the relationship between metacognition, self-efficacy and physics achievement among Grade 9 students. The population of this study consisted of Grade 9 students in Yangon Region. The sample of this study consisted of 400 Grade 9 students from five high schools in Yangon Region. The participants were chosen through random sampling. Descriptive research design was used in this study. Metacognition Awareness Inventory (MAI) and the Survey of Self-Efficacy in Science Courses-Physics (SOSESC-P) were used to measure students' metacognition and self-efficacy. And the test with the scope of course from chapters 6, 7, 8 and 9 in physics textbook prescribed for Grade 9 was constructed to measure students' physics achievement. The data were analyzed using the descriptive statistics, independent sample *t*-test, and multiple regression analysis. The correlation analysis showed that there was a positive interrelationship between physics achievement and self-efficacy. The independent sample *t*-test showed that there were significant differences by gender on physics achievement at 0.01 level and vicarious learning at 0.05 level. Results revealed that there were significant differences in physics achievement among schools at 0.01 level. Regression analysis revealed that knowledge of cognition, mastery experiences and vicarious learning were the important predictors of physics achievement. The results of regression model indicated that 38% of variance in students' physics achievement could be predicted from the combination of metacognition and self-efficacy.

Keywords: Metacognition, Self-Efficacy and Physics Achievement

Introduction

Metacognition describes the processes involved when learners plan, monitor, evaluate and make changes to their own learning behaviors. Metacognitive practices help learners to monitor their own progress and take control of their learning as they read, write and solve problems in the

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classroom. Metacognition has been identified as a key factor in the problem-solving process. In addition, current efforts in education have demanded that more attention be given to the development of problem-solving, critical thinking and decision making skills among students.

One of the most important factors influencing students' metacognition is self-efficacy (Dayere & Aveuman, 2008). Self-efficacy is the extent or strength of one's belief in one's own ability to complete tasks and reach goals. Self-efficacy as a theory to explain human behavior change (Bandura, 1977) has become a focus of education researchers. Self-efficacy is one of the primary dimensions of students' overall science identity and contributes to their persistence in physics (Hazari, Sonnert, Sadler & Shanahan, 2010).

Purpose of the Study

1. To determine metacognition and self-efficacy of the Grade 9 students.
2. To investigate whether there are significant differences in metacognition, self-efficacy and physics achievement of Grade 9 students by gender.
3. To investigate whether there are significant differences in metacognition, self-efficacy and physics achievement of Grade 9 students by schools.
4. To investigate whether there is interrelationship among metacognition, self-efficacy and physics achievement among Grade 9 students.
5. To investigate whether metacognition and self-efficacy factors will predict students' physics achievement or not.

Literature Review

Concept of Metacognition

The term metacognition was introduced by Flavell in 1976 to refer to 'the individuals own awareness and consideration of his or her cognitive processes and strategies' (Flavell 1979). Research activity in metacognition began with John Flavell, who is considered to be the "father of the field" and thereafter a considerable amount of empirical and theoretical research dealing with metacognition can be registered. The 'meta' refers to higher-order cognition about cognition or 'thinking about one's thinking'.

Kuhn (2000) claimed that scientific thinking is a form of higher-order thinking that is rooted in metacognition because the awareness of the source of one's knowledge is critical for understanding evidence as distinct from and bearing on scientific theories. Blakey and Spence (1990) suggested thinking about one's own behavior is the first step towards directing that behavior and learning how to learn.

Metacognition in Physics Education and Problem-Solving

Seroglou and Koumaras (2001), through their framework of Physics teaching, argue that Physics education has shifted from the dimension of cognition in the 1960's to that of metacognition in the 1980's. It has been recommended that metacognitive skills should be taught to the students to help them solve Physics problems (Mestre, 2001). Metacognition roles in education include the area of metamemory, language, communication, perception, observation, understanding and problem-solving (Flavell, 1999). Flavell (1976) first defined metacognition as "the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete goal or objective." Kyurshunov (2005) says that use of problem-solving is one of the best ways to involve students in the thinking operations of analysis, synthesis and evaluation.

While there are studies in metacognition and Physics problem-solving, they focus mainly on university students (Heller & Heller, 1995; Henderson et al., 2001; Kuo, 2004). If metacogniton skills appear to be relevant in Physics problem-solving among university students, then it seems likely that metacognitive skills may play a role in aiding secondary school students when solving Physics problems.

Concept of Self-Efficacy

In an effort to provide a theoretical explanation for human behavior change, self-efficacy was firstly introduced by Albert Bandura and defined as "beliefs in one's capabilities to organize and execute courses of action required to produce given attainments" (Bandura, 1977). As Lent and Brown (2006) describe, self-efficacy is not a single characteristic of an individual, rather self-efficacy is a dynamic set of beliefs that are directly related to a particular task or action.

The level of self-efficacy refers to its dependence on the difficultly level of a particular task, such as physics addition problems of one's efficacy judgments across different tasks or activities, such as different academic subjects; strength of efficacy judgments pertains to the certainty with which one can perform a specific task (Zimmerman, 1995). Academic self-efficacy refers to a person's conviction that they can successfully achieve a designated level in a specific academic subject area.

Sources of Self-Efficacy

Successes build a robust belief in one's personal efficacy. Failures undermine it, especially if failures occur before a sense of efficacy is firmly established. According to Bandura's (1997) social cognitive theory, an individual's self-efficacy is derived from interpreting information from four sources: personal mastery experiences, vicarious learning experiences, social persuasion experiences, and physiological state.

Personal mastery experiences, which involve one's accomplishments, are the strongest source of enhancing perceptions of personal efficacy (Bandura, 1997; Schunk, 2002). Experiences with successful completion of a task should have a strong positive influence on an individual's confidence in their ability to complete a similar task. Analogously, repeated failure on a task would negatively influence a person's confidence in their ability to complete the task later (Bandura, 1997).

Vicarious learning experiences occurs when an individual watches others, who are perceived to be similar to the individual, performing a task similar to the one they are considering their own performance on. The observation of the success/failure of others is particularly important when the individual has on personal experience with the task at hand because then they rely primarily on their experiences of watching others perform the task (Bandura, 1997; Zeldin & Pajares, 2000). Modeling is one of the most important ways to promote learning and self-efficacy (Schunk, 1991; Schunk & Hanson, 1985).

Social persuasion is another source of information that adolescents use to shape and form perceptions of personal capability. The beliefs of students' academic capabilities can be firm and improved by the encouragement from parents, teachers and peers. According to Usher and Pajares (2006) positive feedback from significant others is a reliable source of increasing and strengthening the confidence.

Physiological state source of self-efficacy as the somatic information individuals rely on when evaluating capability to perform a task (Bandura, 1997). High levels of stress and anxiety often undermine any confidence in ability (Bandura, 1997). Mood also often influences beliefs in abilities; cheerfulness and a positive attitude will have a positive effect on self-efficacy beliefs. Analogously, depression and sadness will negatively impact self-efficacy beliefs (Zeldin & Pajares, 2000).

Method

Participants

A total of 400 Grade 9 students from five schools in Yangon Region participated in this study. Out of the subjects, 50% (N=200) of subjects were males and 50% (N=200) were females. The participants for the study were selected from five high schools in the Yangon City Development Area. The samples of this study were collected by using random sampling technique.

Instrumentation

The study was conducted with two instruments, Metacognition Awareness Inventory (MAI) and the Survey of Self-efficacy in Science Courses-Physics (SOSESC-P) to know physics achievement through metacognition and self-efficacy. These two instruments were modified into Myanmar version. The first instrument, Metacognitive Awareness Inventory (MAI) was adapted from Metacognitive Awareness Inventory (MAI) designed by Sperling& Howard (2002). It is composed of knowledge of cognition and cognition of regulation. This measure consists of 25 items to assess students' metacognition. The second instrument, Sources of Physics Self-Efficacy Scale was adapted from the Survey of Self-Efficacy in Science Courses-Physics (SOSESC-P) designed by Fencl and Scheel (2005). It is composed mastery experience, vicarious experience, social persuasions and physiological state. This measure consists of 33 items seeking students' physics self-efficacy. Each items were assessed along a 5-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. Then, a well-made physics achievement test was systematically constructed. The test consisted of 29 items which were selected on the basis of item analysis procedure of pilot test. The test was made up of 11 true-false items, 11 completion items and 7 short questions. The items covered the scope of course from chapters 6 to 9 in physics textbook prescribed for Grade 9. For the representative content validation, table of specification was used.

Procedure

First, relevant information was gathered for literature review through the libraries and internet source. Next, the instruments used for the research were prepared under the suggestions of the supervisor and experts in educational psychology. The pilot study was conducted to determine the internal consistency, the validity, the reliability and the clarity of the items of "Metacognitive Awareness Inventory (MAI) Instrument" and "Survey of Self-Efficacy in Science Courses-Physics (SOSESC-P) Instrument". Then, data collection was done after validating the instruments. After getting the required data, they were analyzed step-by-step.

Data Analysis and Findings

In this study, metacognition and self-efficacy of Grade 9 students were examined among the number of students from the selected schools in Yangon Region. In addition, gender difference was further investigated. Then, the relationship between metacognition and self-efficacy with physics achievement of Grade 9 students were found out. And then, the predictors of physics achievement were also examined. Descriptive statistics for students' physics achievement, self-efficacy and metaognition were performed and data were presented in Table 1.

Table 1: Descriptive Statistics for Physics Achievement, Self-Efficacy and Metacognition of Grade 9 Students

	N	**Minimum**	**Maximum**	**Mean**	**Mean Percent**	**Standard Deviation**
Physics Achievement	400	20	46	30.38	60.76%	5.426
Metacognition	400	49	113	90.86	72.69%	9.347
Self-Efficacy	400	65	149	113.17	68.59%	13.317

Based on the descriptive statistics shown in Table 1, the mean percentage of metacognition was generally the highest of all variables among the students. It can be seen that the mean percentage of self-efficacy was the second highest among the students. And the mean percentage of physics achievement was found to be the lowest among the students. And descriptive analysis on subscales of metacognition and self-efficacy was conducted and the data were presented in Table 2 and Table 3.

Table 2: Descriptive Statistics for Subscales of Metacognition of students

	N	**Minimum**	**Maximum**	**Mean**	**Mean Percent**	**Standard Deviation**
Knowledge of Cognition	400	22	56	44.61	74.35%	4.679
Regulation of Cognition	400	27	59	46.24	71.14%	5.466

Based on the results shown in Table 2, the mean percentage of Knowledge of Cognition was generally higher than that of Regulation of Cognition. And descriptive analysis was conducted for subscales of Self-Efficacy and results were presented in Table 3.

Table 3: Descriptive Statistics for Subscales of Self-Efficacy of students

	N	Minimum	Maximum	Mean	Mean Percent	Standard Deviation
Mastery Experiences	400	17	46	31.73	63.46%	4.652
Vicarious Learning	400	15	35	25.53	72.94%	3.520
Social Persuasion	400	13	35	25.96	74.17%	3.562
Physiological State	400	12	44	29.96	66.58%	5.179

Based on the results shown in Table 3, the mean percentage of Social Persuasion was generally the highest of all subscales for enhancing the students' self-efficacy. The mean percentage of Mastery Experiences was found to be the lowest of all subscales for enhancing the students' self-efficacy.

Table 4: Mean Comparison for Physics Achievement and Subscales from Metacognition and Self-Efficacy of Students by Gender

Variables	Gender	N	Mean	Standard Deviation
Physics Achievement	Male	200	28.49	4.667
	Female	200	32.27	5.486
Knowledge of Cognition	Male	200	44.34	5.048
	Female	200	44.89	4.273
Regulation of Cognition	Male	200	45.88	5.856
	Female	200	46.61	5.033
Mastery Experiences	Male	200	31.54	4.993
	Female	200	31.91	4.288
Vicarious Learning	Male	200	25.11	3.892
	Female	200	25.95	3.056
Social Persuasion	Male	200	25.83	3.782
	Female	200	26.09	3.332
Physiological State	Male	200	29.95	5.473
	Female	200	29.97	4.880

According to the descriptive results in Table 4, it was generally seen that gender differences had existed among the Grade 9 students. It was seen that mean scores of female students was higher than that of male students concerning Physics Achievement scores. It meant that female students could make better learning in physics subject than male students. Then, the mean score of female students was higher than that of male students in Knowledge of Cognition. And the mean score of female students was higher than that of male students in Regulation of Cognition. It was also observed that the mean score of female students was higher than that of male students in Mastery Experiences. It was also seen that female students were more Vicarious Learning than male students. And, the female students were more Social Persuasion than male students. The mean score of female students was higher than that of male students in Physiological State.

To find out whether the differences were significant or not, the independent sample *t*- test was applied and the result were presented in Table 5.

Table 5: The Results of Independent Sample *t*-test on Physics Achievement, Self Efficacy and Metacognition of Students by Gender

Variables	**Gender**	**Mean**	***t***	***df***	***p***
Physics Achievement	Male	28.49	-7.412**	398	**.000**
	Female	32.27			
Knowledge of Cognition	Male	44.34	-1.176	398	.240
	Female	44.89			
Regulation of Cognition	Male	45.88	-1.337	398	.182
	Female	46.61			
Mastery Experiences	Male	31.54	-.795	398	.427
	Female	31.91			
Vicarious Learning	Male	25.11	-2.401*	398	**.017**
	Female	25.95			
Social Persuasion	Male	25.83	-.715	398	.475
	Female	26.09			
Physiological State	Male	29.95	-.039	398	.969
	Female	29.97			

** The mean difference is significant at the 0.01 level (2-tailed).

* The mean difference is significant at the 0.05 level (2-tailed).

According to the results of *t*-test, it was confirmed that there was a significant difference between male and female students. It can be concluded that female students performed significantly higher than male students in Physics Achievement (t =-7.412, p<0.01). It was suggested that female students could make more concentration in physics learning and better problem-solving and creative thinking in physics problems than male students. And, it was said that significant difference had existed in Vicarious Learning between male students and female students (t = -2.401, p<0.05). It was interpreted that female students significantly performed better in Vicarious Learning than male students. It meant that female students could make better imitative learning and modeling than male students. Specifically, it was found that there were no significant differences in Knowledge of Cognition (t = -1.176, p>0.05), Regulation of Cognition (t =-1.337, p>0.05), Mastery Experiences (t = -.795, p >0.05), Social Persuasion (t = -.715, p>0.05) and Physiological State (t = -.39, p>0.05) by gender.

Table 6: Means and Standard Deviations of Physics Achievement, Metacognition and Self-Efficacy by Schools

	School	**N**	**Mean**	**Standard Deviation**
Physics Achievement	B.E.H.S(2)Dagon	73	26.27	5.146
	B.E.H.S(1)DagonSeikkam	80	27.77	3.697
	B.E.H.S(1)Lanmadaw	77	31.40	6.027
	B.E.H.S(4)Insein	87	32.89	3.795
	B.E.H.S(2)Kungyangone	83	32.92	4.722
Metacognition	B.E.H.S(2)Dagon	73	91.32	9.607
	B.E.H.S(1)DagonSeikkam	80	91.08	10.620
	B.E.H.S(1)Lanmadaw	77	91.84	10.577
	B.E.H.S(4)Insein	87	90.57	8.474
	B.E.H.S(2)Kungyangone	83	89.64	7.328
Self-Efficacy	B.E.H.S(2)Dagon	73	113.60	15.066
	B.E.H.S(1)DagonSeikkam	80	110.94	14.394
	B.E.H.S(1)Lanmadaw	77	114.51	14.306
	B.E.H.S(4)Insein	87	115.46	11.756
	B.E.H.S(2)Kungyangone	83	111.29	10.653

According to the results in Table 6, it was observed that the mean scores of B.E.H.S (2) Kungyangone were greater than that of the remaining schools in Physics Achievement. And, the mean scores of B.E.H.S (1) Lanmadaw were greater than that of the remaining schools in Metacognition. Then, the mean scores of B.E.H.S (4) Insein were greater than that of the remaining schools in Self-Efficacy. To find out the differences in physics achievement, metacognition and self-efficacy among school in Yangon Region, one way analysis of variance (ANOVA) was conducted.

Table 7: ANOVA Results in Differences Among Schools in Yangon Region

		Sum of Squares	***df***	**Mean Square**	**F**	***p***
Physics Achievement	Between Groups	2933.747	4	733.437	32.868	**.000**
	Within Groups	8814.250	395	22.315		
Metacognition	Between Groups	224.306	4	56.076	.640	.635
	Within Groups	34635.854	395	87.686		
Self-Efficacy	Between Groups	1299.694	4	324.924	1.848	.119
	Within Groups	69456.083	395	175.838		

According to ANOVA table, it was found that physics achievement among schools was significantly different at 0.01 level. This meant that physics learning was significantly different among selected schools in Yangon Region. But, it was observed that there were no significant differences in metacognition and self-efficacy among schools at 0.05 level. This means that metacognition and self-efficacy were relatively the same among selected schools in Yangon Region.

To obtain more detailed information on which schools performed better than others, Post- Hoc test was executed by Tukey HSD method.

Table 8: The Results of Tukey HSD Multiple Comparison for Physics Achievement of Grade 9 Students Among Schools in Yangon Region

(I) School	(J) School	Mean Difference (I-J)	Std. Error	*p*
BEHS(2)Dagon	BEHS(1)DagonSeikkam	-1.501	.765	.286
	BEHS(1)Lanmadaw	-5.129**	.772	**.000**
	BEHS(4)Insein	-6.611**	.750	**.000**
	BEHS(2)Kungyangone	-6.642**	.758	**.000**
BEHS(1)DagonSeikkam	BEHS(2)Dagon	1.501	.765	.286
	BEHS(1)Lanmadaw	-3.628**	.754	**.000**
	BEHS(4)Insein	-5.110**	.732	**.000**
	BEHS(2)Kungyangone	-5.141**	.740	**.000**
BEHS(1)Lanmadaw	BEHS(2)Dagon	5.129**	.772	**.000**
	BEHS(1)DagonSeikkam	3.628**	.754	**.000**
	BEHS(4)Insein	-1.482	.739	.265
	BEHS(2)Kungyangone	-1.513	.747	.256
BEHS(4)Insein	BEHS(2)Dagon	6.611**	.750	**.000**
	BEHS(1)DagonSeikkam	5.110**	.732	**.000**
	BEHS(1)Lanmadaw	1.482	.739	.265
	BEHS(2)Kungyangone	-0.31	.725	1.000
BEHS(2)Kungyangone	BEHS(2)Dagon	6.642**	.758	**.000**
	BEHS(1)DagonSeikkam	5.141**	.740	**.000**
	BEHS(1)Lanmadaw	1.513	.747	.256
	BEHS(4)Insein	.031	.725	1.000

Note: **$p<.01$

The results of Table 8 showed that there was no significant differences in Physics Achievement between B.E.H.S (2) Dagon and B.E.H.S (1) Dagon Seikkam at 0.05 level. This meant that students' physics achievement scores from B.E.H.S (2) Dagon were relatively the same to that of B.E.H.S (1) Dagon Seikkam. Then, it was observed that the students' physics achievement scores from B.E.H.S (2) Dagon were significantly different from that of B.E.H.S (1) Lanmadaw, B.E.H.S (4) Insein and B.E.H.S (2) Kungyangone at 0.01 level. It can be interpreted that students from B.E.H.S (1) Lanmadaw, B.E.H.S (4) Insein and B.E.H.S (2) Kungyangone got higher scores in physics than students from B.E.H.S (2) Dagon.

The students' physics achievement scores from B.E.H.S (1) Dagon Seikkam were significantly different from that of B.E.H.S (1) Lanmadaw, B.E.H.S (4) Insein and B.E.H.S (2) Kungyangone at 0.01 level. It can be predicted that students from B.E.H.S (2) Lanmadaw, B.E.H.S (4) Insein and B.E.H.S (2) Kungyangone got higher scores in physics than students from B.E.H.S (1) Dagon Seikkam.

After the descriptive analysis and mean difference comparison had seen conducted, the relationship among metacognition, self-efficacy and physics achievement was performed in the following Table.

Table 9: Interitemcorrelations of Physics Achievement, Self-Efficacy and Metacognition of Students in Yangon Region

Variables	1	2	3	4	5	6	7
1. Physics Achievement	1	.030 .550	.047 .344	.154** **.002**	.152** **.002**	.069 .170	.117* **.019**
2. Knowledge of Cognition		1	.696** **.000**	.371** **.000**	.412** **.000**	.402** **.000**	.405** **.000**
3. Regulation of Cognition			1	.404** **.000**	.374** **.000**	.453** **.000**	.439** **.000**
4. Mastery Experiences				1	.525** **.000**	.354** **.000**	.528** **.000**
5.Vicarious Learning					1	.473** **.000**	.534** **.000**
6. Social Persuasion						1	.490** **.000**
7. Physiological State							1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

According to the correlation results in Table 9, the finding showed that there was a positive relationship between Physics Achievement and Mastery Experiences [$r = 0.154$; $p<0.01$]. The finding also showed that there was a positive relationship between Physics Achievement and Vicarious Learning [$r = 0.152$; $p<0.01$]. And there was a positive relationship between Physics Achievement and Physiological State [$r = 0.117$; $p< 0.05$]. Then, there were no relationships among Physics Achievement, Knowledge of Cognition, Regulation of Cognition and Social Persuasion (p>0.05). But all subscales were also positively and significantly with one another. From this result, it can be generally predicted that students with high sense of efficacy in physics could contribute to the high physics achievement scores and also predicted that students with high sense of metacognition in physics could contribute to the high physics achievement. And to determine the predicting factors for physics achievement, simultaneous multiple regression analysis was conducted and the data were presented in Table 10.

Table 10: Simultaneous Multiple Regression Analysis Summary for Metacognition and Self-Efficacy of Grade 9 Students Predicting Physics Achievement (N=400)

Variables	**B**	**β**	***t***	**p**	**R**	**R^2**	**Adjusted R^2**	**F**
Physics Achievement	27.084		9.7**	**.000**	0.619	0.383	0.378	58.241
Knowledge of Cognition	0.158	1.36	2.473*	**0.014**				
Mastery Experiences	0.154	0.132	2.239*	**0.026**				
Vicarious Learning	0.214	1.139	2.309*	**0.021**				

Note: *p<.05

According to the multiple regression analysis results presented in Table 10, the adjusted R Square value was 0.38. The result indicated that 38% of the variance in physics achievement could be predicted from the combination of metacognition and self-efficacy. The model equation to predict the physics achievement from students' metacognition and self-efficacy was;

PA = 27.084 + 0.158KC+ 0.154ME+ 0.214VL
PA= Physics Achievement, KC = Knowledge of Cognition,
ME = Mastery Experiences, VL = Vicarious Learning

It has described that Knowledge of Cognition is the best predicting factor for physics achievement of students in Yangon Region (β=1.36). Again, Vicarious Learning is the second best predictor for physics achievement of students in Yangon Region (β=1.139). Then, Mastery Experiences is the third best predictor for physics achievement of students in Yangon Region (β=0.132). The model was summarized as in Figure 1.

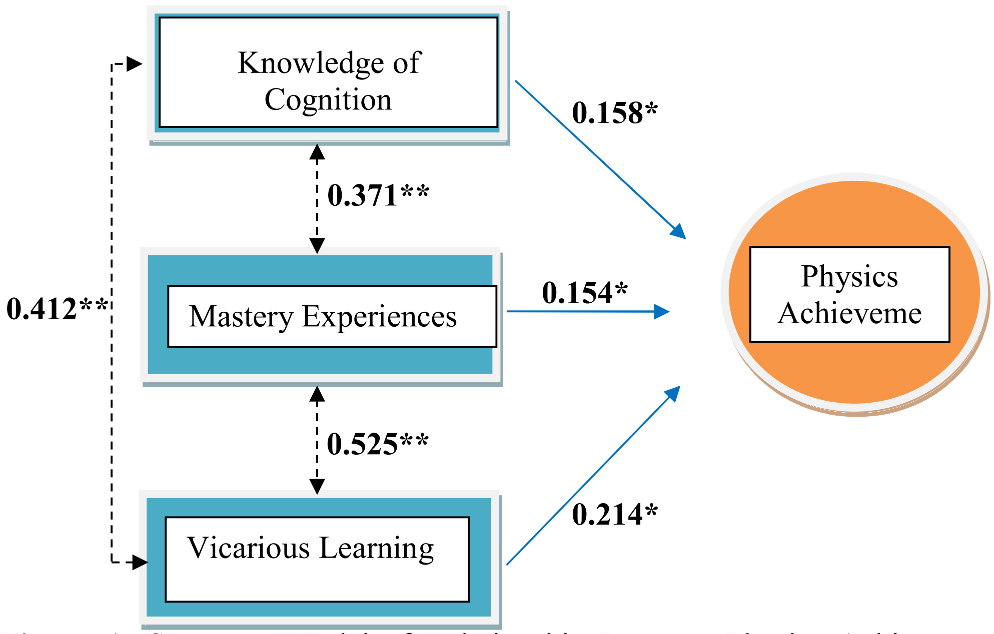

Figure 1: Summary Model of Relationship Between Physics Achievement, Metacognition and Self-Efficacy

Conclusion

The main purpose of this study was to investigate the relationship between metacognition, self-efficacy and physics achievement among Grade 9 students. A survey study was conducted in 2016-2017 academic year with descriptive research design. Descriptive data analyses showed that the mean percent score of the whole sample regarding metacognition, self-efficacy and physics achievement are 73%, 69% and 61%. The result evaluated that students' metacognition, self-efficacy and physics achievement were satisfactory. In this study, the majority of the respondents received the high and moderate mean scores in self-efficacy and metacognition.

The results of *t*-test by gender revealed that there was a significant difference on Physics Achievement between male and female students at the 0.01 level. And then, there was a significant difference in Vicarious Learning between male and female students at the 0.05 level. The result showed that both physics achievement and vicarious learning of female participants were higher than that of male participants.

To find out the significant difference in physics achievement, self-efficacy and metacognition among schools in Yangon region, one way analysis of variance (ANOVA) was done. The result showed that there were significant differences in physics achievement among schools at 0.01 level. And then, there was no significant difference in metacognition and self-efficacy among schools. The results of analysis of multiple comparison for physics achievement showed that there were significant differences between each pair of schools. Students' physics achievement from B.E.H.S (1) Lanmadaw, B.E.H.S (4) Insein and B.E.H.S (2) Kungyangone were significantly different from that of B.E.H.S (2) Dagon and B.E.H. S (1) Dagon Seikkam at the 0.01 level. It meant that students from B.E.H.S (1) Lanmadaw, B.E.H.S (4) Insein and B.E.H.S (2) Kungyangone had higher physics achievement than those from B.E.H.S (2) Dagon and B.E.H.S (1) Dagon Seikkam.

By applying the Pearson Correlation analysis, the results showed that there was a positive significant relationship between physics achievement and students' mastery experiences ($r= 0.154$, $p<0.01$). And then, there was a positive significant relationship between physics achievement and students' vicarious learning ($r= 0.152$, $p<0.01$). Moreover, there was a positive significant relationship between physics achievement and students' physiological state ($r=0.117$, $p<0.05$). But, there were no significant relationship among Physics Achievement, Knowledge of Cognition, Regulation of Cognition and Social Persuasion ($p>0.05$).

Multiple regression analysis was conducted to investigate the best predictors of physics achievement. It has described that Knowledge of Cognition is the best predicting factor for physics achievement of students. Again, Vicarious Learning is the second best predictor for physics achievement of students. Then, Mastery Experiences is the third best predictor for physics achievement of students. The adjusted R square value is .38. This indicates that approximately 38% of the variance in physics achievement was been predicted from the combination of metacognition and self-efficacy. The model equation to predict the physics achievement from students' metacognition and self-efficacy is;

$$\text{Physics Achievement} = 27.084 + 0.158KC + 0.154ME + 0.214VL$$

To summarize the results, the predictor variables concerning Knowledge of Cognition, Mastery Experiences and Vicarious Learning are significantly correlated with students' physics achievement.

Need for Further Research

This research was conducted with metacognition and self-efficacy of students in physics. The further research continues to examine students' metacognition and self-efficacy in other subject areas. This study shows the needs to explore age groups ranging from younger children through older children and individual differences in metacognition and self-efficacy, involving comparisons of better and poor students or students with and without learning disability.

The future research needs to determine the extent of the use of metacognitive strategies in the teaching and learning of physics in the schools. In addition, future research will focus on using teachers' metacognitive instructions in the classroom to identify and assist students in developing their metacognition. Researchers on metacognition and self-efficacy should be extended to all disciplines in universities and colleges. Furthermore, it is also recommended that the research should be conducted to teacher education programs.

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