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Exploring the Relationship between Motivational Beliefs on Self-Regulated Learning Strategies among Chemical Engineering Students

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Abstract

Fostering motivation in undergraduate chemical engineering studies is crucial for students, as it plays a pivotal role in curriculum implementation and significantly influences teaching-learning situations. Positive motivational beliefs correlate with higher levels of self-regulated learning, and the development of learners' self-regulated learning skills is linked to improved understanding of the subject area and enhanced learning efficiency. This study investigate how motivational beliefs affect chemical engineering students' self-regulated learning practices. For this purpose, a quantitative survey using five Likert scales was used for 113 chemical engineering students at the Universiti Teknologi MARA (UiTM), Pasir Gudang campus. The survey is divided into three components: the first collects demographic data, while the second and third sections each with 22 items, concentrate on self-regulated learning process and motivating belief, respectively. The finding reveals that motivated beliefs and self-regulated learning have a strong, beneficial relationship. Positive correlations indicate that people who have a positive outlook on their motivating beliefs are more likely to use cognitive techniques that work and to exhibit proactive self-regulatory behaviours during the learning process. Thus, tailoring instructional methods and interventions to cultivate a positive mindset among students can significantly enhance academic performance. By doing so, students are more likely to actively engage in learning tasks and persist in overcoming challenges.

Keywords: Motivational Belief, Self-Regulated Learning, Chemical Engineering

Introduction

Background of Study

Self-regulated learning (SRL) significantly influences students' academic performance by fostering a proactive approach to learning. Those who practice SRL take on greater responsibility for their academic progress, engaging in activities such as monitoring and adjusting learning strategies, setting goals, evaluating progress, and staying motivated (Paris & Paris, 2001; Zimmerman, 2008). Zimmerman (2000) also defines self-regulation as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals."

The cognitive, metacognitive, and behavioural components of SRL are essential for student academic performance (Pintrich & De Groot, 1990; Zimmerman, 1990). The cognitive dimension includes students' ability to learn, remember, understand, and think critically. Metacognition involves understanding and monitoring one's mental processes. Current behavioural strategies focus on how students manage their efforts, perform challenging tasks, and prevent distractions in the classroom.

Student achievement typically requires more than cognitive and metacognitive methods. Beyond knowing these approaches, students must implement them while managing cognition and effort, requiring motivation. Insights from self-regulation and motivation theories explain why some students successfully manage their learning while others face challenges. Pintrich & De Groot (1990) underscore the significance of exploring connections between the three elements of self-regulated learning. This exploration is crucial for understanding the relationship between individual variations in student motivation, academic achievement, and cognitive engagement in the classroom. It contributes to describing the interplay between personal characteristics and students' academic success.

Motivational beliefs consist of several elements related to self-regulation, including control belief, self-efficacy, goal orientation, task value, and test anxiety (Pintrich & De Groot, 1990). Motivation is referred to as a motivating, preserving, and guiding element influencing goal-oriented behavior. Motivational behaviours exhibit connections with students' self-perceptions and their attitudes towards academic tasks. These views comprise measurements of people's justifications for selecting particular approaches to complete the assignments (Tavakoli et al., 2020). Motivational beliefs are a reflection of how emotional elements affect learning and can affect a learner's motivation for specific subjects, assignments, and exams.

Research on motivation in chemical engineering education has taken diverse approaches to examine student motivation, emphasizing four key areas derived from Eccles and Wigfield's taxonomy: (1) expectancy, which involves beliefs about task difficulty and one's ability to succeed; (2) reasons for engagement; (3) the integration of expectancy and value constructs; and (4) the integration of motivation and cognition (Eccles & Wigfield, 2002).

Not every student is capable of attaining their educational objectives. Due to the rigorous schedule and discipline-specific curriculum, engineering students feel increasing academic pressure as they progress through years of study. This pressure directly affects academic performance and the ability to persist in their studies (Godwin & Boudouris, 2020).

Motivation for pursuing chemical engineering studies primarily stems from students' proficiency in math, science, and problem-solving. The enjoyment of hands-on work and the diverse career opportunities in the field also significantly contribute to motivation. Additionally, the potential for financial security has been identified as a motivating factor in

choosing chemical engineering studies (Alpay et al., 2008; Steven et al., 2007; Ibrahim et al., 2009).

Statement of Problem

A student's progress and academic achievement are greatly affected by their motivational and SRL. The correlation between motivating beliefs and the use of self-regulated learning mechanisms in chemical engineering education has not been thoroughly investigated, despite the significant impact of students' self-regulation on their academic achievements.

Foong & Liew (2022) explained the concepts of amotivation, extrinsic motivation, and intrinsic motivation among first-year chemical engineering students. It was found that first-year chemical engineering students had more internal motivation, more extrinsic motivation, and less amotivation when they started the undergraduate programme. Foong et. al (2022) then conducted a study to assess the fluctuations in motivation among chemical engineering students during the initial six months. The study's findings indicated that the motivation of pupils remained constant over a period of six months. Foong et. al (2022) recommended the need for future studies to include a larger sample size at different local and international institutions to validate whether the changes in students' motivation vary across different educational environments.

In a recent study by Kong & Lin (2023), it was revealed that the teaching instructors had a good knowledge of teaching SRL strategies; however, some of the students were unsuccessfully transforming these strategies into SRL. These suggest improvements in SRL at the higher education level. The improvements include: i) various entities at the university level should take part in the development of SRL, ii) integrating responsive pedagogy with SRL strategies; and iii) tailoring SRL strategies to students' individual preferences. Kong & Lin (2023) also recommended future studies replicate the method used to discover additional factors that affect SRL at a higher education level.

In addition, a study by Soltani & Askarizadeh (2021) discovered that the most influential predictors of student motivational factors and self-regulation are learning a new technique and levelling up in knowledge. The results also support the theory that students' previous learning experiences in science affect their motivational beliefs and self-regulation (Soltani & Askarizadeh, 2021).

Objective of the Study and Research Questions

This study is done to answer the following research questions:

- RQ1: How do learners perceive their motivational beliefs in the learning of chemical engineering courses?
- RQ2: How do learners perceive their use of cognitive strategy in the learning of chemical engineering courses?
- RQ3: How do learners perceive their use of self-regulation in the learning of chemical engineering courses?
- RQ4: Is there a relationship between motivation and self-regulated in the learning of chemical engineering courses?

Literature Review

Motivation to Learn

Motivation to learn is made up of both internal and external factors that affect a person's choice to learn and their ability to keep at it. This includes the willingness, energy, and

commitment to acquire new knowledge, skills, or abilities. Students can use self-regulated learning strategies and achieve academic excellence if they have the right motivational ideas (Zurina et al., 2023; Filgona et al., 2020). Motivation significantly influences the level of active participation, dedication, and perseverance individuals exhibit in educational objectives. Numerous factors might impact an individual's motivation to learn, including intrinsic motivation which arises from an individual's genuine interest, curiosity, or learning enjoyment; and extrinsic motivation, which is driven by rewards, recognition, grades, or the avoidance of punishment. Pintrich & De Groot (1990) introduce self-efficacy, internal evaluation, assignment anxiety, and test anxiety as cognitive and metacognitive techniques in self-regulation learning, as well as motivating beliefs. The extent of student motivation to learn significantly influences their level of involvement, determination, and overall learning outcomes.

Self-Regulation in Learning

Self-regulated learning begins with students plan an assignment, track their progress, and then evaluate the results. The cycle then repeats as the student uses the reflection to adjust and prepare for the next task (Zimmerman, 2002). According to Zimmerman (2002), the process should be tailored for individual students and for specific learning tasks; it is definitely not one-size-fits-all. It is the ability to recognise one's goal and the strategies needed to attain the specific goal, including assessing the progress made throughout the journey towards the goal and making interventions or seeking necessary help whenever needed. Students with high self-efficacy for self-regulated learning have a strong belief in their capabilities to effectively utilise various learning technique, avoid distractions, complete assessment, and engage effectively in class. This belief in their own abilities enables them to take proactive actions in their learning journey and reduces their tendency to procrastinate.

Past Studies on Motivation to Learn

Certain research have been conducted to look at engineering course motivation. Foong & Liew (2022) has conducted a study to investigate (a) the motivation for pursuing an engineering degree course among first-year engineering students and (b) identify the significant relationship between academic motivation and academic performance. The research sample comprised 46 first-year degree students of chemical engineering at a public university, with 13 male and 33 female students aged between 18 and 24 years old. Data were collected using the Academic Motivation Scale (AMS), which demonstrated validity and reliability to measure student motivation. The AMS comprises 28 items of a self-administered questionnaire with seven sub-scales: motivation, extrinsic motivation—external regulation, extrinsic motivation—introjected regulation, extrinsic motivation—identified regulation, intrinsic motivation—to know, intrinsic motivation—to experience simulation, and intrinsic motivation—towards accomplishment (Foong & Liew, 2022).

Conversely, for (b), the GPA of the students was gathered, thereby reflecting the evaluation results for the following fundamental and basic courses during the semester. The result of the study found that engineering freshmen enrolled in the degree programme with greater intrinsic motivation, greater extrinsic motivation, and less amotivation, indicating that the students comprehended the rationale behind their decision to pursue a career as chemical engineers. Students were most aware of the personal importance and values of being chemical engineers throughout the extrinsic motivation subscales. According to the research tool, there is a strong correlation between intrinsic motivation and academic

achievement, which mirrors the correlation between intrinsic motivation and performance. Nevertheless, the author acknowledged that the study may have overlooked other factors that impact academic achievement and that the correlation data do not entirely back the theoretical relationship between student motivation and academic performance. Based on the results, it seems that incorporating self-determination theory into the classroom makes a big difference.

Tavakoli et al (2020) conducted a study to investigate the correlation between motivational belief (namely self-efficacy, internal appraisal, and test anxiety) and self-regulated learning as well as academic performance at Kerman University of Medical Science. About 460 male and female students were randomly selected using Cochran's sample size formula. Academic performance was measured using the student's total GPA, while motivational beliefs were studied using the Motivated Strategies for Learning Questionnaire (MSLQ) instrument developed by (Pintrich and De Groot, 1990). The study's conclusion demonstrated a strong link between students' academic achievement and their motivational views. Additionally, the study's findings showed that there was no statistically significant difference ($p<0.05$) in the motivational views of male and female students at Kerman University of Medical Sciences. The study's implication is that students develop self-motivational skills and employ self-monitoring learning strategies in order to enhance their learning, motivation, and self-esteem. Therefore, universities have the capacity to establish a foundation for students to enhance their academic achievements by imparting and implementing effective learning strategies and by placing an emphasis on fostering student motivation.

Past Studies on Self-Regulated Learning

Recently, Adaramola (2022) investigated how students monitor and control their strategies towards their intended goal in the Material and Energy Balance (MEB) course based on the SRL framework. MEB is a core fundamental course in the chemical engineering undergraduate programme, normally taken by second-year students. Two focus groups were selected from students who enrolled in the MEB course in Fall 2021. This study used directed qualitative content analysis and then reported on the participants' visual representation and verbal description of their learning experience in the MEB course. The study's findings highlight the potential for enhancing cognitive and behavioural regulation strategies and emphasise the need for effective classroom approaches. Instead of focusing on smaller, well-defined learning goals, students tend to set broader goals. Hence, it was suggested for the instructor to guide the students towards a more manageable goal earlier in the semester. In order to support students further, instructors are advised to encourage the setting of learning goals based on individual interests, provide opportunities for reflection within the classroom, and discuss active monitoring and timely adjustments, normalising the challenges and frustrations inherent in this process (Adaramola, 2022).

On the other hand, Li et al (2020) examined changes in students' SRL profiles through a longitudinal approach. The study was done on 111 ninth grade students who participated in modelling and simulation of engineering design using CAD software. However, nine participants were not able to complete the study, leaving a sample size of 102. Based on the SRL behaviours that the students portrayed in engineering design, it was found that students could be clustered into three groups in general: i) reflective-oriented self-regulated learners (N = 22), ii) adaptive self-regulated learners (N = 30), and iii) minimally self-regulated learners N = 50). Significant variations in design performance were observed among students with

distinct SRL profiles. Notably, adaptive self-regulated learners exhibited better design completeness compared to minimally self-regulated learners, while reflective-oriented self-regulated learners displayed greater design efficiency than their minimally self-regulated counterparts (Li et al., 2020). This underscores the impact of self-regulation profiles on different facets of design performance, emphasising the importance of considering diverse self-regulatory approaches in educational contexts.

Conceptual Framework

Figure 1 shows the conceptual framework of the study. The framework is adapted from the study by Pintrich & De Groot (1990). Their study explored motivation and self-regulated strategies. According to Pintrich & De Groot (1990), motivational beliefs have an impact on learners' motivation. The three motivational beliefs under consideration are self-efficacy, intrinsic value, and test anxiety. On the other hand, self-regulated learning strategies involve both the utilisation of cognitive strategies and the demonstration of self-regulation by the learner.

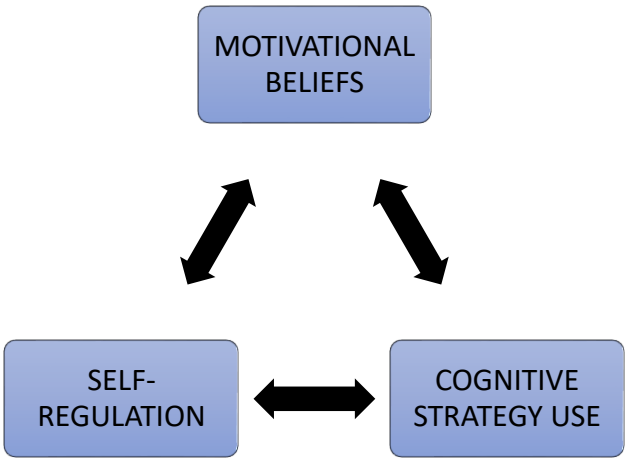

Figure 1- Conceptual Framework of the Study

Methodology

This study aims to investigate the motivational elements that influence learning among undergraduate students. A deliberate sample of 113 individuals completed the survey. The survey instrument employed is a 5-point Likert scale, based on the framework developed by Pintrich and De Groot (1990), to assess the factors outlined in Table 1. There are three sections in the survey. Section one contains information regarding the demographic characteristics. Part two consists of a total of 22 items that pertain to motivational beliefs. Part three consists of a total of 22 items that pertain to self-regulated learning processes.

Table 1
Distribution of Items in the Survey

Part	Strategy		Scale	Items	Total Items
Two	Motivational Beliefs	A	Self-Efficacy	9	22
		B	Intrinsic Value	9	
		C	Test Anxiety	4	
Three	Self-Regulated Learning Strategies	D	Cognitive Strategy Use	13	22
		E	Self-Regulation	9	
	Total No. of Items				44

Table 2
Reliability of Survey

Reliability Statistics

Cronbach's Alpha	N of Items
.926	44

The survey's reliability is displayed in Table 2. The analysis indicates a Cronbach alpha coefficient of 0.926, demonstrating a high level of reliability for the selected instrument. Additional analysis utilising SPSS is conducted to show the data that address the research topics of this study.

Findings

Findings for Demographic Profile

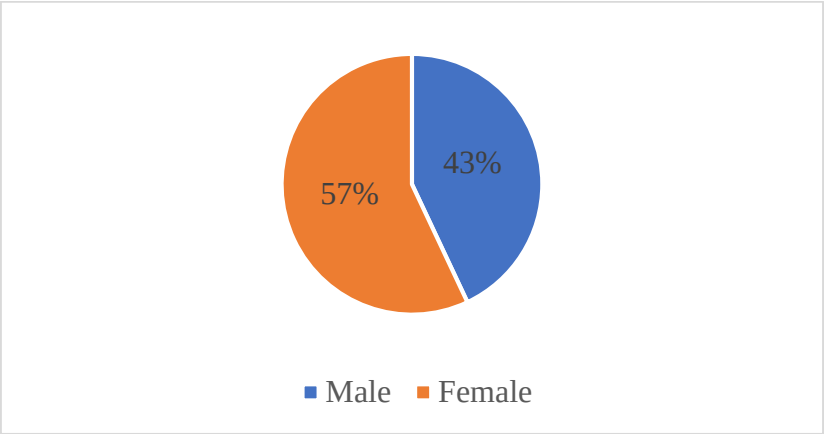

Figure 2- Percentage for Gender

In the pie chart that can be found in Figure 2, the percentages of male and female undergraduates who responded to this survey are shown separately. According to the pie chart, there were 57% female respondents and 43% male respondents.

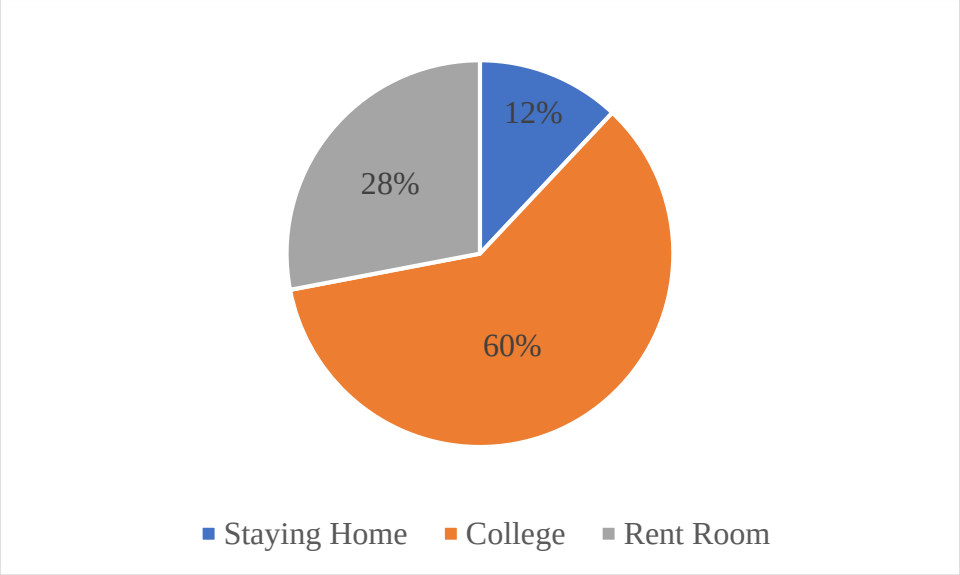

Figure 3- Percentage for Living Status

The students' living arrangements exhibit a wide array of housing options, which mirror the varying lifestyles and interests found within the student population. Based on Figure 3, this study reveals that 60% of the students have chosen to live on the college campus. This option provides them with the advantage of being close to academic facilities, which promotes a deeply engaging educational experience. Residing on campus provides students with convenient access to libraries, courses, and campus facilities, fostering a feeling of camaraderie and active engagement in campus life. Conversely, 28% of the students have opted to lease residences or flats outside the university campus. By renting a property, these students gain greater autonomy and adaptability regarding their living situations. They can derive satisfaction from increased privacy, autonomy, and the chance to sample independent living. A smaller but noteworthy fraction, accounting for 12% of the students, has chosen to live in their homes, which are advantageously situated near the university. This alternative provides the convenience and assistance of their familial setting while also facilitating their participation in classes and involvement in university activities effortlessly. While pursuing higher education, these students can benefit from the emotional and financial support of their families.

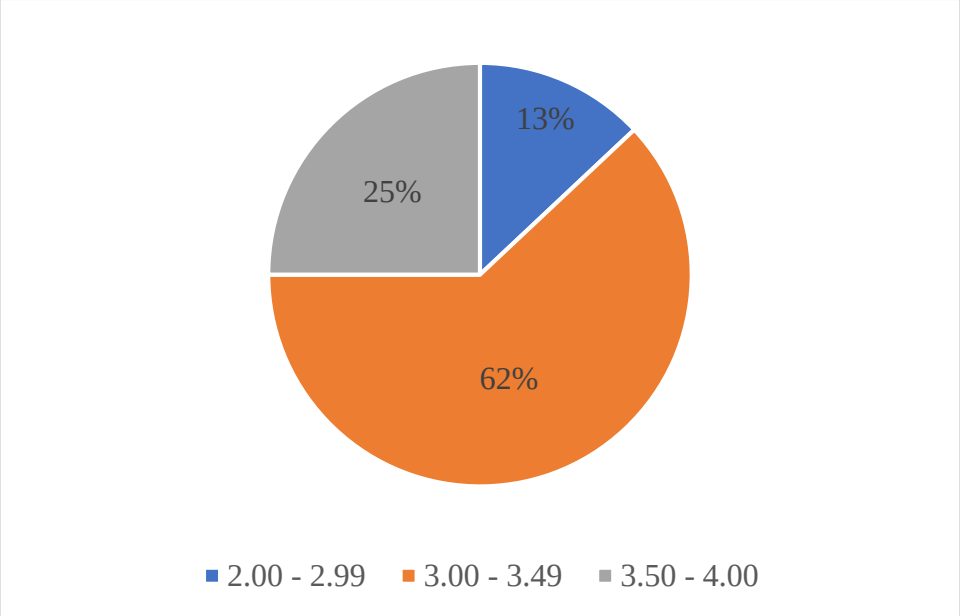

Figure 4- Percentage for CGPA

The current achievement in terms of CGPA for this group of students shown in Figure 4 reflects a spectrum of academic performance, with varying levels of excellence and dedication. Most students, 62%, have a good CGPA between 3.00 and 3.49. This group has shown dedication to their studies and course knowledge. They are likely to fulfill their educational goals due to their continuous academic performance. 25% of the students had CGPAs between 3.50 and 4.00, indicating academic success. This reflects strong coursework competency and devotion. These students are high achievers in the cohort due to their exceptional topic knowledge and dedication to success. Small yet important, 13% of students had CGPAs between 2.00 and 2.99. While this group may face some academic challenges or have room for improvement, they are actively engaged in their studies and are likely working towards enhancing their academic performance.

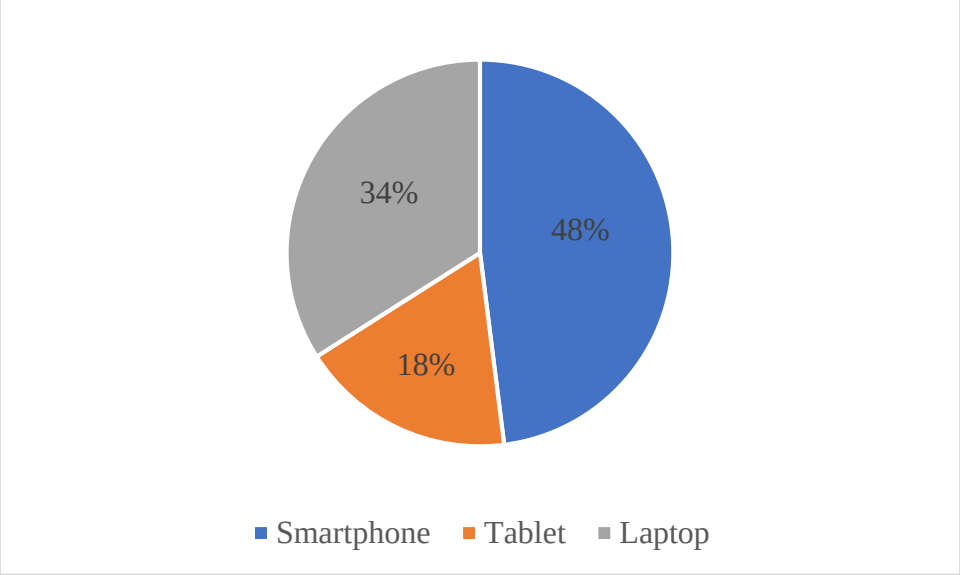

Figure 5- Percentage for Device

This group of students' device usage during learning activities reveals their preferred means for accessing educational resources and learning activities. 48% of students use their smartphones for learning. Mobile and convenient, smartphones allow students to access instructional materials, participate in online classes, and study from anywhere. Modern learners prefer cell phones for their adaptability and speedy information retrieval and communication. 34% of students favour laptops for learning. Laptops are better for multitasking, typing, and software applications due to their larger screens and more powerful computer environments. Laptops' versatility and functionality for academic needs may appeal to these students. Tablets are used by 18% of students for learning. Tablets combine portability and screen size, making them ideal for reading digital textbooks, taking notes, and watching multimedia. Students who value mobility prefer tablets' touch interface and lightweight design.

Findings for Motivational Beliefs

This section provides data that addresses research question 1: How do learners perceive their motivational beliefs in the learning of chemical engineering courses? Within the scope of this study, motivational beliefs can be categorised into three components: (i) self-efficacy, (ii) intrinsic worth, and (iii) text anxiety. The results are displayed in Figures 6, 7, and 8, correspondingly.

i) Self-efficacy

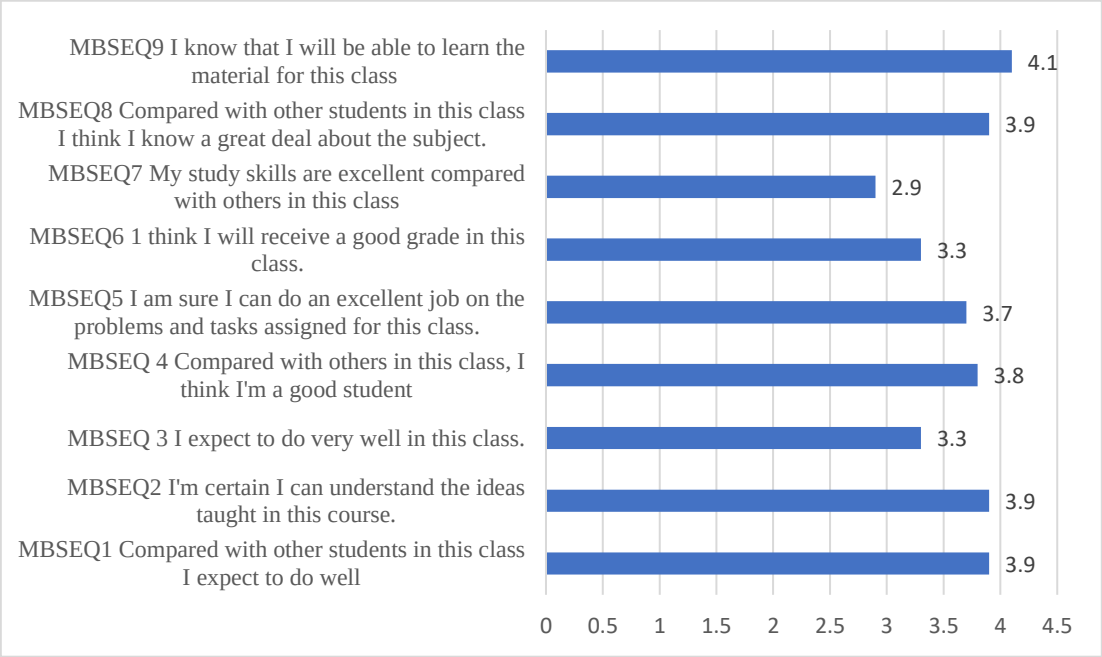

Figure 6- Mean for Self-Efficacy

Based on Figure 6, MBSEQ9 has the highest mean value, which reveals that most students know that they are able to learn the materials provided by the lecturers for that particular class. The second highest mean score is 3.9, which is the same score obtained by MBSEQ1, MBSEQ2, and MBSEQ8. These three questionnaires show that the students believe that they are expected to do well, that they can strongly understand the ideas taught, and that they know a great deal about the subject. The lowest mean score is MBSEQ7, where the

students seem to question their study skills compared with their classmates. The mean for all nine questionnaires is 3.64, which indicates that students had a medium level of self-efficacy.

ii) Intrinsic Value

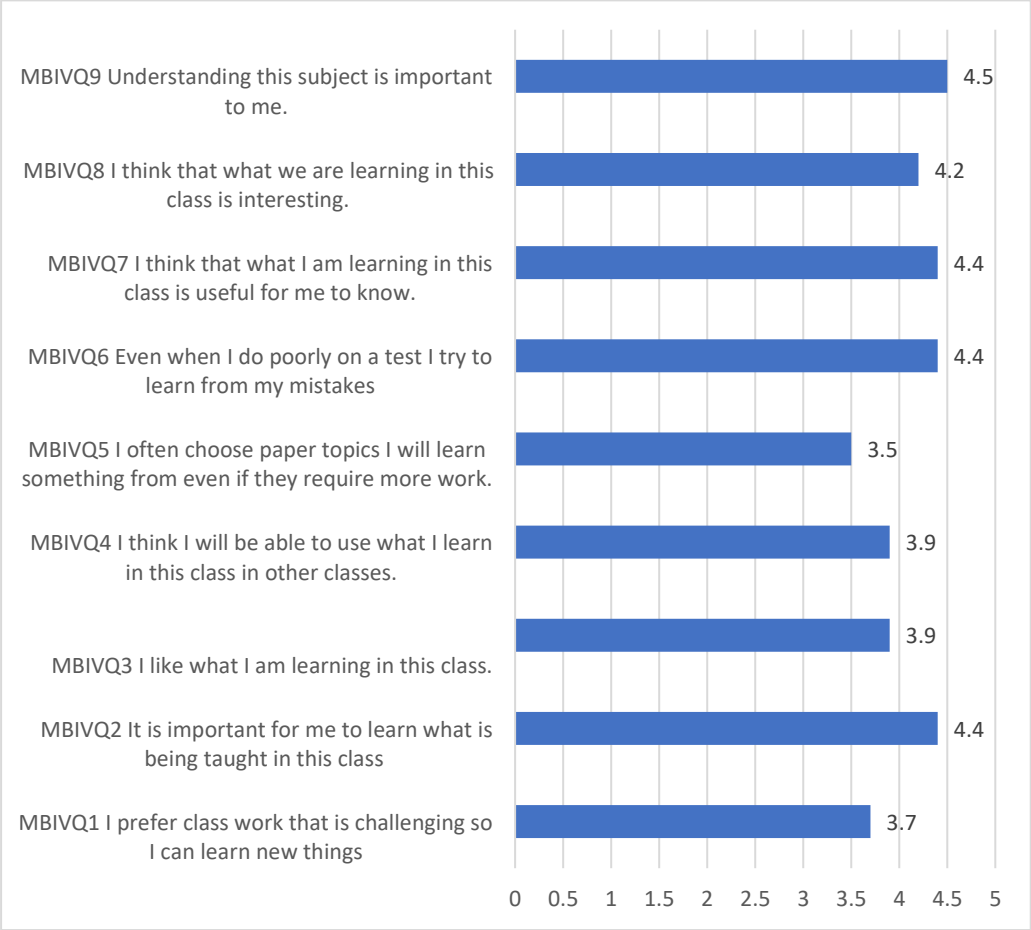

Figure 7- Mean for Intrinsic Value

As can be seen from Figure 7, the highest mean score is 4.5, which is item MBIVQ9. The students mostly agree that understanding the subject is important for them. This also corresponds to the second highest score (4.4), which is item MBIVQ2. The students agree that it is important for them to learn what is being taught in class. Item MBIVQ5 obtained the lowest mean score, only 3.5. Students often choose paper topics they will learn something from, even if they require more work. The mean for all nine questionnaires is 4.1, which signifies that intrinsic value does play an important aspect in chemical engineering students' motivational beliefs.

iii) Test Anxiety

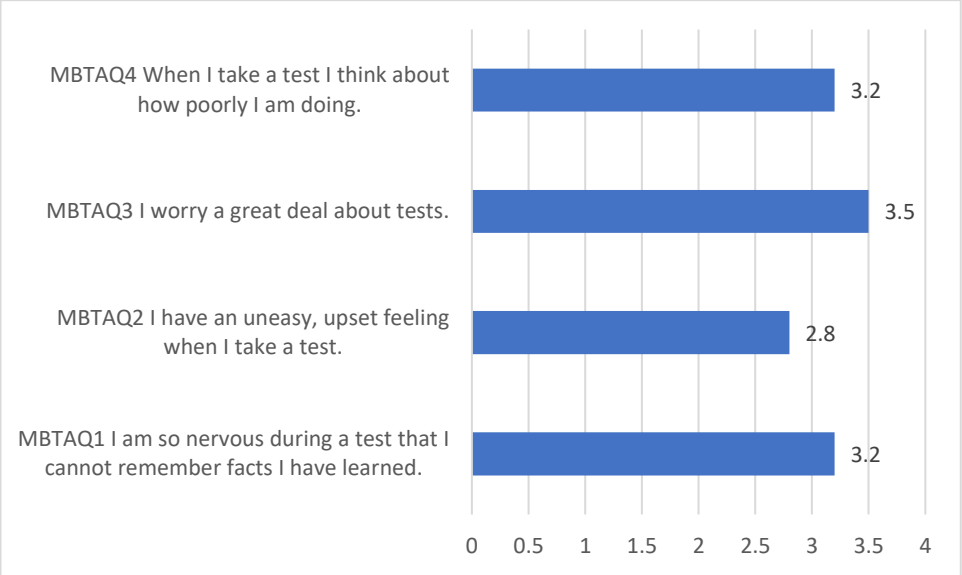

Figure 8- Mean for Test Anxiety

Based on Figure 8, the highest mean score is 3.5, which corresponds to item MBTAQ3, where students worry a great deal about the test. The median score is 3.2, which is for items MBTAQ1 and MBTAQ4. In these two questionnaires, students did feel nervous during a test, and that has caused them to not be able to remember the facts they have learned. The students also keep track of how poor their performance was when they took the test. Item MBTAQ2 has the lowest mean score of 2.8. Students feel uneasy and upset when they take a test.

Findings for Cognitive Strategy Use

The data presented in this section is to address research question 2: How do learners perceive their use of cognitive strategy in the learning of chemical engineering courses? Data are analysed with SPSS for correlations to evaluate whether there is a statistically significant relationship between cognitive strategies used towards self-regulated learning employed by undergraduates in chemical engineering courses. The results are shown in Figure 9 below.

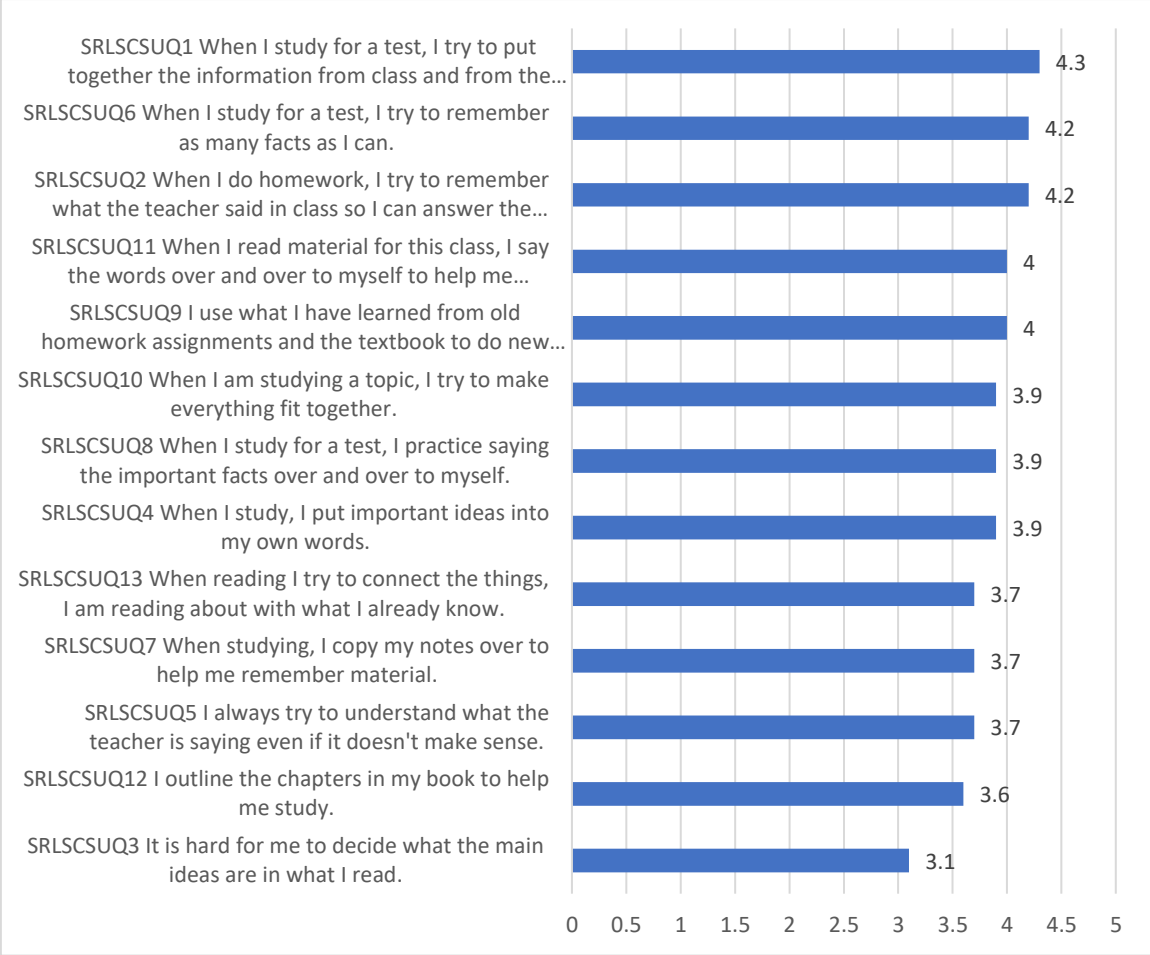

Figure 9- Mean for Cognitive Strategy Use

Learning cognitive strategies are humans' mental processes and methods to acquire, analyse, retain, and use new information. Effective learning and problem-solving require these methods. Cognitive methods help students organise and manipulate information, improving understanding and retention (Lewalter, 2003). Figure 9 shows students prefer to combine class and book information for test preparation. Note-taking has the highest mean of 4.3. Other relevant strategies, like memorising as many facts as possible and what the teacher said in class, scored a mean of 4.2. Rehearsal, which involves repeating information to oneself to retain it in short-term or long-term memory, and transfer of learning, where students used old homework and the textbook to do new assignments, scored 4.0. SRLSCSUQ 4 and 10 demonstrate a chunking strategy, which breaks down complex information into manageable bits. Smaller pieces of information are easier to remember and use, simplifying learning. This method scored 3.9. Students love to copy their notes to help them recall material, grasp what the teacher is saying, and integrate what they read with what they already know. SRLSCSUQ 3, 7, and 5 scored 3.7 on the mean value. Students also agree that they outline book chapters to study, scoring 3.6 on the mean value. Finally, students slightly agree that it is challenging to identify the main ideas in what they read. This statement had the lowest mean value of 3.1.

Findings for Self-Regulation

This section presents data to answer research question 3 (RQ3): How do learners perceive their use of self-regulation in the learning of chemical engineering courses? The results are shown in Figure 10 below.

Figure 10- Mean for Self -Regulation

Based on Figure 10, SRLSSRQ 9 scored the highest mean of 4.1, where the students agreed that they work hard to get a good grade even when they do not like the class or subject. It showed that they have a high level of self-awareness that helps students achieve good grades. Both SRLSSRQ 8 and SRLSSRQ 1 have the same mean value of 3.9, where the students occasionally stop and go over what they have read and ask themselves questions to ensure they know the material. On the other hand, SRLSSRQ 4 and SRLSSRQ 5 have mean values of 3.8 and 3.7, respectively. It shows students' effort to keep studying even if the materials are uninteresting, and they think about what they need to do to learn before studying. On the other hand, SRLSSRQ 6 and SRLSSRQ 3 scored a mean value of 3.3, while SRLSSRQ 7 and SRLSSRQ 2 scored the lowest mean value of 2.9.

Findings for Relationship between Motivation and Self-regulated strategies

This section presents data to answer research question 4: Is there a relationship between motivation and self-regulated learning for the learning of chemical engineering courses? To determine if there is a significant association in the mean scores between motivational components and burnout, the data is analysed using SPSS for correlations. The results are presented separately in Table 3 below.

Table 3
Correlation between Motivation and Cognitive Strategy Use

Correlations

		MOTIVATIONAL	COGNITIVE
MOTIVATIONAL	Pearson Correlation	1	.611**
	Sig. (2-tailed)		.000
	N	113	113
COGNITIVE	Pearson Correlation	.611**	1
	Sig. (2-tailed)	.000	
	N	113	113

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

Table 3 demonstrates a correlation between motivation and the utilisation of cognitive strategies. The correlation analysis reveals a fairly significant correlation between motivation and cognitive strategy utilisation (r = .611**) with a p-value of .000. Based on Jackson's (2015) findings, the coefficient is statistically significant at the 0.05 level, and there is a positive association observed on a scale ranging from 0.1 to 1.0. A weak positive correlation is typically defined as a correlation coefficient ranging from 0.1 to 0.3. A moderate positive correlation is typically defined as a correlation coefficient ranging from 0.3 to 0.5. A high positive correlation is typically defined as a correlation coefficient ranging from 0.5 to 1.0. This means that there is also a strong positive relationship between motivation and cognitive strategy use.

Table 4
Correlation between Motivation and Self-Regulation Strategy Use

Correlations

		MOTIVATIONAL	SELFREGULATION
MOTIVATIONAL	Pearson Correlation	1	.694**
	Sig. (2-tailed)		.000
	N	113	113
SELFREGULATION	Pearson Correlation	.694**	1
	Sig. (2-tailed)	.000	
	N	113	113

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

Table 4 shows there is an association between motivation and self-regulation. Correlation analysis shows that there is a moderately significant association between motivation and self-regulation (r =.694**) 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. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and high positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between motivation and self-regulation.

Table 5
Correlation between Cognitive and Self-Regulation Strategy Use

Correlations

		COGNITIVE	SELFREGULATION
COGNITIVE	Pearson Correlation	1	.643**
	Sig. (2-tailed)		.000
	N	113	113
SELFREGULATION	Pearson Correlation	.643**	1
	Sig. (2-tailed)	.000	
	N	113	113

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

Table 5 shows there is an association between cognitive and self-regulation. Correlation analysis shows that there is a moderate significant association between cognitive and self-regulation (r=.643**) and (p=.000). According to Jackson (2015), coefficient is significant at the .05 level and positive correlation is measured on a 0.1 to 1.0 scale. Weak positive correlation would be in the range of 0.1 to 0.3, moderate positive correlation from 0.3 to 0.5, and moderate positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between cognitive and self-regulation.

Conclusion

Summary of Finding

In conclusion, the study sheds light on crucial aspects of the learning process among chemical engineering students during their early academic stages. The students strongly belief that they capable to learn the course and confidently perceive high performance in learning if they can understand the subject better. The findings reveal a positive perception among learners regarding self-efficacy and intrinsic value, both of which significantly contribute to motivation. However, they also express significant worries about the outcome especially after taking test. It becomes clear that reducing exam anxiety is crucial for improving chemical engineering students' motivational beliefs. Notably, the study aligns with Marcou & Philippou (2005) discovery of a positive relationship between self-regulated learning (SRL) components and motivational beliefs.

Furthermore, despite of believing in themselves to learn the course, the finding showed that student highly prefer to memorizing facts they learned, taking note and apply knowledge the gained from previous task to do new one. It demonstrates that students actively incorporate cognitive strategies into their self-regulated learning processes when studying chemical engineering. This underscores the interconnectedness of cognitive and motivational aspects, echoing Anais et al (2012) insights. These findings significantly advance our understanding of how engineering students navigate their learning journey in the early stages of their education.

In addition, our study emphasizes the crucial role of self-regulation in addressing challenges within chemical engineering education. The survey indicated the students are agreed they can achieve good result due to their work hard in learning, frequently use self-monitoring and reviewing, often engage in self-questioning to mastering and understanding

the course. The finding showed that student employed several self-regulations in learning. To succeed and achieve academic accomplishment in the subject, it is necessary to recognise and encourage these self-regulation abilities. Lestariningsih et al. (2018) support the idea that students with high self-regulated learning tend to comprehend concepts better, leading to improved academic results compared to those with low self-regulated learning.

Lastly, the positive correlation between motivational beliefs and self-regulated learning for chemical engineering students underscores the importance of recognizing and fostering this relationship. Our findings, in line with Lopez-Proton et al (2017) research, affirm the significant connection between learning motivation and self-organization among engineering students. Intrinsic motivations, including beliefs, achievement orientation, passion for the task, personal initiative, and fear of failure, contribute to students' ability to explore ideas, comprehend diverse perspectives, and develop skills that facilitate the achievement of learning objectives. Recognizing and supporting this interplay can lead to academic success and a more fulfilling learning journey for chemical engineering students.

Pedagogical Implications and Suggestions for Future Research

The results demonstrate that students who pursue chemical engineering are highly motivated to complete their courses, highlighting the importance of this aspect as an essential factor of self-regulated learning and classroom engagement. Educators can enhance their students' motivational belief in self-regulated learning by linking course material to practical applications, highlighting the importance of chemical engineering, encouraging group problem-solving, and highlighting the effectiveness of newly learned concepts, as argued by (Godwin & Bourdouris, 2020). The level of test anxiety among students can be mitigated by engaging in thorough preparation for tests and exams and assuming greater responsibility in the learning process (Ocak et al., 2022) Consequently, this research provides valuable insights for educators aiming to optimise students' test anxiety levels. The four primary questions regarding SRL have been substantially explored; however, further studies are needed to build upon these discoveries. It is recommended to examine the correlation between positive perceptions of motivational belief in self-regulated learning and academic performance by analysing students' grades or other measures of academic or knowledge achievement in chemical engineering studies.

References

Adaramola, A. (2022). Contextualized Self-Regulated Learning: Chemical Engineering Student's Learning Experience in a Materials and Energy balance course. *ASEE 2022 Annual Conference: Excellence through Diversity.* Minneapolis: American Society for Engineering Education.

Anais, M., Hojas, A., Bustos, A., Letelier, C., Zuzulich, M., Cabieses, B., & Zubiaguirre, M. (2012). Motivational and Cognitive Learning Strategies Used by First-Year Engineering Undergraduate Students at Universidad Católica in Chile. *Creative Education, 3,* 811-817. doi: 10.4236/ce.2012.326121

Alpay, E., Ahearn, A. L., Graham, R. H., and Bull, A. M. J. (2008) Student enthusiasm for engineering: charting changes in student aspirations and motivation. *Eur. J. Eng. Educ.* 33(5-6): 573–585. https://doi.org/10.1080/03043790802585454

Barry, J. Z. (2008). Investigating Self-Regulation and Motivation: Historical Background Methodological Developments, and Future Prospects. American Educational Research

Journal Manth 2008, Vol. 45, No. 1, pp. 166 – 183.https://doi.org/10.3102/0002831207312909

Eccles, J. S., and Wigfield, A. (2002) Motivational beliefs, values, and goals. *Annu. Rev. Psychol.* 53: 109–132. DOI:10.1146/annurev.psych.53.100901.135153

Filgona, J., Sakiyo, J., Gwany, D. M., and Okoronka, A. U. (2020) Motivation in Learning. Asian Journal of Education and Social Studies. 10(4), p16-37

Foong, C. C., & Liew, P. Y. (2022) The Relationships between Academic Motivation and Academic Performance of First-Year Chemical Engineering Students. *Regional Conference in Engineering Education (RCEE) & Research in Higher Education (RHEd) 2020.* AIP Conf. Proc. 2433, 020012-1–020012-10; https://doi.org/10.1063/5.0072668

Foong, C. C., Liew, P. Y., & Lye, A. J. (2022). Changes in motivation and its relationship with academic performance among first year chemical engineering students. Education for Chemical Engineers, 70-77.

Godwin, A., & Bourdouris, W. B. (2020). Fostering motivation for chemical engineering students' academic success: an example from a sophomore materials and energy balances course. Chemical Engineering Education. Vol. 54(3), p-121-128

Ocak, G., Karafil, B., & Akar, F. (2022) Exploring the Relationship between Self-Regulation Skill and Test Anxiety Level of Secondary School Students. Bulletin of Education and Research. December 2022, Vol. 44, No.3 pp. 55-76

Ibrahim, Y. E., Salman, A., El-Brawany, M., & Abdel-Magid, I. M. (2009) Motivation and Persistence in Engineering Education: A Case Study at King Faisal University, Dammam Campus, KSA. In Proceedings of the 1st International Conference on Engineering Education (ICEE2009), Engineering and Technology Education: Challenges of Globalization, Al-Madina, Saudi Arabia, 6–17 May 2009.

Jackson, S. L. (2015) Research methods and Statistics-A Critical Thinking Approach (5^{tH} Edition) Boston, USA:: Cengage Learning.

Kong, S.-C., & Lin, T. (2023). Developing self-regulated learning as a pedagogy in higher education. An institutional survey and case study in Hong Kong. Heliyon, E22115.

Lestariningsih, D., Nurlaela, L., & Mariono, A. (2018). The Impact of Self-Regulated Learning to Wards on The Ability to Understand A Concept of Practical Chemical Engineering Operation. 10.2991/icei-17.2018.24.

Lewalter, D. (2003). Cognitive strategies for learning from static and dynamic visuals. *Learning and Instruction*, *13*(2), 177–189. https://doi.org/10.1016/S0959-4752(02)00019-1

Li, S., Chen, G., Xing, W., Zheng, J., & Xie, C. (2020). Longitudinal clustering of students' self-regulated learning behaviors in engineering design . *Computers & Education*, 103899.

Marcou, A., & Philippou, G. (2005). Motivational beliefs, self-regulated learning and mathematical problem solving. Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education. 3, pp297-304

Paris, S., & Paris, A. (2001). Classroom applications of research on self-regulated learning. *Educational Psychology, 36,* 89-101.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. Journal of Educational Psychology, 82(1), 33–40. Retrieved from https://psycnet.apa.org/doi/10.1037/0022-0663.82.1.33

Soltani, A., & Askarizadeh, G. (2021). How students' conceptions of learning science are related to their motivational beliefs and self-regulation. Learning and Motivation, 101707.

Tavakoli, A. M., Bahonar, E., Rafie, F., & Mohammadi, P. (2020). Investigating the relationship between motivational beliefs and self-regulation learning with students' academic performance. Journal of Advanced Pharmacy Education & Research| Jan-Mar, 10(S1), 149.

Zimmerman, B. J. (2000). Attainment of self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). Academic Press.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. Theory Into Practices, 41(2), 64-70.Zurina md Nen, Nur Zafifa Kamarunzaman, Muhamad Fuad bin Abdul Karim, Thenmolli Vadeveloo, Alice Shanthi (2023) Exploring the relationship between motivational belief and self-regulated learning. International Journal of Social Science Research. Vol 11, No.1 p.43 – 60.