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RESEARCH ARTICLE

The Influence of Resource Management Strategies on Students' Use of Cognitive Components and Metacognitive Self-Regulation among Pre-University Students

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ABSTRACT

Education in today's world poses numerous challenges due to globalisation and the widespread use of the Internet. These challenges affect not only students but also instructors. It is crucial for everyone involved in education to understand and implement appropriate learning strategies tailored to their disciplines and levels of study. The present study investigated how pre-university students perceive their use of learning strategies. This quantitative study aims to explore the relationship between resource management and cognitive components and metacognitive self-regulation, which are key components of learning strategies, as proposed by Wenden and Rubin (1987). A purposive sample of 297 participants, randomly selected from among students at the Centre of Foundation Studies, Universiti Teknologi MARA, responded to the survey. The survey employed a 5-point Likert scale and comprised four sections. The results indicated a positive correlation between the three learning strategy components. Furthermore, the findings highlight the importance of resource management, particularly time management, study management, and help-seeking as integral elements of effective learning strategies. These findings are significant for educators in selecting appropriate learning strategies for pre-university students to prepare them for future degree studies.

INTRODUCTION

1.1 Background of study

Students' academic performance depends on many variables; therefore, employing suitable learning strategies is indispensable. Learning strategies are techniques or skills that an individual uses to accomplish a learning task (Conti, 2009). Different disciplines can employ different learning strategies. Understanding learning strategies is vital to addressing individual differences, allowing differentiation when designing learning activities and learning spaces (Goeman and Deschacht, 2019). Learning strategies are intended to influence learning processes; hence, any useful theory of learning strategies must be based on an underlying theory of human learning (Mayer, 1988).

One important element in learning strategies is resource management. This refers to activities in which students engage, allowing learning, task control, setting control, and actively seeking assistance (Anthony, 1994). According to Ahmed and Khanam (2014), some commonly used learning resource management strategies are management of learning time, study environment management, effort management, peer learning, and seeking assistance from qualified and significant others. As part of the learning strategies, optimising resource management efficiently may be one of the

contributing factors to the good academic performance of students. It is now time to investigate the influence of resource management on students' use of cognitive components and metacognitive self-regulation among pre-university students, as this area is currently unknown.

1.2 Statement of Problem

Pre-university students are in the transitional stage from secondary education to tertiary education as the styles of learning and teaching are different. Some courses are continuations from subjects taught in secondary schools, such as science and mathematics, and some courses are new, such as law and international relations. Therefore, learning strategies are important for supporting the learning process and producing desired results. Wenden and Rubin (1987) explain three learning components: cognitive, metacognitive self-regulation, and resource management. In addition, Stegers-Jager et al. (2012) believe that academic achievement significantly positively correlates with time and study management environment, and effort regulation.

Though the theories of learning strategies have been developed and discussed at length by researchers, challenges still emerge that may pace down the development of the best strategies. Anthony (1994) reports that some students and instructors are unaware of the learning strategies they are using due to students' automaticity of strategy use, inability to verbalise a strategy, or other noteworthy judgements. This may hinder the search for the best learning strategies for a particular course or an individual student.

This study sought to determine whether there is any relationship between learning resource management strategies, namely time and study environment management, effort management, and seeking assistance from others, on the cognitive components and metacognitive self-regulation of pre-university students.

1.3 Objective of the Study and Research Questions

This study was conducted to explore the relationship between resource management, cognitive components, and metacognitive self-regulation and whether resource management influences other learning strategies. Specifically, this study was constructed to answer the following questions:

How do pre-university students perceive the use of resource management in their learning?

How do pre-university students perceive the use of cognitive components in their learning?

How do pre-university students perceive the use of metacognitive self-regulation in their learning?

Is there a relationship between resource management and cognitive components and metacognitive self-regulation?

LITERATURE REVIEW

2.1 Resource Management Strategies for Learning

Every student learns uniquely. The differences in pace, style, and level of effort can lead them to varied outcomes. McKeachie et al. (1986) integrate elements from several learning models, including Weinstein and Mayer's cognitive approach (1986), to develop a taxonomy of learning strategies. This taxonomy, supported by Wenben and Rubin (1987), encompasses the cognitive, metacognitive, and resource management aspects of learning. Effective resource management can facilitate the learning process. Resource management strategies include time, study environment, effort, and support from others (McKeachie et al., 1986).

Time management is pivotal for determining the success of a study. According to Ahmed and Khanam (2014), time management entails that the student has an awareness of deadlines and the length of time needed for task completion and prioritises learning tasks. On the other hand, study environment management involves the development of a setting conducive to learning (Pilcher, 2000). Generally, if a student allocates a specific place to a quiet environment, he can study in a more focused environment. In addition, effort management is the process by which students utilise tactics such as attributions to effort, mood, self-talk, persistence, and self-reinforcement (McKeachie et al., 1986). A

student who perseveres and finds interest in studying can remain motivated and would continue even when he finds difficulty in his studies. Moreover, Razak and See (2010) discover a positive impact of peer learning on students' academic achievement and motivation. Xiaodong and Chung (1999) discover a positive relationship between academic achievement and the benefits of seeking help and instrumental help-seeking. These findings highlight the significance of resource management strategies, including time management, study environment management, effort management, and seeking support from peers, to optimise learning outcomes and promote academic achievement.

2.2 Past Studies on the Use of Resource Management

Resource management is a crucial aspect of learning strategies and can be divided into three components such as environment management, effort management, and help-seeking. The relationship between resource management and its impact on cognitive components and metacognitive self-regulation has been investigated in various studies, including a notable study conducted by Ahmed and Khanam (2014). The study shed light on the significance of effectively managing resources to optimise learning outcomes and develop effective learning strategies by investigating the relationship between learning resource management strategies and academic achievement. The survey employed participants from 100 secondary school students from classes IX and X in Bangladesh. The study, which aimed to determine the differences between high and low achievers, gender differences, and differences between science and humanities students, revealed that academic achievement was positively correlated with time and study environment management, effort management, and seeking assistance from qualified others. Through effective time management, one sets goals and tries to accomplish them by controlling the study environment. Therefore, it has been proven that there is a positive correlation between time and environmental management.

Vaezi et al. (2018) conducted another significant research on the relationship between resource management learning strategies and academic achievement. The research was conducted on 300 college students in Kermanshah, Western Iran. The specific objective of the study was to investigate the correlation between resource management learning strategies and academic achievement among college students. The findings revealed a significant relationship between the overall score of learning resource management strategies and students' academic achievement. These results highlight the importance of effective resource management strategies for facilitating academic success among college students. This study suggests that designing and implementing educational programmes aimed at promoting resource management strategies could yield beneficial outcomes, leading to enhanced academic achievement among students.

2.3 Conceptual Framework

Figure 1 illustrates the conceptual framework of the study. This study explored how students perceive their utilization of resource management within their learning strategies. This study also investigated the influence of resource management on students' use of cognitive components and metacognitive self-regulation. Wenden and Rubin (1987) proposed three learning strategies for students, such as cognitive components, metacognitive self-regulation, and resource management. Resource management is measured by subcategories such as (a) environment management, (b) effort management, and (c) help-seeking. In addition, cognitive components can be measured by sub-strategies, such as (a) rehearsal, (b) organisation, (c) elaboration, and (d) critical thinking. Previous research by Stegers-Jager et al. (2012) suggests a significant positive correlation between academic achievement and other factors such as time and study management environment, as well as effort regulation.

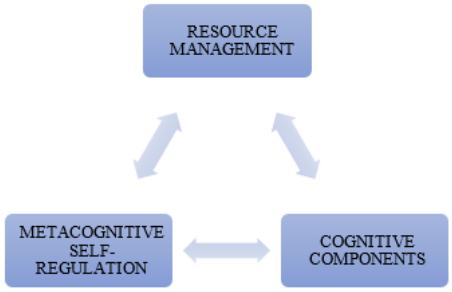

Figure 1: Conceptual Framework of the Study-The Influence of Resource Management on Students' Use of Cognitive Components and Metacognitive Self-Regulation

2.4 METHODOLOGY

This quantitative study aimed to explore the influence of resource management on the use of cognitive components and metacognitive self-regulation among pre-university students. A link to Google Forms was shared and 297 participants responded to the survey. Data was converted from Microsoft Excel to SPSS. Then, Cronbach's alpha was used to check the external reliability of the instrument. The mean score was calculated and analysed using a correlation test. The instrument used was a 5 Likert-scale survey rooted in Wenden and Rubin (1987) on learning strategies (refer to Table 1). The survey consisted of four sections. Section A contained items on the demographic profile, Section B contained 19 items related to cognitive components, Section C contained 11 items focusing on metacognitive self-regulation, and Section D contained 11 items related to resource management.

Table 1: Distribution of items in the survey

Section	Components		Items		
B	COGNITIVE COMPONENTS	(a)	Rehearsal	4	19
		(b)	Organisation	4	
		(c)	Elaboration	6	
		(d)	Critical Thinking	5	
C	METACOGNITIVE SELF-REGULATION				11
D	RESOURCE MANAGEMENT	(a)	Environment Management	5	11
		(b)	Effort Management	4	
		(c)	Help-Seeking	2	
					41

Table 2: Reliability of the survey

Reliability Statistics	
Cronbach's Alpha	N of Items
.924	41

Table 2 presents the results of the reliability test. The analysis showed a Cronbach's alpha of .924, indicating good reliability of the instrument of the study. A further analysis of the findings was performed using SPSS to address the research questions of this study.

FINDINGS

3.1 Findings for Demographic Profile

Q1 Gender

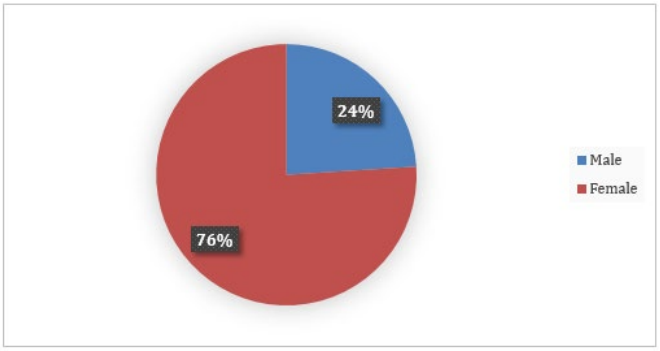

Figure 2: Percentage of gender

The data were collected from a sample of 297 participants, consisting of 227 females and 70 males. The female participants represented a substantial majority, accounting for 76 per cent of the overall number of participants, while male participants comprised 24 per cent of the overall number of participants (see Figure 2).

Q2 Foundation Programme

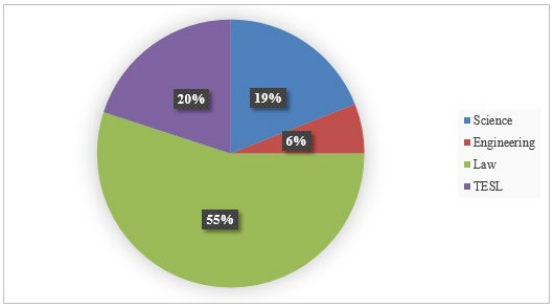

Figure 3: Percentage for Programme

Figure 3 presents the percentage of the courses taken by the study participants. Among the participants, 163 students enrolled in the Law Foundation Programme, comprising 55 per cent of the sample population and representing the majority of this study. The number of participants undergoing the Teaching English as a Second Language Foundation Programme (TESL) was 58 students, accounting for 20 per cent of the overall number of participants. The Foundation in Science students formed the third biggest group of participants (56 students), representing 19 per cent of the overall number of participants. The students of the Engineering Foundation Programme accounted for the remaining 6 per cent of the overall number of participants (20 students).

Q3 Semester

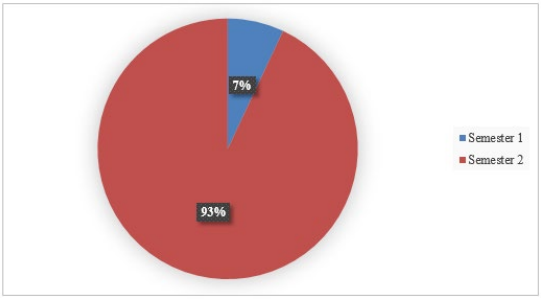

Figure 4: Percentage for Semester

Figure 4 depicts the distribution of participants according to the semester in Foundation Studies. The figure revealed that the majority of the participants, comprising 276 individuals or 93 per cent of the overall number of participants, were in their second semester. The remaining 21 participants, accounting for 7 per cent of the overall number of participants, were first-semester students.

3.2 Findings for Resource Management

This section presents the findings to address the first research question: How do students perceive the use of resource management in their learning? In the context of this study, resource management was measured by (i) environment management, (ii) effort management, and (iii) help-seeking.

Environment Management (5 items)

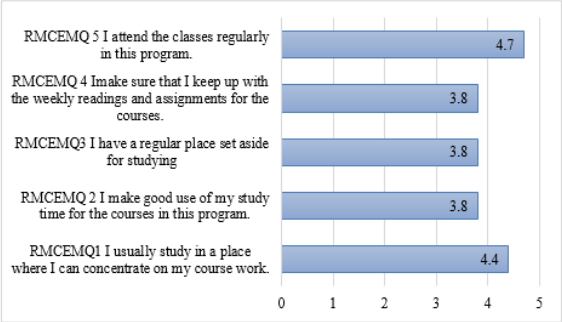

Figure 5: Mean for Environment Management

Figure 5 provides data on the resource management components of environmental management. The table displays five items (RMCEMQ1, RMCEMQ2, RMCEMQ3, RMCEMQ4, and RMCEMQ5), along with their respective mean scores. The first item, 'I usually study in a place where I can concentrate on my coursework,' received a relatively high mean score of 4.4. This indicated that most of the pre-university students were likely to have dedicated study spaces where they could effectively focus on their coursework. Items 2, 3, and 4 received the same mean score of 3.8. This suggested that students generally agreed to the same extent on the importance of utilising study time effectively, maintaining a regular study space, and staying on top of readings and assignments. Furthermore, the highest mean score of 4.7 was obtained for item 5, 'I attend the classes regularly in this program.' This indicated a high attendance rate among students, highlighting their commitment to class attendance. In general, the data suggest that students have a positive approach to environmental management, emphasising the significance of studying in conducive environments and attending classes regularly.

(ii) Effort Management (4 items)

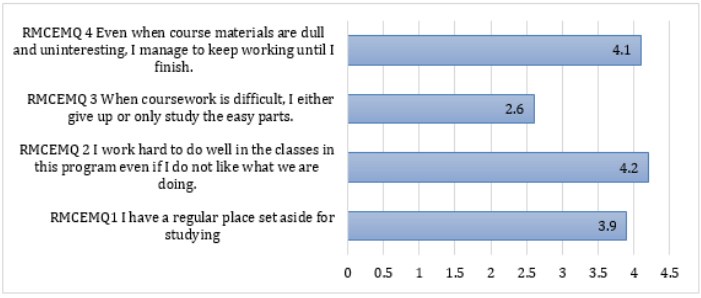

Figure 6: Mean Effort Management

Figure 6 presents the mean scores for the effort management component. The component consisted of four items. Item 1, 'I have a regular place set aside for studying,' received a mean score of 3.9, indicating that the participants generally agreed that they had a designated study area. Item 2, 'I work hard to do well in the classes in this program even if I do not like what we are doing,' obtained the highest mean score of 4.2, suggesting that the participants were motivated to put in effort and perform well in their classes, even if they found the content uninteresting. Item 3, 'When coursework is difficult, I either give up or only study the easy parts,' received the lowest mean score of 2.6,

indicating that participants might have struggled with perseverance and thus might have been inclined to give up or focus only on easier aspects when faced with challenging course materials. Item 4, 'Even when course materials are dull and uninteresting, I manage to keep working until I finish,' obtained a mean score of 4.1. This suggested that the participants possessed the ability to stay motivated and continue working on their studies, even when the materials were not engaging. Overall, the data suggest that the participants generally have regular study space and demonstrate effort and perseverance in their studies but may encounter difficulties in dealing with challenging course materials.

(iii) Help-Seeking (2 items)

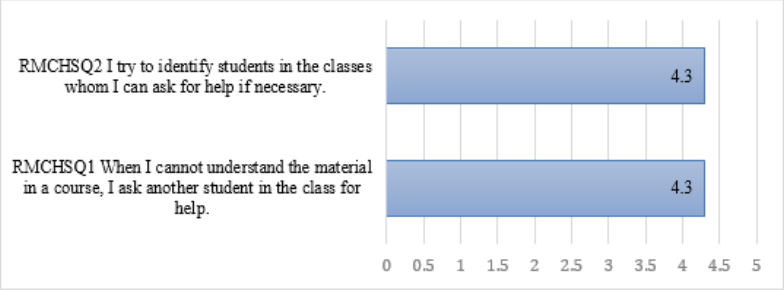

Figure 7: Mean for Help-Seeking

Figure 7 provides data on the two items of help-seeking components. Both items exhibited a high mean score of 4.3, indicating that the study participants were eager to seek assistance from their classmates when they encountered difficulties comprehending the material on their own (refer to Item 1). Meanwhile, Item 2 revealed that participants proactively identified potential peers in their class that they could approach for guidance. These findings suggest that students have a positive inclination towards seeking help and actively engage in collaborative learning by relying on their classmates for support when necessary.

3.3 Findings for Cognitive Components

This section presents the findings to answer the second research question: How do students perceive the use of cognitive components in their learning? In the context of this study, this was measured by (i) rehearsal, (ii) organisation, (iii) elaboration, and (iv) critical thinking.

Rehearsal (4 items)

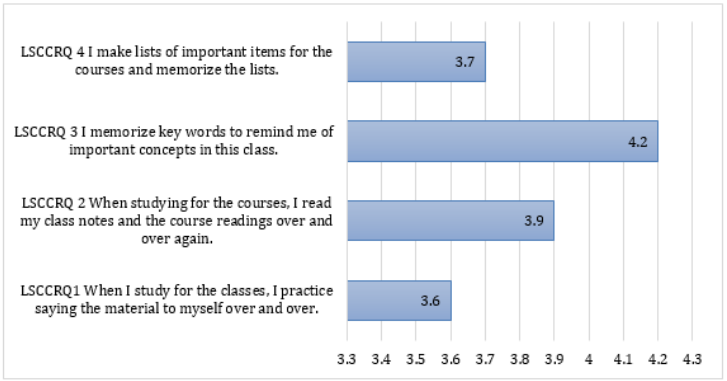

Figure 8: Mean for Rehearsal

For the cognitive components, participants employed four strategies: rehearsal, organisation, elaboration, and critical thinking. These cognitive strategies help students to enhance their thinking and active engagement in their learning process. Figure 8 shows the results of rehearsal as a cognitive component for learning strategies. The highest mean score in this category was 4.2, as observed for Item 3. This indicated that the participants preferred to engage in continuous practice and memorisation of the essential components necessary for effective learning. On the other hand, the

lowest mean score of 3.6 was recorded for Item 1, suggesting that participants had a relatively lower preference for repeatedly reciting the material they had learned. The remaining items obtained scores of 3.9 for Item 2 and 3.7 for Item 4. In general, the results indicate that the students demonstrate a positive utilisation of the rehearsal strategy, showing their inclination towards continuous practice and memorisation of crucial learning content.

(ii) Organization (4 items)

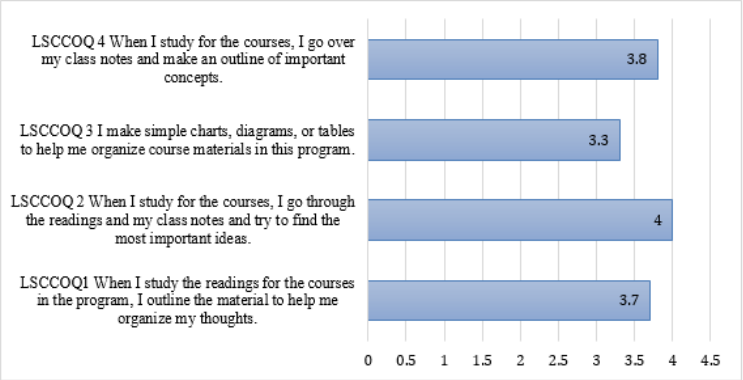

Figure 9: Mean for Organization

Figure 9 presents the results of the organisation strategy, which consists of four items. The organisation strategy enables participants to structure and map out their learning processes effectively. The highest mean score for organisation strategy was 4 (Item 2). This suggested that most participants engaged in the practice of reviewing their class notes to identify the key ideas essential for their learning. In contrast, the lowest mean score was 3.3 for Item 3, indicating that participants did not demonstrate a strong preference for using graphic organisers, such as charts or diagrams, to organise their learning materials. Item 4 obtained a mean score of 3.8, while Item 1 scored 3.7, demonstrating that participants moderately engaged in organising their learning through other means. In general, the results highlight the positive use of organisation strategies among students. Despite this, there may be room for further development in utilising graphic organisers for effective learning organisations.

(iii) Elaboration (6 items)

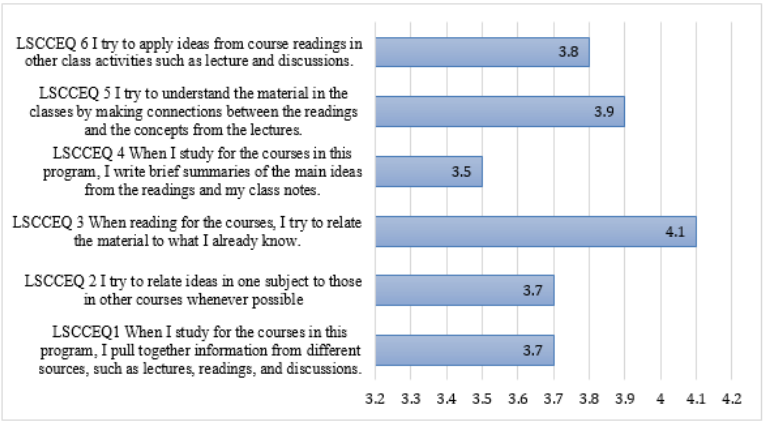

Figure 10: Mean for Elaboration

Figure 10 displays the mean scores for the elaboration strategy, which comprised six items. This strategy aims to enhance learning by encouraging students to make connections and expand their understanding of the material. Item 1, 'When I study for the courses in this program, I pull together information from different sources, such as lectures, readings, and discussions,' and Item 2, 'I try to relate ideas in one subject to those in other courses whenever possible,' both obtained a mean score of 3.7. This suggested that participants exhibited a moderate inclination to combine information from

various sources to establish connections between ideas across different courses. The highest mean score in this strategy was 4.1 (Item 3), which indicated that participants were actively trying to relate the material they read for their courses to their existing knowledge. This demonstrated their ability to integrate new information into prior knowledge. Item 4, 'When I study for the courses in this program, I write brief summaries of the main ideas from the readings and my class notes,' received a mean score of 3.5, indicating a relatively low preference for summarising the main ideas from readings and class notes. Furthermore, Item 5 had a mean score of 3.9, suggesting that participants strive to understand the material in their classes by making connections between their readings and the concepts discussed in lectures. In addition, Item 6 received a mean score of 3.8, indicating that participants attempted to apply ideas from course readings in other class activities such as lectures and discussions. In general, the results indicate that students generally demonstrate a positive inclination towards elaboration strategy and actively engage in activities that facilitate the integration and application of new knowledge in their learning process.

(iv) Critical Thinking (5 items)

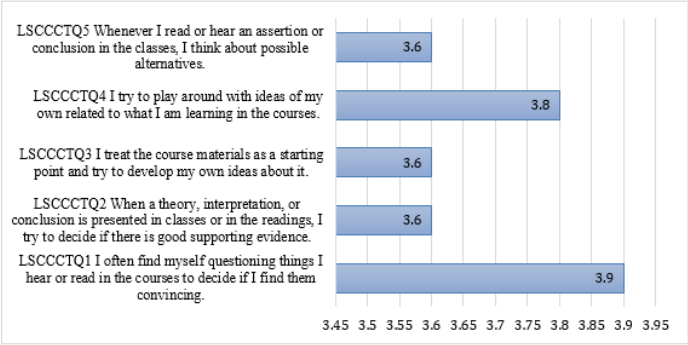

Figure 11: Mean for Critical Thinking

Figure 11 presents the mean scores for critical thinking strategy, which consisted of five items. Critical thinking strategy aims to develop the student's ability to evaluate and create new ideas related to their learning. Item 1, 'I often find myself questioning things I hear or read in the courses to decide if I find them convincing,' received the highest mean score of 3.9. This indicates that participants frequently engaged in questioning and critically evaluating the information presented in their courses. Items 2, 3, and 5 obtained a mean score of 3.6. Item 2, 'When a theory, interpretation, or conclusion is presented in classes or in the readings, I try to decide if there is good supporting evidence,' suggested that participants made an effort to assess the validity and supported evidence of the theories or conclusions presented in their courses. Item 3, 'I treat the course materials as a starting point and try to develop my own ideas about it,' indicated that participants strived to develop their perspectives and ideas based on the course materials. Item 5, 'Whenever I read or hear an assertion or conclusion in the classes, I think about possible alternatives,' highlighted participants' inclination to consider alternative viewpoints and possibilities when encountering assertions or conclusions in their classes. Finally, Item 4 received a mean score of 3.8. This item, 'I try to play around with ideas of my own related to what I am learning in the courses,' suggested that participants actively engaged in exploring and developing their ideas in relation to the concepts and topics they are studying. In general, the results indicate that students exhibit an inclination towards critical thinking, demonstrating their willingness to question, as well as evaluate and generate ideas in response to the course materials and information presented to them.

3.4 Findings for Metacognitive Self-Regulation

This section presents the findings to answer the third research question: How do students perceive the use of metacognitive self-regulation in their learning?

Metacognitive Self-Regulation (11 items)

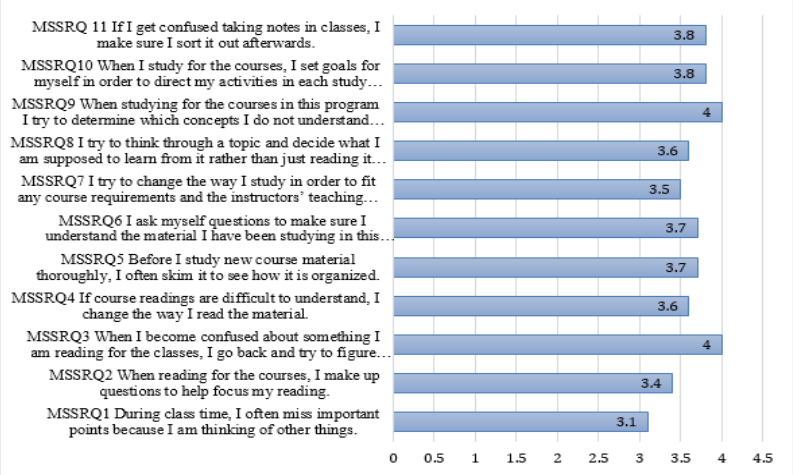

Figure 12: Mean for Metacognitive Self-Regulation

Figure 12 provides data on metacognitive self-regulation during learning processes. The table consists of 11 items (RMCEMQ1 to RMCEMQ11) and their corresponding mean scores. The highest mean scores in this section were 4, (Item 3 and Item 9. These findings indicated that participants often referred to their reading materials when they encountered confusion and would actively attempt to identify concepts they did not understand well. The remaining items in the table recorded satisfactory responses with mean scores ranging from 3.4 to 3.8. These scores indicated that participants perceive themselves to be engaged in metacognitive activities such as monitoring their learning progress, reflecting on their understanding, and employing strategies to enhance their learning. However, the lowest mean score in this section was 3.1, suggesting that participants occasionally found themselves distracted by thoughts about others, resulting in potentially missing important points during class. In general, the data suggest that pre-university students exhibit a moderate level of metacognitive self-regulation, demonstrating their awareness of monitoring their understanding and employing strategies. However, there is room for improvement to minimise distractions and maintain focus during class discussions.

3.5 Findings for Relationship between Resource Management with Cognitive Components and Metacognitive Self-Regulation

This section presents the findings to answer the fourth research question 4: Is there a relationship between resource management, cognitive components, and metacognitive self-regulation? To determine if there is a significant association in the mean scores between resource management with cognitive components and metacognitive self-regulation, the data was analysed using SPSS for correlations. Results are presented separately in Tables 3, 4, and 5.

Table 3: Relationship between Resource Management and Cognitive Components

Correlations			
		Resource Management	Cognitive
Resource Management	Pearson Correlation	1	.536**
	Sig. (2-tailed)		.000
	N	297	297
Cognitive	Pearson Correlation	.536**	1
	Sig. (2-tailed)	.000	
	N	297	297

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

Table 3 shows there is an association between resource management and cognitive components. Correlation analysis shows that there is a highly significant association between resource

management and cognitive components (r=.536**) and (p=.000). According to Jackson (2015), the coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. A weak positive correlation would be in the range of 0.1 to 0.3, a moderate positive correlation from 0.3 to 0.5, and a strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between resource management and cognitive components.

Table 4: Relationship between Resource Management and Metacognitive Self-Regulation

Correlations			
		Resource Management	MetaCognitive
Resource Management	Pearson Correlation	1	.572**
	Sig. (2-tailed)		.000
	N	297	297
Metacognitive	Pearson Correlation	.572**	1
	Sig. (2-tailed)	.000	
	N	297	297

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

Table 4 shows there is an association between resource management and metacognitive self-regulation. Correlation analysis shows that there is a highly significant association between resource management and metacognitive self-regulation (r=.572**) and (p=.000). According to Jackson (2015), the coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. A weak positive correlation would be in the range of 0.1 to 0.3, a moderate positive correlation from 0.3 to 0.5, and a strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between resource management and metacognitive self-regulation.

Table 5: Relationship between Cognitive Components and Metacognitive Self-Regulation

Correlations			
		Cognitive	MetaCognitive
Cognitive	Pearson Correlation	1	.751**
	Sig. (2-tailed)		.000
	N	297	297
Metacognitive	Pearson Correlation	.751**	1
	Sig. (2-tailed)	.000	
	N	297	297

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

Table 5 shows there was an association between cognitive components and metacognitive self-regulation. Correlation analysis revealed a highly significant association between cognitive components and metacognitive self-regulation (*r*=.751***, *p*=.000). According to Jackson (2015), the coefficient is significant at the .05 level and a positive correlation is measured on a 0.1 to 1.0 scale. A weak positive correlation would be in the range of 0.1 to 0.3, a moderate positive correlation would be from 0.3 to 0.5, and a strong positive correlation would be from 0.5 to 1.0. This means that there is also a strong positive relationship between cognitive components and metacognitive self-regulation.

CONCLUSION

4.1 Summary of Findings and Discussions

After referring to the learning strategies proposed by Wenben and Rubin (1987), this research produced interesting findings. The questionnaire was designed to investigate the relationships among the three elements of learning strategies. The first element was the cognitive components of the study: rehearsal, organisation, elaboration, and critical thinking. The second element focused on resource management, which was broken into time and study management, effort management, and help-seeking. Finally, metacognitive self-regulation comprised planning, monitoring, and regulating strategies.

The results indicate a positive influence of resource management on cognitive components and metacognitive self-regulation. Students' efforts to allocate a specific study location and their commitment to attending classes regularly demonstrate a good study environment. Students with these positive traits can find success in their studies. In addition, students with strong motivation can persevere when they face difficulties understanding their subjects. These findings are consistent with previous research conducted by Pintrich et al. (1991), Ahmed and Khanam (1994), Xiaodong and Chung (1999), Jones et al. (2010) and Stegers-Jager et al. (2012). The study highlights that it is important for educators to use the information from the current study to improve teaching and learning processes. It is also important for educators to recognise that students are normal human beings and that tertiary education is a journey that takes years to complete. Therefore, educators must consider the effective domains of students and not overly emphasise content-based learning. Keeping the interest of students at high peaks consistently should be explored, and this may be achieved through innovative fun and enjoyable learning experiences.

4.2 Pedagogical Implications and Suggestions for Future Research

The present study recommends further research to enhance the current educational system. Firstly, to add a new variable in the help-seeking element. The present study demonstrates peer assistance only, without reference to seeking help from the instructors. It is crucial to find out if communicating with instructors is preferred or a better approach for seeking help. This suggestion is consistent with the question posted by Pilcher and Miller (2000). Furthermore, future research should investigate whether academic achievement is significantly associated with time and study environment management, effort management, and seeking help from qualified individuals. This can be accomplished by studying samples of pre-university students from various courses and measuring their academic achievement based on their most recent academic results.

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