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The Study on the Relationship between Students' Learning Motivation and their Achievement in Physics

Mr. Pema wangchuk[1], Dr. Kinley Seden[2] and Dr. Karma Utha[3]

[1]*Ministry of Education, Dagana, Bhutan*
[2,3]*Samtse College of Education, the Royal University of Bhutan*
[1]*pemaw27@education.gov.bt,* [2]*kseden.sce@rub.edu.bt,* [3]*kutha.sce@rub.edu.bt*

Abstract

Educational researchers have carried out several reviews to understand the impact of various aspects of motivation on academic performance. Studies found a positive relationship between learning motivation and physics learning outcomes [42][45]. This study aimed to investigate the relationship between various aspects of motivation (Self-efficacy, Physics learning values, active learning strategies, achievement goal, performance goal, and learning environment) and academic achievement. A convergent parallel mixed-method design was used to explore the relationship between these variables. Data were collected from 183 students who were purposively selected using a survey questionnaire and focus group discussions. Quantitative data were analyzed for descriptive and inferential statistics while thematic analysis was conducted for focus group discussions and document analysis. Results show a positive and statistically significant relationship between academic performance and four constructs of motivation (Self-efficacy, Physics learning values, active learning strategies, and achievement goal). However, the relationship between academic achievement and the remaining two constructs (performance goal and learning environment) was not statistically significant. In addition, the results indicate a moderate level of learning motivation in physics among grade 10 students. The results reported here contribute to our understanding that motivation is crucial for learning and hence, it may shed new insights for teachers to plan their teaching and learning process considering the levels of motivation for promoting meaningful learning. Future research on the same topic can be conducted by considering the different aspects of learning motivation.

Keywords: *Academic achievement, Learning motivation, Physics*

1. Introduction

Motivation is a key to learning. Several studies have demonstrated that students' motivation is an indispensable requirement for efficient learning in the classroom and consequently for academic achievement [3][31]. Similarly, another study on students' psychological predictors of academic achievement in physics reports that motivation is a primary determinant of students' achievement in Physics [18].

In the context of Physics learning worldwide, it is found that fewer students undertake the study of science than other subjects at a higher level of education [38]. There is a common preconception among students and the public in general, including teachers that Physics is a

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difficult subject [38], which influences students' motivation in Physics learning. It is evident from overall academic performance in BSCEA Examinations for the last three years. The grade 10 students' performance in Physics decreases every year [8][9]. Moreover, Bhutan Education Blueprint 2014-2020 indicated that the standard of education in Bhutan is below average and requires upgrading the quality of resources and enhancement of teacher competencies for better teaching, learning, and assessments [35]. A continuous process of research in the field of education is necessary for addressing the need and requirements for quality. The aspiring national goal to produce "nationally rooted and globally competent" [35] citizens will be only achieved by incorporating all the factors that foster students' interest and motivation. This is because studies found that students were moderately motivated towards learning Physics [11][44]. Further, a few studies have measured the level of students' learning motivation using Attention, Relevance, Confidence, and Satisfaction (ARCS) aspects and reported a moderate level of students' learning motivation [18][45] and However, student's level of learning motivation in Physics was not studied in Bhutan. In line with this, the study aimed at investigating students' level of motivation in learning Physics.

1.1. Research questions

- What is the level of student motivation in learning physics?
- Is there a relationship between students' motivational factors in learning physics and their achievements?

2. Literature Review

Motivation is crucial to determining a student's success in learning. Without motivation, the learning process is difficult to achieve optimal success. The purpose of this study was to investigate the relationship between the levels of motivation and learning.

2.1. Students' motivation toward learning science

Among motivational factors, Tuan et al., [55] researched to analyze and identify the motivational factors, particularly in learning science. This was done by developing the questionnaire known as Students' Motivation towards Learning Science (SMTLS). The findings confirmed the reliability and validity of the questionnaire to measure the motivation of students in learning science. It consists of six scales namely, (a) self-efficacy, (b) active learning strategies, (c) science learning values, (d) performing goal, (e) achievement goal, and (f) learning environment stimulation.

2.2. Self-efficacy

According to Bandura [6], self-efficacy is people's beliefs about their capabilities to achieve the desired result or goal. It has received attention in the field of educational research and a strong relationship between self-efficacy and achievement was observed. Several studies show that self-efficacy is the primary factor contributing to academic achievement [58]. Moreover, studies revealed that there is a strong, positive, and significant relationship between self-efficacy and academic performance [4]. While performing a task, individuals with a high level of self-efficacy prefer the challenging task over individuals with low self-efficacy [6]. Going by this, students with high self-efficacy are more likely to show better academic performance than those with low self-efficacy. However, several studies conducted

in the field of sciences show that there does not exist a statistically positive and significant relationship between self-efficacy and academic performance [1].

2.3. Active learning strategies

Active learning strategies are a critical source of motivation. According to Freeman et al., [17] active learning is described as a process in which students learn through activities and group discussions and emphasize high-order thinking, and often students are involved in group work. Thereby, the classroom is transformed from a teacher-centered to a learner-centered learning environment. However, Aji and Khan [2] state that the biggest challenge to incorporating active learning in the classroom is the duration of the period.

The transition of the learning style from passive to active learning strategies can improve the motivation level of the students. Scheyvens et al., [48] concluded that active learning increases motivation and students' understanding of the subject, promotes self-learning, and builds confidence in their ability to learn; thus, confirming that active learning improves academic achievement. Likewise, several studies also revealed that an active learning approach in teaching and learning science enhances academic achievement [13].

2.4. Physics learning values

Science becomes the everyday language of human society. It is the only subject that makes a profound contribution to human progress and technological development. The lack of adequate knowledge, skills, and values in science has a greater impact on socioeconomic development. The high rate of unemployment among the youth is one of the major evolving concerns of the government [36]. According to the Labour Force Survey [37], 20.2% of the total sample responded that the reason for unemployment is a lack of adequate qualifications; which is one of the highest among other indicators. One of the national goals of science is to allow the youth to make a smooth transition into a job that requires knowledge of science [43]. These issues cast doubt on the appropriateness of education in changing times; possibly the education system has failed to help students value science learning. Although science education pervades our daily activities, its value for diverse career options in the future remains unnoticed by youth.

However, diverse career options are not only the reason to understand and value science. Everyday decisions are informed by scientific literacy and the capability of an individual to think about and analyze the situation using evidence [49]. It leads to creative thinking, stimulates students' curiosity and inquiring minds, and promotes the reinforcement of general social values by applying highly regarded human values such as integrity, diligence, curiosity, and openness to new ideas [28].

Several factors encourage or discourage young people from learning science. The factors include learning context, social groups of individuals (e.g. teachers, parents, friends, and family members), and individual perspectives. For instance, the comparative study conducted by Khan et al., [33] on teaching methods discovered that students learn better in activity-based teaching than in the traditional teaching method. A similar study done by Lee and Suliaman [24] found that students show more interest in learning physics and a better understanding of the concept was observed when the students were taught using experiments and practicals. These studies show that learning context does matter in learning science. When students confirm the physical laws through practical experiments, strong beliefs in science arose within them, and they start to value science.

2.5. Performance goal

As per the goal orientation theory, performance goal is distinctively categorized as performance-approach goals and performance-avoidance goals. Performance-approach goals mainly focus on the demonstration of competency among others [16]. When the students have performance-approach goals, they were not concerned about mastering the task, but rather emphasize getting good grades and doing better than others [15]. The focus is on positive outcomes to facilitate the successful completion of the task [50]. The performance approach was also labeled as an ego-social orientation that emphasized high grades and performing better than others to enhance one's self-esteem [52]. Moreover, it leads to great investment in situations that are likely to bring positive evaluation [15]. Probably, individual-oriented to these goals were extrinsically motivated and prefer a challenging task or problem [29].

On the other hand, individual-oriented with performance-avoidance goals focus on avoidance of negative evaluation and trying to avoid failure in front of others [15]. Moreover, it is a view of oneself as lacking ability and wishes to avoid public demonstration of achievement that would prove the lack of ability [55]. Since performance avoidance is grounded in fear of failure, challenging tasks with a relatively high risk of failure associated with them will be avoided [50]. The different performance orientation goals are related differently to motivation and performance. A study done by Was and Beziat [57] concluded that performance-approach-oriented individuals are more likely to perform better in exams than individuals oriented to a performance-avoidance goal. Furthermore, silver et al., [50] state that performance-avoidance individuals do not see the relationship between effort and ability and they do not put effort to improve their skills, rather they avoid the subject.

2.6. Achievement goal

Achievement goals are defined as self-regulatory commitments that provide ways to interpret and respond to competence-relevant situations [51]. Four types of achievement goals, namely, mastery approach goal, performance-approach goal, mastery-avoidance goal, and performance-avoidance goal were the primary focus in the existing literature [51]. Mastery goal orientation is defined in terms of its focus on the development of one's abilities such as mastering new skills, understanding the learning materials, and trying to achieve challenging tasks [27]. According to Printrich [41], mastery goals can be further categorized into mastery-approach goals and mastery-avoidance goals. When the students focused on the mastery-approach variable, they want to learn, master the task, and truly understand the task at hand whereas the mastery-avoidance goal tends to avoid misunderstanding [27].

Meece and Anderman [27] posited that students show the most positive motivation and learning patterns in schools where the settings emphasize mastery, understanding, developing skills, and knowledge. However, although school settings that prioritize demonstrating high ability and competing for grades can improve academic performance, the students were associated with diminished motivation under this condition. Moreover, Grajcevci and Shala [29] disclosed that mastery goals are positively correlated with intrinsic motivation. Furthermore, deep learning strategies such as cognitive and metacognitive strategies are associated with mastery- goals oriented learners which result in self-regulation and reduction of anxiety, which in turn have a significant impact on academic achievement [5].

2.7. Learning environment

Intelligence is not only the determinant that contributes to academic achievement. Lizzio et al. [25] pointed out that the academic achievement of students was most often associated with various components of the learning environment. According to Kilgour [32], the two major components of the learning environment are the physical component and the psychosocial component. The physical environment includes all physical aspects such as classroom learning equipment, teaching materials, and external environments namely, classroom and school. Psychosocial components are related to interactions among students, between students with teachers, and between students in the environment [40]. Duruji, et al., [14] stated that the quality of learning facilities available within the educational institution has a positive impact on teaching and learning activities which in turn leads to the achievement of academic performance. Several studies showed that students in a school with adequate facilities and a favorable learning environment perform well in academics than those in schools with inadequate facilities and less enabling environment [19][20]. Moreover, the study contended that a positive perception of the learning environment can have a positive influence on students' learning outcomes [54]. However, some studies demonstrated that no relationship exists between the learning environment and academic achievement. A study conducted by Lawrence and Vimala [34] on the school environment and achievement of standard IX students in India revealed that there is no positive relationship between the school learning environment and academic achievement.

3. Research Method

A convergent parallel mixed method design was administered for this study. According to Creswell and Creswell [12], it is a single-phase approach; the researcher collects both qualitative and quantitative data, analyzed it separately, and then compares the results to confirm or disconfirm the findings. The present study intended to find the relationship between students' learning motivation and academic achievement. Testing of this relationship requires quantitative data (questionnaires) and discovering the motivational factors beyond the researcher's predetermined areas involves qualitative data (interviews). Therefore, the mixed method must contribute to a new understanding; as stated by Ivankoba et al., [22] there is more potential for triangulation and vigorous analysis when the qualitative and quantitative data are combined.

3.1. Research context and participants

This study was carried out in two different schools in the Dagana District. The schools were selected based on the convenience of the researcher in carrying out the research successfully. The selection of the schools was based on purposive sampling, and the schools were identified based on their academic performance in the last four years. Two central schools successively having poor performance in academic achievement in physics were selected for the data collection.

The population for the study was class X students from two schools. One hundred eighty-three participants from two schools were drawn using purposive sampling. For the collection of qualitative data, eight students from each school were interviewed and two focus group discussion from each school was conducted. The interview participants were chosen purposively which consists of high, average, and low achievers to have a far more detailed understanding.

3.2. Data collection tools

To collect the data on learning motivation, the researcher used survey questionnaires, focus group discussions, and document analysis. The survey questionnaire involves data collection from a large group of students for authentic findings. A standardized self-administered questionnaire, namely the Students' Motivation towards Physics Learning (SMTPL) was adapted from the Students' Motivation towards Science Learning (SMTSL) questionnaire developed by Tuan et al. [55]. It consists of six key scales, namely a) self-efficacy, b) science learning values, c) performance goal, d) achievement goal, e) active learning strategies, and f) learning environment stimulation. The SMTSL consists of 35 items and uses a 4-Point Likert scale rating ranging from strongly disagree to strongly agree. To ensure the high reliability of the survey questionnaire, a Cronbach coefficient test was carried out and the value was found to be 0.79. According to Tavakol and Dennick [53], the acceptable value of Cronbach's alpha varies from 0.70 to 0.95. Therefore, the survey items were reliable and valid.

Focus group discussion involves gathering pupils from similar backgrounds or experiences together to discuss a specific topic of interest. Gundumogula [30] stated that data generated through FGD are often deeper and richer than those obtained from one-to-one interviews. In this study, two FGDs were conducted consisting of six members to seek additional information that is not catered to by the survey questionnaire.

As per the need of the study, the researcher attempted to measure academic achievement in physics via analysis of the mid-term examination results of the research participants. This enables the researcher to correlate six identified variables of learning motivation with academic achievement and determine the level of motivation in learning physics. Moreover, it also helps to understand what motivates students in learning physics and which variables of motivation influence academic achievement.

3.3. Data analysis

Data analysis is one of the important elements of the research. Its purpose is to identify, transform, support decision-making, and bring a conclusion to research. Thus, to analyze the quantitative data, SPSS software was used and for the qualitative data, thematic analysis by Braun & Clarke [10] was used.

Statistical Package for the Social Science (IBM SPSS 22.0) software was used to conduct descriptive (mean and standard deviation) and inferential (Spearman's rho correlation) tests. Therefore, the use of these tests helped in determining the student's level of learning motivation and its relationship with academic achievement. The spearman's rho correlation was used to find the relationship between various motivational factors and academic performance. Moreover, all the themes were clubbed under the theme 'students' learning motivation' and its correlation with academic achievement.

The deductive thematic analysis approach was carried out on the qualitative data collected through focus group discussions and document analysis. Following Braun and Clarke's [18] deductive approach, the data were transcribed and codes were developed to identify common and similar responses based on established themes, namely, self-efficacy, Physics learning values, performance goal, achievement goal, active learning activities, and environmental stimulation. The method of triangulation was then used to confirm the findings.

4. Result and discussion

4.1. Students' level of learning motivation

The weighted mean Table 1 adapted from Best and Kahn [7] was used to determine the extent of learning motivation for each theme among the grade 10 students. The higher composite mean for different sub-scale indicates students have high learning motivation in the construct that is being measured by that particular sub-scale. For instance, the self-efficacy sub-scale comprises 7 statements and the composite mean of 7 statements is somewhat closer to 4. This is an indication that students have high learning motivation in the construct of self-efficacy.

Table 1. Interpretation table to determine the extent of motivation for each theme

Weight	Adjectival rating		Mean range	Interpretation
4	Strongly agree		3.26 – 4.00	High
3	Agree		2.51 – 3.25	Moderate
2	Disagree		1.76 – 2.5	Low
1	Strongly disagree		1.00-1.75	Not at all

The student's level of learning motivation in Physics measured through the STMPL survey questionnaire was found to be moderate as shown in [Table 2]. Students have a moderate level of learning motivation in all six constructs, consequently resulting in a moderate level of learning motivation in Physics.

Table 2. Students' level of learning motivation in physics

Themes	Number of items	Mean	SD	Level of agreement
Self-efficacy	7	2.83	0.68	Moderate
Active Learning Strategies	8	2.97	0.63	Moderate
Physics Learning values	5	3.10	0.66	Moderate
Achievement Goal	5	3.17	0.59	Moderate
Performance Goal	4	2.60	0.79	Moderate
Learning Environment	6	2.79	0.69	Moderate
Level of motivation in learning Physics		2.91	0.67	Moderate

It is evident from the data that students have a moderate level of motivation in learning Physics (Mean = 2.9, SD= 0.67), with the highest level of learning motivation in achievement goals and the lowest in performance goals. This indicates that most of the students were motivated in learning physics. The findings of this study are consistent with the studies of Saleh (2014) and Chan and Norlizah (2017) in Malaysia who have found a moderately high level of motivation of students in learning physics. These findings are further supported by Huwang and Hew (2016) and Sari et al. (2017) who measure the level of students' learning motivation using Attention, Relevance, Confidence, and Satisfaction (ARCS) aspects. The possible explanation for this result might be due to the Bhutanese students' nature of perceiving Physics as a difficult subject. For instance, the item "*I am not confident about understanding difficult physics concepts*" was rated low which indicates a lack of confidence to comprehend difficult Physics concepts.

Likewise, the qualitative data supported the students' survey findings. For instance, achievement goal is the highest indicating that when students achieve certain goals in the process of learning, a sense of satisfaction and fulfillment is developed for them. This might be related to the education system because Bhutanese students perceive test and examination scores as their achievement rather than considering them as one of the tools to measure their

achievement. For example, students have rated high in the item "*During the physics class, I feel most fulfilled when I attain a good score on a test"* hence scoring good marks on the test is perceived as their achievement. Therefore, students' level of motivation in learning Physics is moderate because students are not able to score good marks in the examinations. The findings indisputably reveal that a great source of motivation in learning is drawn from this subscale (achievement goal) as evident from the mean average of each item not falling below 3 affirms that all the participants agreed to have a higher level of motivation to perform better in Physics.

On contrary, performance goals have the lowest average mean with a high standard deviation which indicates that only a few students are driven by the performance goal in learning physics. In this study, performance goals refer to students' goals in learning physic driven by a sense of competition with other students and seeking the teacher's attention in the process of learning. In comparison between performance and achievement goals, students rated high in the former than the latter. This result may be explained by the fact that students' emphasis is more on mastery of the task than simply being focused on the successful completion of the task. For instance, the item "*I think that learning physics is important because I can use it in my daily life*", an underachievement goal, is rated high which shows that students' learning goals are to acquire knowledge and skills to apply in their daily life. Therefore, the related stakeholders need to be aware of the student's level of learning motivation and incorporate relevant strategies for further enhancement and ultimately academic achievement.

Moreover, the qualitative data reveal that teachers' reinforcement is one of the key factors that encourage them for class participation. For example, three of the participants mentioned that when teachers appreciate and value their participation, they are inspired to participate. On the other hand, two of the participants shared that they rarely participate in class due to fear of the wrong answer and lack of confidence. These indicate that besides the support rendered by teachers to motivate students in learning, their interpersonal relationship with students could be a barrier to learning.

4.2. Analysis of the correlation coefficient

Table 3 was used to interpret the relationship between various factors of learning motivation and academic achievement adopted by Dancy and Reidy.

Table 3. Interpretation of Spearman's correlation coefficient

Correlation coefficient			Correlation
±1			Perfect
±0.9	-	±0.7	Strong
±0.6	-	±0.4	Moderate
±0.3	-	±0.1	Weak
0			Zero

[Table 4] shows the correlation between academic achievement (AC) and various motivational constructs. At a 95% confidence level, Spearman's rho correlation of academic achievement (AC) and Self-efficacy (SE) was found to be statistically significant, $r = 0.447$, $n=183$, $p < .001$. This shows that there exists a moderate positive correlation between self-efficacy and academic achievement. The finding of this study is consistent with earlier studies [26] However, it is in contrast to those of other studies [1][23]. The differences observed in the result of this particular study and those of others could be due to the influence of other

variables that contribute to students' academic achievement complementing the self-efficacy in their study. However, in the context of this study, it was observed that self-efficacy has a moderately positive correlation with academic achievement.

Similarly, Spearman's rho correlations between academic achievement and other motivational constructs such as Active learning strategies (ALS), r =.282, n = 183, P<.001 and Physics learning values (PLV), r = .232, n= 183, p=.002 was found to have weak positive correlation and statistically significant. This finding supports previous research [17][48] which reported that active learning strategies enhance and improve academic achievement. A possible explanation for these results could be that students were physically and intellectually engaged and their high-order thinking skills (critical and creative) were provoked which then resulted in improved academic achievement. Furthermore, the relationship between academic achievement and Physics learning values was found to be statistically significant with a positive correlation. This indicates that scientific literacy can promote general social values such as integrity, diligence, curiosity, and openness to new ideas [28]. Therefore, logically, the use of active learning strategies in physics help students in acquiring Physics learning values which ultimately contributes to academic achievement. Hence, with the advancement of science and technology, incorporating various learning tools to engage students actively is of paramount importance.

Moreover, the relationship between Academic achievement and achievement goal (AG), r= .221, n= 183, p= .003; was found to have a weak positive correlation and statistically significant. The findings aligned with the study conducted by Baneshi et al. [5], however, a statistically insignificant correlation between Academic achievement and Performance Goals, r = -.019, n=183, p = .794 contradicted their study finding. This indicates that performance goal does not contribute to students' academic achievement. However, creating a better learning environment and encouraging students to master the task to develop their skills is found to be more important than insisting students participate in the class to demonstrate competency and successful completion of the task.

Table 4. Spearman's rho correlation matrix of academic achievement and six constructs

		SE	ALS	PLV	PG	AG	LES
AC	Spearman's rho Correlation	.447**	.282**	.232**	-.019	.221**	.138
	Sig. (2-tailed)	.000	.000	.002	.794	.003	.063
	N	183	183	183	183	183	183

Likewise, the correlation between academic achievement and Learning Environment Stimulation (LES) was also found to be statistically not significant, r=.138, n = 183, p =.063, showing that there is no relationship between these two subscales and academic achievement. This finding is inconsistent with that of previous studies [19][20] which reported that students in the school with a favorable learning environment perform better in academics. Nonetheless, the finding corroborated with the study conducted by Lawrence and Vimala [34] who reported that there is no positive relationship between academic achievement and the learning environment. This result may be explained by the prevalence of Bhutanese prejudice against the culture such as the introverted nature and extremely restrained nature of the students. Teachers tend to like those students who are introverts as they view these students as decent and good students. These preconceived notions hinder students' willingness to participate in class. Although qualitative data shows that environments such as ill-equipped classrooms, authoritative behavior of the teacher, and obsolete teaching methods rooted in a Bhutanese classroom were some predominant factors that hamper academic achievement, the

quantitative data indicates that there does not exist any relationship between academic achievement and student's willingness to participate based on learning environment. This could be because the students are used to any type of learning environment as they do not have the power to change anything and have to be content with whatever the school provides. Therefore, the relevant stakeholders need to create a conducive learning environment in terms of physical (teaching approach and school infrastructures) and psychosocial components (relationship between the students and the teachers) to enhance the learning motivation of the students.

Table 5. Spearman's rho correlation between students' learning motivation and academic achievement

			AC
spearman's rho	Students learning motivation	Correlation Coefficient	.386**
		Sig. (2-tailed)	.000
		N	183

The correlation between students learning motivation and academic achievement was found to be moderately positive and statistically significant, r= .386, n= 183, p <.001 at a 95% confidence level as shown in [Table 5]. This finding aligned with previous studies [31] which reported that students' learning motivation is an indispensable requirement for efficient learning and academic achievement. This study concludes that students' learning motivation is one of the key determinants of academic achievement as affirmed by Gana et al. [18].

5. Conclusion

The purpose of the study was to examine the relationship between students' level of motivation and learning. Motivation is not a widely researched issue in the Bhutanese school setting and this study is to be viewed as a preliminary one, which draws attention to exploring the relations between motivation and learning.

The results of this study confirm that students have a moderate level of learning motivation in physics. The possible explanation for this result might be due to the Bhutanese students' nature of perceiving Physics as a difficult subject.

The results also show that most of the students possess foundational and functional Physics knowledge with an adequate level of competency-based on their mean Physics scores (REC, 2021). Furthermore, the study found a positive and significant relationship between Academic achievement and four aspects of learning motivation, namely self-efficacy, active learning strategies, Physics learning values, and achievement goals. However, the relationship between academic achievement and the other two aspects of the motivational factors (performance goal and learning environment) was not statistically significant. This is because of factors such as ill-equipped classrooms, authoritative behavior of the teacher, and obsolete teaching methods which are commonly rooted in a Bhutanese classroom The findings reported here contribute to our understanding that motivation is crucial for learning and hence, it may shed new insights for teachers to plan their teaching and learning process considering the levels of motivation for promoting meaningful learning.

Although the results from this study are inspiring, it needs to be validated by a large sample size and different motivational aspects. Therefore, further studies on the same topic are recommended to be carried out with large sample size, using different motivational aspects for the findings to be generalized to the whole population of the class ten students. In the current study, the researcher captured only six aspects of the learning motivation self-efficacy, active learning strategies, physics learning values, achievement goal, performance

goal, and learning environment. Thus, the study recommends future researchers conduct similar studies considering, for instance, the Attention, Relevance, Confidence, and Satisfaction (ARCS) aspects of learning motivation because viewing from different perspectives can help to build a strong and concrete theory that provides absolute understanding.

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