

## Mathematical Anxiety as Predictor of Learning Motivation Strategies

Jeovanny A. Marticion

*Zamboanga del Norte National High School, the Philippines*  
*jamarticion@up.edu.ph*

### Abstract

Empirical findings showed how the mathematical anxiety predicts the academic performance of learners. As a coping mechanism, learners are left with various choices in dealing with subjects involving mathematical concepts. One way of coping with these subjects is a preference for learning motivation strategies. The motivation strategies were categorized into cognitive, meta-cognitive, non-informational resources management and information resources management. However, there is scarce literature on how anxiety could predict the behaviour of an individual accommodation of these strategies. This led the researcher to investigate the predictive behaviour of mathematical anxiety on utilization of learning motivation strategies among senior high school students enrolled in the Science, Technology, Engineering and Mathematics program. The program was crafted for students who are inclined towards sciences and mathematics. Results revealed that respondents have a moderate level of anxiety. During the course, anxiety contributes to the level of anxiety of the respondents. The self-regulation strategy was the most commonly utilized learning motivation strategy among respondents, while peer learning was the least utilized among the learning motivation strategies. However, the bivariate analysis showed anxiety was moderately related to rehearsal, organization, effort regulation, time and study environment, peer learning and help-seeking strategies. Regression analysis was also applied to reveal how anxiety predicts specific learning motivation strategies. Analysis disclosed that anxiety predicts the utilization of effort regulations strategies in learning mathematically inclined subjects. The findings provided a new perspective on how anxiety allows learners to utilize available strategies to understand various concepts. Teachers are encouraged to cultivate a culture of regulation, an environment conducive for learning, peer interaction and access to Internet-based or digital resources for learning

**Keywords:** mathematical anxiety, mathematics anxiety reasoning scale, learning motivation strategies, regression analysis

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### Introduction

The performance of learners in Mathematics mainly relies on the influential factors present within themselves and their environment. Acquiring conceptual and procedural knowledge in this subject requires moderate control of these factors. If appropriately addressed, this could enhance or improve their willingness to learn, thus unlocking their full potentials. However, if left unchecked, it might impair the ability of a learner to learn basic concepts. Eventually, this will lead to the learner's decreasing engagement in complex mathematics-related tasks.

This manifestation accounts for the mathematical literacy results of the Programme for International Student Assessment (PISA), where only 0.01% of the Filipino students could perform on complex problems through the development of techniques and mastery of mathematical symbols, operations, and relationships. This is true for public and private schools (Department of Education, 2019). Despite the various claims on how self-discipline and

positive outlook determine a learner's success in mathematics, factors related to psychological aspects in approaching mathematics could somehow be linked with their poor performance. Studies revealed how learners undergo stress, fear, unfavourable sentiments, and frustration caused by mathematical anxiety (Xu, 2004). When this anxiety is combined with lower reports of self-confidence, this increases their levels of distress and tendencies to neglect the significance of mathematics learning (Jameson & Fusco, 2014; Oxford & Vordick, 2006).

While overcoming anxiety has always been a challenge, learners prefer various strategies in acquiring knowledge and skills. It represents the effort to practice, comprehend and absorb information during the classroom experience providing more meaning to cognitive and affective learning (Kafadar, 2013). Studies were conducted on investigating and exploring the strategies commonly used in Mathematics classes. A study conducted by Gurat (2018), revealed that student and teachers of Saint Mary's University applied various problem-solving strategies, i.e. cognitive, meta-cognitive, prediction, monitoring and evaluation. In a sample of Taiwanese students, Liu and Lin (2010) found out that students have the weak motivation and less utilization of learning strategies for mathematics. The ability to alter strategy and reasons when introduced to mathematical problems has improved procedural and conceptual knowledge (Star et al., 2015).

### ***Anxiety and Achievement***

The mechanisms of anxiety, performance and achievement of learners in mathematics could be explained by how learners accommodate cognitive sources (processing efficiency theory) (Eysenck & Calvo, 1992) and how they control (attentional control theory) (Eysenck, Derakshan, Santos, & Calvo, 2007). There should be an emphasis among individuals with higher levels of anxiety. Since these people are worried that it would threaten their current goal, they will always manipulate ways to employ varying strategies. Hence, this reduces the effects of anxiety (Derakshan & Eysenck, 2009).

Individual's anxiety towards mathematics gradually reduces cognitive resources such as working memory. It is the short-term memory that initially handles information. As anxiety increases worry, worry takes significant parts of the working memories, overloads the resources, and leaves insufficient working space. Processing efficiency theory may associate anxiety with performance interference by burdening the cognitive resources (Eysenck & Calvo, 1992). The working memory system is comprised of three components, i.e., phonological loop, visuospatial sketchpad, and central executive. The phonological loop rehearses the verbal medium, while the visou-spatial sketchpad processes and stores visual and spatial information. The two components are considered "slave" systems of the central executive, the apex of the hierarchy. When a person becomes anxious, the entire system is compromised. Worrying is considered an irrelevant task that could affect its functions. In cases of dual tasks, an anxious individual would not utilize the high demands of their slave systems. Consequently, the central executive becomes dysfunctional in terms of preparation, choice of strategy or techniques and attentional control (Derakshan & Eysenck, 2009).

On the other hand, attentional control theory accounts for the interaction of two known attentional control systems when an individual feels anxious (Eysenck et al., 2007). There is a sudden decrease of the goal-directed attentional system, which refers to control and execution

of a task and is influenced by goals, expectations and knowledge, and an abrupt increase of the stimulus-driven system, which is driven by threat internally and externally (Corbetta & Shulman, 2002). When anxiety impairs attention control, the adverse effects are on the functions involving attentional control. The central executive performs three functions. First, it inhibits using attentional control to tolerate irrelevant tasks. Moreover, it shifts attention flexibly just to finish the task on hand. Finally, it updates and monitors the working memory representations (Derakshan & Eysenck, 2009).

There is substantive evidence that learners who possess higher levels of anxiety tend to have lower academic performance in mathematics. However, it is not yet clear that anxiety could also affect their working memory and attentional control. Through the investigation of Ibrahim (2018), less effective study strategies were constantly used by the students with higher anxiety. Even helpful strategies were discarded as part of their study habits. Hence, there is a need to understand the relationships between study strategies and learning outcomes in mathematics. Furthermore, these strategies should be monitored for a specific time frame to accurately represent their strategies and how they could affect their learning outcomes.

### ***Motivated Learning Strategies***

Learners utilized various strategies in learning mathematics. Resource management strategies mainly were utilized in the investigation of Liu and Lin (2010) using the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ). Findings revealed that help-seeking ( $M = 2.99$ ) is the most utilized strategy while communication behaviour on the internet ( $M = 1.51$ ) is the least utilized strategy. In terms of gender, a significant difference exists in all dimensions of strategy in favour of males except for the help-seeking strategy in favour of females. Students enrolled in cram schools after classes showed a significant difference in all dimensions. A lot of resource management strategies was also conducted. Vaezi et al. (2018) found out how their strategies could predict students' time and study environment achievement. Regression analysis showed how these resource management strategies are related to their achievement. Ahmed and Khanam (2014) indicated that the academic achievement, time and study environment, effort regulation and help-seeking among grades 9 and 10 learners were significantly correlated. High-achieving students in the class utilize more time and study environment, peer, help and effort regulation than low achievers. Science-inclined students use time and study environment and peer learning compared to humanities students in terms of specialization. Hamid and Singaram (2016) revealed that time and study environment are correlated with academic performance among medical students for two modules: becoming a professional and basic science. However, Pearson's product-moment correlation coefficient showed a weak relationship between the two variables. Problem-solving strategies were also investigated among student and teachers. Planning was revealed as the most utilized strategy ( $M = 3.58$ ), while monitoring was the least utilized ( $M = 3.16$ ). Planning involves summarizing and reflecting on the answer, reflecting on tasks solved, drawing conclusions, relating future problems and relating problems with other problems.

Similar studies were conducted using the same instrument and found out how cognitive strategies prevailed as a learning strategy. In the study of Baumgartner, Spangenberg, and Jacobs (2018), results showed that elaboration was the most preferred learning strategy for mathematics and mathematical literacy students, while peer learning was the least utilized,

respectively. Significant difference exists in terms of effort regulation ( $t = 2.38$ ,  $p < 0.05$ ) in favor of Mathematics students.

Hamid and Singaram (2016) revealed that critical thinking, time, and study environment were correlated with academic performance among medical students for two modules: becoming a professional and basic science. However, Pearson's product-moment correlation coefficient showed a weak relationship between the two variables.

### *Anxiety and Learning Strategies*

A few studies focused on anxiety and strategies were conducted to show that these variables were associated with each other. Anxiety could also predict how learners utilize strategies in learning mathematics. Studies show how the learners mostly utilize cognitive strategies. The study of Ibrahim (2018) involved 293 students through a survey on an online platform. Sets of linear regressions were used. The third model highlighted the strategies for learning mathematics as predictors of anxiety. Results showed that higher anxiety was associated with higher utilization of rehearsals and organization and lesser utilization of elaboration and help-seeking. Individuals with higher anxiety used less effective study strategies. Helpful learning strategies were sometimes used. Surprisingly, these strategies were beneficial in their mathematics achievement. Similarly, Kesici and Erdogan (2009) revealed how rehearsal and elaboration among cognitive learning strategies significantly predict mathematical anxiety.

Studies have highlighted the relationship of mathematical anxiety with their academic achievement. Although few studies could refute the relationship, the majority revealed the negative relationship between anxiety and achievement. In mathematics learning, the primary concern is the development of efficacy and conceptual knowledge. The relationship between achievement, conceptual knowledge and efficacy is undeniably related to each other. In contrast, a study involving older respondents did not show any relationship between these variables but considering young learners, efficacy will always determine one's achievement. Therefore, to address these problems, students need to develop learning strategies. Learning strategies in mathematics learning are essential as they unconsciously allow learners to solve the problems at their pace. However, among the mentioned learning strategies for mathematics, resource management and cognitive strategies were mostly used in learning concepts and skills. Furthermore, cognitive strategies predicted an individual's anxiousness (Kesici & Erdogan, 2009, Ibrahim 2018).

The literature review on anxiety as predictors of an individual's strategy is relatively sparse. Thus, local studies are still needed to fully understand the association between anxiety and learning strategy selection and how these strategies can increase the efficiency and self-concept of Filipino students in mathematics learning. The researcher investigated the association between anxiety and learning motivation strategies. The investigation of learning strategies and the level of anxiety may help explain the declining performance of the Philippines for the past years and promote research-based solutions to this problem.

## **Methods**

This is a prediction study that revolves around the relationship between anxiety and learning motivation strategies. The study design focuses on analysing how anxiety can establish the relationship and make predictions between the anxiety and learning motivations strategies. (Kabir, 2016). The study involved 335 students enrolled in the Science, Technology, Engineering and Mathematics strand for Senior High School of Zamboanga del Norte National High School. It is considered as one of the major public schools in the Division of Dipolog City, Zamboanga del Norte. The respondents were randomly selected through master lists retrieved from the advisers. The study was conducted from February to April 2020. Survey questionnaires were used in collecting the data and were composed of 3 parts: the demographic profile, mathematical anxiety and learning motivation strategies.

The level of anxiety was measured using the Revised Mathematics Anxiety Rating Scale (RMARS) (Alexander & Martray, 1989). The 25-item instrument comprises three subscales in measuring anxiety: mathematics test anxiety, mathematics course anxiety and numerical task anxiety. The mathematics test anxiety evaluates the reaction of students to any assessments conducted in mathematics class. It also measures the responses of students when they are present in any mathematics class. The numerical anxiety measures the anxiety brought by basic activities in mathematics. Initial internal consistency reliability coefficients of the RMARS subscales were 0.96 for the mathematics test anxiety, 0.86 for the numerical task anxiety, and 0.84 for the math course anxiety (Alexander & Martray, 1989). Respondents will report their anxiety levels through a 5-point Likert Scale: 1 – Not at all, 2 – A little, 3 – A fair amount, 4 – Much and 5 – Very much. The higher the score obtained would mean a higher level of anxiety reported by the respondent.

The strategies used by the respondents in learning concepts and problem solving would be determined through the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ) (Liu & Lin, 2010). For this study, the researcher would utilize the second section of the questionnaire – motivated strategies. It is a 64-item questionnaire covering four factors: cognitive strategies, metacognitive strategies, non-informational resources management and informational resource management. The components for cognitive strategies were rehearsals (6 items), organization (6 items) and elaboration (6 items). The components of metacognitive strategies included two elements: critical thinking (6 items) and self-regulation (6 items). The component of non-informational resources management could be divided into four elements: effort regulation (5 items), time and study environment (8 items), peer-learning (6 items), and help-seeking (6 items). The component of informational resources management could be divided into two elements: exploratory behaviour on the internet (6 items) and communication behaviour on the internet (7 items). Table 3 shows the strategies, corresponding components and item numbers. The higher mean obtained from the component means the most utilized learning strategy. Respondents would respond through a 5-point Likert Scale: 1- Strongly Disagree, 2- Disagree, 3 – Neither Agree nor Disagree, 4 – Agree and 5 – Strongly Agree. Table 2 shows the rating scales with their corresponding description for self-report of junior high preparation, anxiety and learning strategies.

Survey forms through Google Form were distributed to respondents. The respondents were assured of the confidentiality of the data

## **Results and Discussion**

## Results

Table 1 shows the level of anxiety by the respondents in terms of mathematics test, numeric test, and course anxiety.

Table 1.

*Level of Anxiety in Terms of Mathematics Test, Numeric Test and Course Anxiety*

Dimension	Mean	s. d.	Interpretation
Course	3.38	1.0216	Moderately Anxious
Mathematics Test	3.26	0.8462	Moderately Anxious
Numeric Test	3.04	0.3429	Moderately Anxious
Mean	3.23	0.8078	Moderately Anxious

  

Range	Description	Interpretation
4.21-5.00	Strongly Agree	Very High Anxious
3.41-4.20	Agree	High Anxious
2.61-3.40	Either Agree or Disagree	Moderately Anxious
1.81-2.60	Disagree	Low Anxious
1.00-1.80	Strongly Disagree	Very Low Anxious

Respondents' level of mathematical anxiety was found to be moderate ( $\bar{x} = 3.23$ , s.d. = .8078). Among the dimensions, the course anxiety was high ( $\bar{x} = 3.38$ , s.d. = 1.0216). Course anxiety items covered the anxiety they have felt from course orientation and requirements. This implied that most students in the STEM program were still anxious about tasks related to mathematics.

Table 2 presents the level of utilization of learning motivation strategies by major categories.

Table 2

*Level of Utilization of Learning Motivation Strategies by Major Categories*

Categories of Strategies	Mean	s. d.	Interpretation
Meta-cognitive	3.9977	0.6368	High Utilization
Cognitive	3.9676	0.6105	High Utilization
Non-Informational Resources Management	3.7256	0.5745	High Utilization
Informational Resources Management	3.7778	0.8200	High Utilization

  

Range	Description	Interpretation
4.21-5.00	Usually	Very High Utilization
3.41-4.20	Often	High Utilization
2.61-3.40	Sometimes	Moderate Utilization
1.81-2.60	Seldom	Low Utilization
1.00-1.80	Never	Very Low Utilization

Among the major categories of learning motivation strategies, the most commonly used was the meta-cognitive strategy ( $\bar{x} = 3.9977$ , s.d. = .6368), while the least utilized was informational resources management. Meta-cognitive strategies included critical thinking and self-regulation. Table 3 illustrates the level of utilization in terms of sub-categories.

Table 3.

*Level of Utilization of Learning Motivation Strategies by Sub-Domains*

Domains of Strategies		Mean	<i>s. d.</i>	Interpretation
Self-Regulation		4.1065	0.6352	High Utilization
Rehearsals		4.0278	0.63639	High Utilization
Organization		3.9769	0.6443	High Utilization
Exploratory Behaviour on Internet		3.9583	0.9328	High Utilization
Help-Seeking		3.912	0.5899	High Utilization
Elaboration		3.8981	0.6448	High Utilization
Critical Thinking		3.8889	0.6915	High Utilization
Effort Regulation		3.7611	0.5635	High Utilization
Time and Study Environment		3.6319	0.7263	High Utilization
Communication Behaviour on Internet		3.5972	0.8165	High Utilization
Peer-Learning		3.5972	0.6961	High Utilization
Range	Description	Interpretation		
4.21-5.00	Usually	Very High Utilization		
3.41-4.20	Often	High Utilization		
2.61-3.40	Sometimes	Moderate Utilization		
1.81-2.60	Seldom	Low Utilization		
1.00-1.80	Never	Very Low Utilization		

Among the items for learning motivation strategies, self-regulation is the most commonly utilized learning motivation strategy when dealing with mathematics and mathematics-related subjects. Self-regulation refers to the ability of students to develop skills even without supervision or expectations of receiving incentives. Respondents rated the statement, “If I feel confused about the math class materials, I will go over to find out where the problem is”, as high in terms of self-regulation strategies. This implies that students cultivate the value of initiative when they want to clarify the concept. Ideally, this attitude is very relevant when dealing with subjects that seek constant drills.

Bivariate analysis was conducted to determine the relationship between respondent’s anxiety and utilization of learning strategies.

Table 4.

*Relationship of Anxiety and Learning Strategies using Pearson Correlation  $r$* 

Strategies	Anxiety and Strategies Pearson $r$
Effort Regulation	.486**
Time and Study Environment	.466*
Peer Learning	.416*
Help-Seeking	.415*
Exploratory Behavior on Internet	.397*
Rehearsal	.375*
Organization	.392*

Communication Behavior on the Internet	.241
Self-Regulation	.232
Elaboration	.220
Critical Thinking	.121

\*\*Correlation is significant at the 0.01 level (two-tailed)

\*Correlation is significant at 0.05 level (two-tailed)

Anxiety has a significant relationship between effort regulation ( $r = 0.486$ ,  $p < 0.01$ ), rehearsal, organization, time and study environment, peer learning, help-seeking and exploratory behaviour on the Internet. Furthermore, there is a positive and moderate relationship between the variables. Multiple regression analysis was used to test if anxiety predicts learning motivation strategies.

Table 5.

*Multiple regression analysis for anxiety and learning motivation strategies*

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	SE of Estimate	R <sup>2</sup> Change	F change	df1	df2	Sig.
1	.486 <sup>a</sup>	.236	.215	.71532	.236	10.832	1	134	.002

a Predictors: (Constant), Effort Regulation

The multiple regression analysis revealed that Model 1 was significant ( $F(1,134) = 10.832$ ,  $p < 0.05$ ). Furthermore, the model accounted for 23.6% of anxiety variance. The rest of the learning strategies could not account for the anxiety of the learners. Respondent's utilization of effort regulation as a learning motivations strategy indicated that when students experienced higher anxiety levels, they tended to use effort regulation to support their learning.

### **Discussion**

The level of anxiety of a respondent could pose a threat to their academic performance as it determines their motivation and self-efficacy. Course anxiety had a higher contribution to the levels of anxiety felt by the respondents. This dimension refers to how they perceive the subject through their own interpretation. External and internal sources could also influence this. The way respondents perceive mathematics as a difficult subject might contribute to the anxiousness they have felt. Hence, it is always essential to allow learners to appreciate the value of the subject. Through activities that are realistic and attainable, students will be able to feel comfortable with the subject. In fact, Spaniol (2017) found that students who passed the Pre-Calculus examination have higher self-efficacy and lower anxiety. Factors contributing to their anxiety might be classroom activities that require drills on boards, oral recitation, feeling tense, and the presence of teachers (Reyes, 2019). Age could be another factor in the level of anxiety they have handled. The study of Smith (2010), where respondents are teachers, showed a significantly low level of anxiety. The level of preparation of students could determine anxiety.

In reviewing the school's protocol on admitting students to the STEM program, it was found out that there was no assessment or entrance examination which determined their admission to

the program. As the characteristics of the respondents would show, somehow, the admitted senior high school students were less confident in terms of equipping themselves with mathematical skills. In the path model analysis of Shishigu (2018), prior mathematics achievement was the strongest predictor for mathematical anxiety and present achievement in mathematics.

The respondents mostly utilized self-regulation. Self-regulation refers to how learners attempt to control their own learning. This implies that aside from using other learning motivation strategies, self-regulation was considered the most commonly used strategy in their learning and peer learning as the least utilized strategy. In fact, the study of Lavasani, Hejazi and Varzaneh (2011) demonstrated that the performance-approach structure has a negative effect on an individual's level of anxiety and directly affects self-regulation. Lavasani et al. (2011) revealed a positive impact of self-regulation learning strategies towards students' academic performance, motivation, and self-efficacy. Respondents mostly utilize cognitive and metacognitive strategies in their learning tasks.

Although self-regulation was the most utilized learning motivation strategy among respondents, it had no significant relationship with mathematical anxiety. The same result goes with other cognitive and meta-cognitive strategies which have no connection with anxiety except for organization. Effort regulation, rehearsal, organization, time and study environment, peer learning, help-seeking and exploratory behaviour on the Internet has a significant relationship with anxiety. Furthermore, resources management strategies were moderately correlated with their levels of anxiety. These strategies can be classified into informational and non-informational resources. Hence, the environment, peers, and other information sources can help learners develop confidence when learning.

Furthermore, a positive relationship was found between anxiety and learning motivation strategies. The strength of their relationship was also found to be moderate. This was already evident that anxiety was related to the utilization of strategies. This implies that when anxiety increases, they tend to utilize specific strategies. The study results suggest that this particular group of students with moderate anxiety performed better when they used the preferred strategy. These findings are also consistent with Ahmed and Khanam (2014) results where high-achieving students in the class better utilized time and study environment, peer, help, and effort regulation than the low achievers.

Science-inclined students better utilize time and study environments and peer learning than humanities students. It can also be noticed that meta-cognitive strategies are not related to anxiety, although it is one of the highly utilized strategies by learners. The nature of subjects that employ mathematical concepts demands a learner to develop cognitive and meta-cognitive strategies as these are very helpful. However, respondents employ less valuable techniques, as affirmed by the findings of Ibrahim (2018). The results revealed that learners with a higher level of anxiety tend to utilize less helpful strategies. Amidst being less beneficial, respondents claimed it had helped them perform better in mathematics class. The study also suggests that even if learners utilize common strategies, anxiety allows learners to develop specific learning strategies. Psychological status can also determine an individual's accommodation of specific strategies.

However, regression analysis has provided evidence that the effort regulation strategy among the investigated learning motivation strategies was predicted by mathematical anxiety.

Effort regulation refers to the level of efforts pursued on a specific task. The level of effort depends on the value of the tasks and the commitment to the target. Hence, the weight of academic tasks regulates their sense of effort in accomplishing the task. When one is motivated to perform the task, they use too much effort. Thus, when they face uninteresting tasks, they tend to keep these tasks. However, in this case, anxiety affects the way they see the value of a task. This suggests that difficult tasks tend to motivate them and allow them to assess how significant it is for their course undertaking. Therefore, the more anxious they are, the more they regulate their efforts. This contrasts with the findings of Ibrahim (2018), where higher anxiety was associated with higher utilization of rehearsals and organization and lesser utilization of elaboration and help seeking. Rehearsal and elaboration were also found to be the strategies related to anxiety in the study of Kesici and Erdogan (2009). Ibrahim (2018) showed that higher anxiety was associated with higher utilization of rehearsals and organization and lesser utilization of elaboration and help seeking. On the other hand, Kesici and Erdogan (2009) revealed how rehearsal and elaboration among cognitive learning strategies significantly predicted mathematical anxiety. This suggests that this group of learners who are inclined with STEM education prefers the use of effort regulation when they encounter higher levels of anxiety.

According to Mariani (2002), the central theme of learning strategies represents a bridge between one's competency and process. These strategies are innate within the learners. There is no such thing as a good or bad strategy; it is just a matter of activating them. Thus, tasks could be designed to let the learners discover these strategies. Lastly, strategies could become a part of the interaction between students and learners.

### **Conclusion**

The findings revealed how students utilized learning strategies when they felt anxious. This is shown by the ability of STEM learners to motivate themselves in achieving their goals and realizing the learning outcomes. A specific level of student's anxiety has already proven a negative effect on their academic performance. Looking at mathematical anxiety from a different perspective, we might be able to understand how human behaviours accommodate stressors and controls cognitive sources. Aside from looking at possible solutions to decrease factors contributing to higher levels of anxiety, there could also be interventions that could develop learning motivation strategies. In this way, they could mediate the effects brought by the feeling of anxiousness.

Future research studies could be conducted where diverse learners are involved. This could be composed of learners of different strands, disciplines, and various profiles. Variables such as anxiety and learning motivation strategies could also be monitored regularly to come up with observable patterns of their behaviour. Comparisons of the contributing factors of anxiety towards learning motivation strategies based on their profiles could also be conducted to understand the relationship among variables better. Finally, teachers and academic institutions could implement interventions to develop learning motivation strategies among students in terms of informational and non-informational resources strategies. The provision of the Internet, simulations and rich sources could help them in their learning experience

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