Exploring the Relationship Between Social Support and Motivational Components in Online Learning: A Study of Undergraduate Polymer Chemistry Students

Syuhada Mohd Tahir[1*], Nor Wahida Awang[2], Noraishah Abdullah[3], Sharil Fadli Mohamad Zamri[4], Wan Norfirdaus Wan Salleh[5]

[1]Faculty of Applied Sciences, University Technology MARA, Pahang Branch, 26400 Bandar Tun Abdul Razak Jengka, Pahang,Malaysia

[2]Faculty of Applied Sciences, University Technology MARA, Sarawak Branch, 94300 Kota Samarahan, Sarawak, Malaysia

[3]Faculty of Applied Sciences, University Technology MARA, 40450 Shah Alam, Selangor, Malaysia

[4]Faculty of Applied Sciences, University Technology MARA, 40450 Shah Alam, Selangor, Malaysia

[5]Jabatan Kimia Malaysia, Tawau Branch, 91000 Tawau, Sabah, Malaysia

***Corresponding Author**

DOI: https://dx.doi.org/10.47772/IJRISS.2025.909000124

Received: 26 August 2025; Accepted: 03 September 2025; Published: 01 October 2025

ABSTRACT

The shift to online learning has raised concerns about how motivation is sustained in complex, high-cognitive-load subjects like Polymer Chemistry. Online platforms offer flexibility, but they may lack sufficient interaction and support, potentially impacting student engagement and achievement. Previous research has identified social support, expectancy, and value as key motivational components, yet limited studies have explored how these constructs interact in STEM-specific contexts, especially within Malaysian higher education. This study investigates the relationship between social support and motivational components, specifically expectancy and value, among undergraduate Chemistry students who have taken an online or blended Polymer Chemistry course. Using a quantitative survey design, data were collected from 109 participants across three branches of Universiti Teknologi MARA, a public university in Malaysia. The instrument, adapted from Fowler (2018), comprised 40 items across three main sections: Expectancy (12 items), Value (16 items), and Social Support (12 items), with high internal consistency (Cronbach's alpha = .963). Findings indicate that students reported moderate to high levels of expectancy and value, and generally perceived strong instructor and peer support. Pearson correlation analysis revealed strong positive relationships between social support and both expectancy ($r = .723$, $p < .01$) and value ($r = .778$, $p < .01$). These results suggest that social support plays a pivotal role in shaping students' motivational beliefs in online STEM education. The study offers theoretical insights grounded in McClelland's Theory of Needs and the Expectancy-Value Model and provides pedagogical implications for designing motivation-sensitive online chemistry instruction. It calls for the enhancement of social engagement and instructor presence to better support students in online laboratory and content-heavy learning environments.

Keywords— Online Learning; Student Motivation; Social Support; Expectancy-Value Theory; STEM Education

INTRODUCTION

Pandemic COVID-19 has catalysed the integration of digital technologies such as online learning that reshape the current landscape of teaching and learning. Even though online platforms provide easy access and flexible

learning, the effectiveness of virtual learning is totally dependent on students' motivation to participate actively and engage constructively with the content. In this context, motivation is defined as a student's desire, need, obligation and aspiration to engage and succeed in the learning process [1]. Motivation consists of three elements; expectancy (students' belief in their ability to succeed), value (interest of the learning task, perceived importance and usefulness) and social support (e.g., peer, family, instructor) which are considered as key factors in facilitating student engagement in online learning environments [2].This transition to virtual learning however has raised several challenges that impact student's motivation such as perception of irrelevant content, feelings of isolation and dysconnectivity due to limited interaction with instructor and peers, poor time management and technology incompetencies [2]-[6]. This will lead to a decrease in motivation and is particularly concerning for science, technology, engineering, and mathematics (STEM) subjects exemplified by Polymer Chemistry that requires students to understand complex concepts, abstract reasoning and visualisation for hands-on laboratory experience, which often integrates collaborative problem solving and group discussion rather than individual learning process. Addressing these issues is crucial to sustaining students' motivation as the primary factor that influences their academic success.

Numerous studies have investigated the relationship between motivational components and students' motivation in learning online. For instance, a study on secondary and undergraduate levels in Indonesia suggests a strong correlation between social support and value on students' motivational beliefs [3], [7]. Similarly, Zahid et al. [6] examined the influence of motivational components (value, social support, expectancy) on student's motivation using structural equation modeling. However, the studies did not investigate how these constructs work in high cognitive-load subjects such as Chemistry that might interact differently in online learning. In most example, studies on theory-related courses are well established and often found positive correlation between the motivational constructs (self-efficacy, expectancy, task value etc.) and motivation to learn online. However, lab-based or practical related subjects often showed weaker correlation and mixed relationship [8]. It clearly indicates that laboratory-based learning that involve psychomotor skills exemplified by Polymer Chemistry may need different motivational components and may interact differently, thus requiring further investigation. Furthermore, no comprehensive study to date has explored cultural values and social support in the Malaysian landscape that may differ from other countries that influence the students' response to virtual Chemistry learning [4].

There are several theories relevant to these studies to better enrich the understanding of student motivation in studying online. McClelland's Theory of Needs [9] is incorporated in the studies to highlight that individuals are being motivated and driven by three primary needs: the need for achievement (nAch), the need for affiliation (nAff), and the need for power (nPow). In online Polymer Chemistry education, the need for success and academic achievement (nAch) may motivate the students to grasp complex concepts and be able to adapt from virtual lab demonstrations. On the other hand, the need for affiliation (nAff) refers to students' motivation to interact with instructors and peers in online settings, which is crucial in the collaborative problem-solving approach needed in the chemistry subject. Meanwhile, the need for power (nPow) relates to students' aspiration to master the subject that influences the advancement in their study. According to Expectancy-Value Theory, when applied in the Polymer Chemistry context, students' motivation is influenced by the belief in their ability to understand theoretical concepts (expectancy) and how they perceive the relevance of polymer science in real-world applications (value) [10]. Bandura's Social Learning Theory [11] complements the theory by highlighting the significant role of observation and modelling in learning, which is difficult to implement in virtual laboratory experience. This involves developing psychomotor skills such as synthesizing and analysing polymer properties, as well as data interpretation requires innovative approaches in online learning. In addition, this theory also emphasizes social support such as instructor and peer interaction. These theories offer comprehensive perspectives to examine the students' motivation in online Polymer Chemistry education which requires both cognitive and practical approaches.

Statement of Problem

Despite extensive research in online learning that has been done so far, there is limited research in subject-specific topics, especially highlighting complex STEM subjects, such as Polymer Chemistry. Rahmat et al. [12] suggested that interdisciplinary studies are required to enrich understanding on how motivational factors operate across diverse disciplines. Chemistry subjects require the development of psychomotor skills through

laboratory work, the ability to visualize abstract concepts, and the integration of collaborative problem-solving. Online settings often lack the capacity to fully transfer those skills and support the required experiential learning, potentially impacting students' motivation, engagement, and learning outcomes.

Unlike non-STEM subjects, Polymer Chemistry involves abstract thinking, complex concepts, symbolic interpretation, and practical-based visualization, demanding not only cognitive abilities but also strong internal motivation to stay engaged. It potentially alters and impacts distinctly how the students perceive their expectancy component, their value and social support in online learning compared to other disciplines, given the unique challenges in understanding concepts and conducting experiments in virtual settings. It is hypothesized that there is a stronger correlation between expectancy, value and social support in online Chemistry learning when compared to non-STEM subjects due to its complexity and practical driven learning processes. It is postulated that the relationship between social support and motivational components will be more pronounced.

This study seeks to fill these gaps by investigating perceptions of expectancy (self-efficacy, control of learning beliefs, intrinsic/extrinsic goal orientation) among undergraduate Chemistry students in Malaysian universities who have participated in the online or blended learning Polymer Chemistry course. Meanwhile, value is explored through the perceived task value, and social support. It further examines the relationship between these motivational components and how these factors relate to their overall motivation to continue learning Chemistry in a virtual environment. The findings provide insight for actionable ways to increase engagement and sustain students' motivation aligning with SDG 4 Quality Education and supporting the National Digital Education Policy.

Objective of the Study and Research Questions

This study is done to explore motivation to learn online, specifically to answer the following research questions;

- How do learners perceive their expectancy components in online learning?
- How do learners perceive their value components in online learning?
- How do learners perceive their social support in online learning?
- Is there a relationship between all components for motivation to learn online?

LITERATURE REVIEW

Theoretical Framework of the Study

In the current digital era, online learning has become a widely accepted mode of instruction across various disciplines. However, sustaining student motivation in virtual environments remains a significant challenge, particularly for technical and abstract subjects such as polymer chemistry. The diversity in students' learning preferences and the absence of traditional classroom dynamics often make it difficult for learners to stay focused, comprehend complex content, and remain actively engaged. Without adequate internal motivation, students may find it difficult to grasp key polymer chemistry concepts, which often require visual, practical, and conceptual understanding.

To better understand the factors influencing student engagement, McClelland's Theory of Needs [9] provides a valuable psychological framework. This theory posits that human behaviour is driven by three primary needs: the need for achievement (nAch), the need for affiliation (nAff), and the need for power (nPow). Unlike hierarchical models such as Maslow's, McClelland's theory suggests that these needs are learned through life experiences and can vary significantly between individuals [9].

The need for achievement reflects a strong desire to excel and accomplish goals through personal effort. In an online learning context, students with high achievement needs are typically self-motivated, goal-oriented, and responsive to structured learning environments. These learners benefit from features such as clearly defined learning outcomes, interactive assessments, feedback mechanisms, and progress-tracking tools [13], [14]. For a

content-heavy subject like polymer chemistry, online modules that emphasize problem-solving tasks, quizzes, and mastery-based progression are particularly appealing to achievement-driven learners.

The need for affiliation refers to the motivation to form social bonds and feel a sense of belonging. Students with strong affiliation needs may find online learning isolating unless collaborative opportunities are embedded within the course design. Group assignments, peer discussions, virtual study groups, and synchronous video sessions help fulfil this need and enhance students' emotional connection to the learning environment [15], [16]. In the context of polymer chemistry, incorporating teamwork in assignments such as polymer case analyses or collaborative simulations can promote both learning and social engagement.

The need for power involves the desire to influence others, lead, and gain recognition. Online learners motivated by power are more likely to participate actively in class forums, volunteer for leadership roles in group projects, or contribute to peer learning. Providing these students with leadership opportunities, such as moderating discussions or presenting polymer synthesis projects along with recognition systems like top-performer badges, helps sustain their engagement with the subject [17].

By recognising these motivational differences and aligning course design with McClelland's three needs, educators can create more inclusive and effective online learning environments. This is especially important for subjects like polymer chemistry, where learner motivation directly impacts comprehension of complex mechanisms, such as polymerisation processes, structure–property relationships, and analytical techniques. Applying McClelland's framework [9] to instructional design enables the development of adaptive, personalised learning strategies, ultimately improving student performance, satisfaction, and retention.

Motivation to Learn Online

Previous studies have shown several motivational factors on online learning by the students. Lin and Lei, (2022) [18] stated that intrinsic goal orientation mainly focusing on learning has been proven to contribute significantly to learning in both traditional and online learning. The theory was further supported by Cho and Shen (2013) [19]. They found that the students' academic achievement is strongly influenced by students' intrinsic goal orientation of online learning settings. Interestingly, some studies reported that the enjoyment of learning which is a part of intrinsic motivation may be the main factor determining the consistency of students to study online learning [20,21]. Mekheimer (2025) [22] investigated student attitudes and motivation in online learning and claimed that teacher's confidence and preparation to utilise technology are significant to the online learning process. The study proved that active engagement with study during the online learning process are the main factors of the motivation to learn online.

Past Studies on Motivation to Learn Online

Post COVID-19 brings a new norm to teaching and learning where online learning has been embedded into the lesson to offer flexibility and accessibility. Deeper understanding and identifying the crucial components in boosting students' motivation could help institutions in crafting effective teaching and learning strategies and help the learners to stay engaged. Research on learners' motivation to study online reveals multifaceted factors.

Recent works have explored the correlation between the role of expectancy (self-efficacy, control of learning beliefs), value (task value, intrinsic and extrinsic goal orientation) and social support (social engagement and instructor support) in boosting students' motivation. According to Yusop et. al. (2022) [23], a study on Malaysian public universities involving 102 respondents using a questionnaire adopted from Fowler (2018) [24] reveals positive relationships between the components under study with motivation to learn online. It indicates that the interrelationship between motivational constructs is crucial in strategizing effective online learning to ensure students stay engaged.

Similarly, [25] examined the factors that influence the learners' motivation among 100 undergraduate students using a 5-point Likert scale. The study highlights positive correlations between online learning motivation with learner's behaviour (self-directed learning belief), extrinsic goal orientation, social support and relevancy of the content. However, the study also reported neutral responses in terms of instructor and peers' interaction.

Another example by [26] investigates the influence of intrinsic motivation among 89 undergraduate students taking the Social Marketing course measured by 24-item Likert-scale questionnaire. The study found that the learner's motivation was driven by strong intrinsic motives such as satisfaction from content comprehension, active participation in collaborative work, and achieving academic success. Furthermore, the students were found to strongly believe in their ability to succeed, self-regulate over their study and their emotional influences such as feeling anxiety during exams were also identified as contributing factors affecting their motivation. The findings suggest that identifying motivational components (Cognitive, Social and Affective) and their holistic strategies could enhance their motivation to stay engaged in online learning. Thus, the present study extends the investigation to STEM contexts such as Polymer Chemistry learners that require both cognitive and psychomotor skills in learning online.

Conceptual Framework of the Study

McClelland (1965) [9] proposed that motivation arises from three fundamental human needs: the need for power, achievement, and affiliation. In the context of online learning, these needs remain relevant, as learners continue to seek meaningful interaction and affirmation, similar to traditional face-to-face environments. Online learners, in particular, require certain motivational elements to stay engaged. Rahmat et al. (2021) [12] highlight that online students actively seek attention and recognition from both instructors and peers, which helps them feel connected and confident in their learning experience.

This study is conceptualized based on the understanding that learners' motivation in online environments is influenced by their need for affiliation, particularly in the form of social support. As shown in Figure 1, the framework draws upon Fowler's (2018) [24] model of motivational components in online learning, which identifies three key elements: social support, expectancy, and value. According to Fowler, students remain motivated when they perceive support from their learning environment, have confidence in their ability to succeed (expectancy), and find value in the learning tasks.

The current study focuses on examining the relationship between social support and expectancy, as well as the relationship between social support and value. By exploring these relationships, the study aims to determine the extent to which social support influences other motivational components in an online learning context.

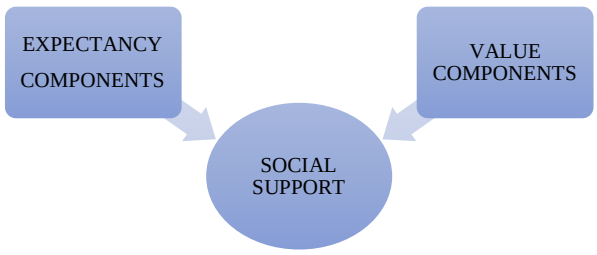

Fig. 1 Conceptual framework of the study. Relationship between social support and expectancy and value components.

METHODOLOGY

This quantitative study is done to explore learners' perception about motivation to lean online. A convenient sample of 109 participants across three branches of Universiti Teknologi MARA, Malaysia responded to the survey. The instrument used is a 5 Likert-scale survey. Table 1 below shows the categories used for the Likert scale; 1 is for Never, 2 is for Seldom, 3 is for Sometimes, 4 is for Often and 5 is for Almost Always.

Table 1 Likert Scale Use

1	Never
2	Seldom

3	Sometimes
4	Often
5	Almost Always

Table 2 shows the distribution of items in the survey. The instrument for this study is replicated from Fowler (2018) [24] to reveal the variables in table 2 below. Section B has 12 items on Expectancy. Section C has 16 items on Value and section D has 12 items on Social Support.

Table II Distribution of Items in the Survey

Section	Motivation (keyword)	Sub-scales	No of items	Tot items	Cronbach alpha
B	Expectancy	Self-Efficacy	7	12	.918
		Control of Learning Beliefs	5		
C	Value	Intrinsic Goal Orientation	5	16	.931
		Extrinsic Goal Orientation	5		
		Task Value	6		
D	Social support	Social Engagement	5	12	.891
		Instructor Support	7		
			TOTAL ITEMS	40	.963

Table 2 also shows the reliability of the survey. The analysis shows a Cronbach alpha of .918 for Expectancy, .931 for Value and .891 for Social Support. The overall Cronbach Alpha for all 40 items is .963; thus, revealing a good reliability of the instrument chosen/used. Further analysis using SPSS is done to present findings to answer the research questions for this study.

FINDINGS

Demographic Analysis

Table III Percentage for Demographic Profile

Question	Demographic Profile	Categories	Percentage (%)
1	Gender	Male	24%
		Female	76%
2	Semester	Part 1-3	2%
		Part 4-6	98%

The demographic profile of the respondents revealed that the majority were female students, accounting for 76%, while male students made up 24% of the total participants. In terms of academic standing, a significant

proportion of the respondents (98%) were from Part 4 to Part 6, indicating that most participants were senior students in their respective programs. Only a small fraction (2%) was from Part 1 to Part 3, suggesting that the findings primarily reflect the perspectives and experiences of more advanced students in the program.

Descriptive Statistics- Findings for Expectancy Components

This section presents data to answer research question 1- How do learners perceive their expectancy components in online learning? In the context of this study, this is measured by (i) self-efficacy and, (ii) control of learning beliefs.

The findings for the self-efficacy (ESE) component, which addresses Research Question 1 on learners' expectancy beliefs in online learning, indicate that students generally demonstrated moderate to high levels of confidence in their academic abilities. These results are illustrated in Fig. 2, which presents the mean scores for the self-efficacy items. Mean scores across the seven self-efficacy items ranged from 3.3 to 3.7, suggesting a consistent belief in their capability to succeed in an online learning environment. The highest mean scores (M = 3.7) were recorded for statements related to mastering basic concepts, performing well on assignments and tests, and managing academic challenges effectively, indicating strong confidence in core learning tasks.

In contrast, lower mean scores (M = 3.3) were associated with more complex learning activities, such as understanding difficult material from readings or instructor explanations, suggesting a slight decrease in confidence when dealing with abstract or challenging content. Overall, the results reflect a generally positive yet cautious self-efficacy perception, highlighting students' readiness to engage with online learning while acknowledging areas that may require additional support.

Figure 3 shows the mean for control of learning beliefs. The highest mean is item 3 (mean=4,SD=0.7) where the students state that if they tried hard enough, they would understand the material. Two items share the lowest mean of 3.7. First is item 4 (mean=3.7, SD=0.9) and it states that if they (the students) do not understand the material presented, that was because they did not try hard enough. Next is item 5 (mean=3.7, SD=0.9) that states that if the students did not understand the online material, it was their responsibility.

The findings from Figure 2 and Figure 3 provide important insights into students' expectancy components in online learning. Students demonstrate high confidence in handling fundamental academic tasks (as reflected in self-efficacy scores) and express a strong belief in the role of personal effort in achieving success (as shown in control of learning beliefs).

However, slightly lower mean scores for complex learning tasks and responsibility-based statements suggest that students may require additional instructional support, especially when navigating difficult materials or adapting to online learning environments.

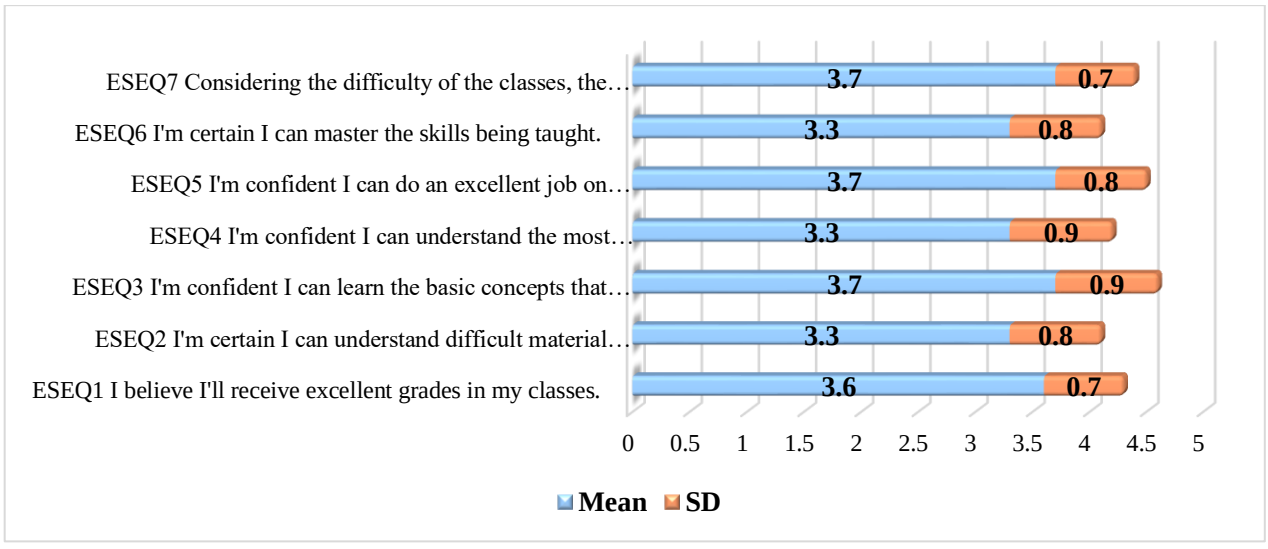

Fig. 2 Mean for self-efficacy (ESE)

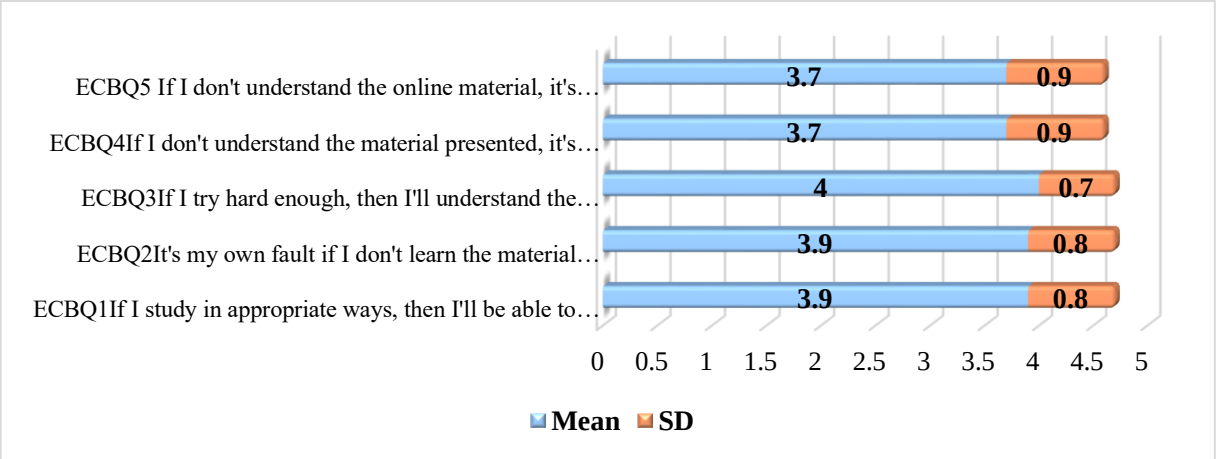

Fig. 3 Mean for control of learning belief

Descriptive Statistics- Findings for Value Components

This section presents data to answer research question 2- How do learners perceive their value components in online learning? In the context of this study, this is measured by (i) intrinsic goal orientation, (i) external goal orientation, and (iii) task value.

Intrinsic Goal Orientation (VI):

Figure 4 shows the Intrinsic Goal Orientation of motivation on learning online. The result clearly shows that the mean are moderate to high ranging from 3.4 to 3.7. The highest rated item (VIQ5, M = 3.7, SD = 0.8) where the students claimed that they are motivated to learn online including when dealing with their assignment on their own. Meanwhile, the lower rated item (VIQ11, M = 3.4, SD 0.9) as student online material challenges them to learn new content of knowledge. From Figure 4 it can be concluded that the students have a good attitude towards the challenges while learning online.

Extrinsic Goal Orientation (VE):

Meanwhile, Figure 5 shows the Extrinsic Goal Orientation (VE) of students with a high score ranging from 4.1 to 4.4 indicating that the student's motivation on online learning is mostly driven by external factors. The higher rated item (VEQ5, M = 4.3, SD = 0.8) where the students claimed that they are motivated in order to secure better paying jobs, promotions and financial stability. Whereas the lower rated items (VEQ2, M = 4.1, SD = 0.8 and VEQ3, M = 4.1, SD = 0.9) as the students tend to improve their overall grade point average and compete for better grades within the students in their class.

Task Value (VT):

The findings in Figure 6 reflect the task value (VT) component of motivation in online learning, revealing generally high mean scores across all statements, ranging from 3.9 to 4.1. These results suggest that students perceive the course content as meaningful, relevant, and applicable to their broader academic experience, which supports the value component of motivation described by [24]. The highest-rated item (VTQ6, M = 4.1, SD = 0.7) indicates that students place significant importance on understanding the subject matter, which aligns with McClelland's theory [9] of the need for achievement. The overall consistency of responses (SDs between 0.7 and 0.8) shows a shared perception of the course's value. When interpreted within the conceptual framework of this study, these findings suggest that value, as a motivational component, is strongly present in online learning. This reinforces the importance of examining whether social support, which is central to the need for affiliation, has a correlational relationship with perceived task value. If such a relationship exists, it may indicate that students who feel more socially supported are also more likely to find value in their coursework, which is essential for sustaining motivation in online environments.

Descriptive Statistics- Findings for Social Support

This section presents data to answer research question 3- How do learners perceive their social support in online learning? In the context of this study, this is measured by (i) social engagement and (ii) instructor support.

Social Engagement (SSE):

This section presents the analysis of data to answer research question 3 - How do learners perceive their social support in online learning? In this study, social support was measured by (i) Social Engagement, and (ii) Instructor Support.

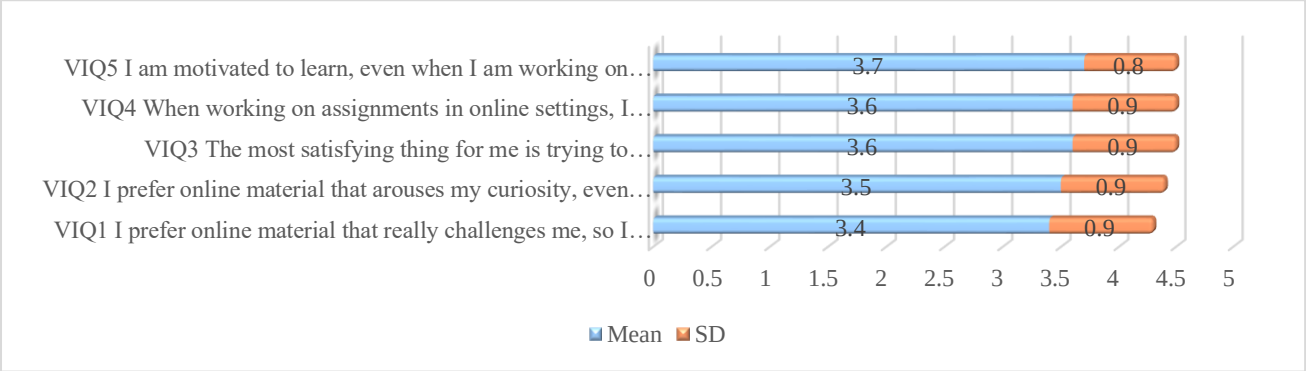

Fig. 4 Mean for Intrinsic Goal Orientation

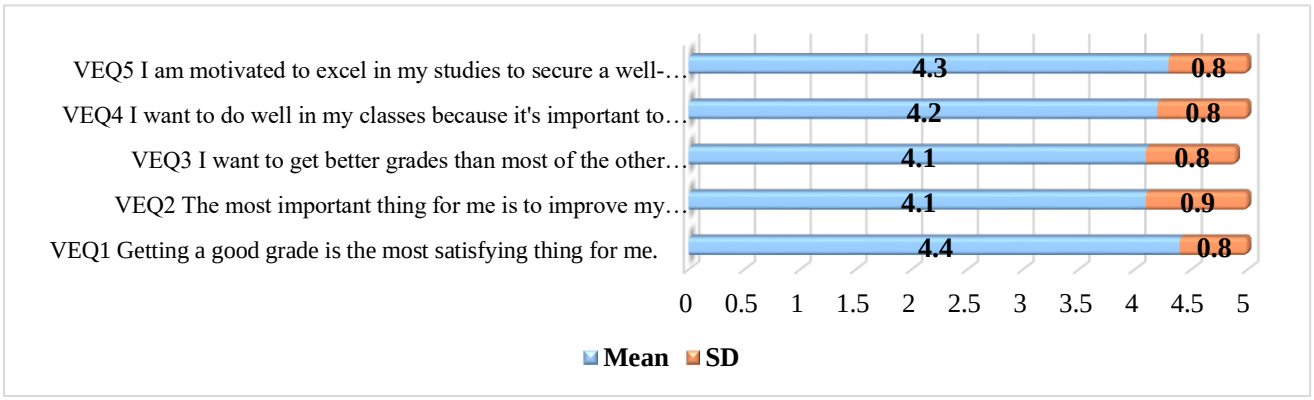

Fig. 5 Mean for Extrinsic Goal Orientation

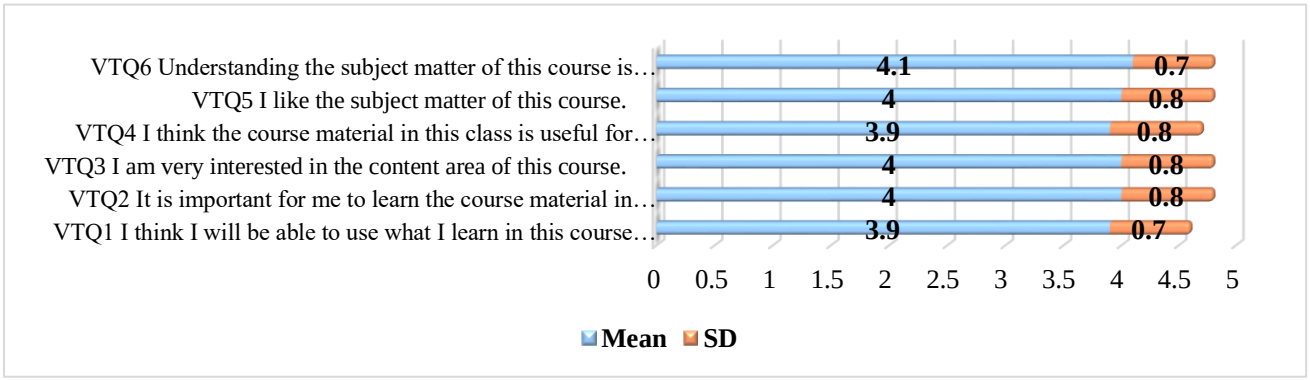

Fig. 6 Mean for Task Valu

The data in Figure 7 showed encouraging results with most indicators scoring high mean values suggesting strong association to peer interaction. The items such as strong relationships with fellow students (M=3.9, SD=0.8), pleasure in class discussion, (M = 4.0, SD = 0.7) and freely communicating to others (M = 3.9, SD = 0.8) are among the top scores suggesting positive peer engagement among the students. The students are also reported to pay attention during online learning (M = 3.8, SD = 0.8). These findings are consistent with

studies by [7] which emphasize the role of peer interaction on the Indonesian students' motivation. Similarly, strong social support contributes to learners' satisfaction in Chinese vocational students [27]. However, low mean value was observed for feeling of connection with the instructor demonstrating a gap in virtual social presence. This finding is in line with a study by [28] that highlighted the need for instructor roles for academic assistance in online learning. This study revealed that Polymer Chemistry students who particularly require understanding complex concepts and practical-based learning require instructor presence and guidance in virtual education. This data presented here suggests that even online settings promote peer interaction, but instructor presence plays a critical role in sustaining their motivation to learn online. In conclusion, there is a pressing need to enhance instructor-students connection as a holistic approach for online pedagogical strategies.

Instructor Support (SIS)

Figure 8 shows the mean values for the instructor support (SIS) component. Based on the data, all the items scored a high level of perceived instructional quality in online polymer chemistry learning with the mean values ranging from 4.0 - 4.3.

The instructor's role in giving prompt responses to students' inquiries is critical as evident by the high mean value (M = 4.3, SD = 0.7). This finding emphasizes that effective communication between instructors and students is crucial in sustaining their motivation and engagement. Students also positively perceived instructor guidance (M = 4.2), course content relevancy (M = 4.2), and periodic performance feedback (M = 4.1) as critical components in staying motivated. These results align with findings from [29] and [30] that highlight coursework relevance and constructive feedback boosting students' expectancy in their academic success. This finding suggests that the instructor guidance is equally crucial to bridge the complexity of chemistry-based content in online settings. Both items for self-regulated learning and freely communicating with the instructor scored the same mean values of 4.0, which further suggests that the needs of balancing autonomy learning, and supportive learning environment could encourage active participation and motivation of the students.

Exploratory Statistics

This section addresses Research Question 4: Is there a relationship among all components of motivation to learn in an online environment?

To examine the potential associations among the various motivational components, the data were analyzed using Pearson correlation in SPSS. The analysis aimed to determine whether there are statistically significant relationships between the mean scores of each motivational component. The results are summarized and presented in Tables 4 and 5 below.

Table IV Correlation Between Social Support And Value Components

		Social Support	Value Components
Social Support	Pearson (Correlation	1	.778**
	Sig (2-tailed)		.000
	N	109	109
Value	Pearson (Correlation	.778**	1

Components			
	Sig (2-tailed)	.000	
	N	109	109

Table 4 shows there is an association between social support and value components. Correlation analysis shows that there is a highly significant association between social support and value components (r=.778**) and (p=.000). According to [31], 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 strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between social support and value components.

Table 5 shows there is an association between social support and expectancy components. Correlation analysis shows that there is a highly significant association between support and expectancy components (r=.723**) and (p=.000).

Table IV Correlation Between Social Support And ExpectancyComponents

		Social Support	Expectancy Components
Social Support	Pearson (Correlation	1	.723**
	Sig (2-tailed)		.000
	N	109	109
Expectancy Components	Pearson (Correlation	.723**	1
	Sig (2-tailed)	.000	
	N	109	109

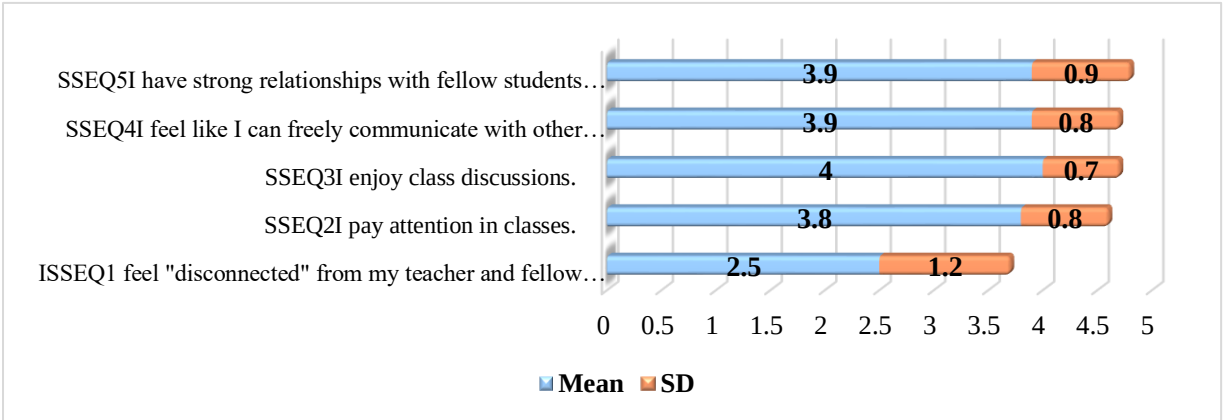

Fig. 7 Mean for Social Engagement

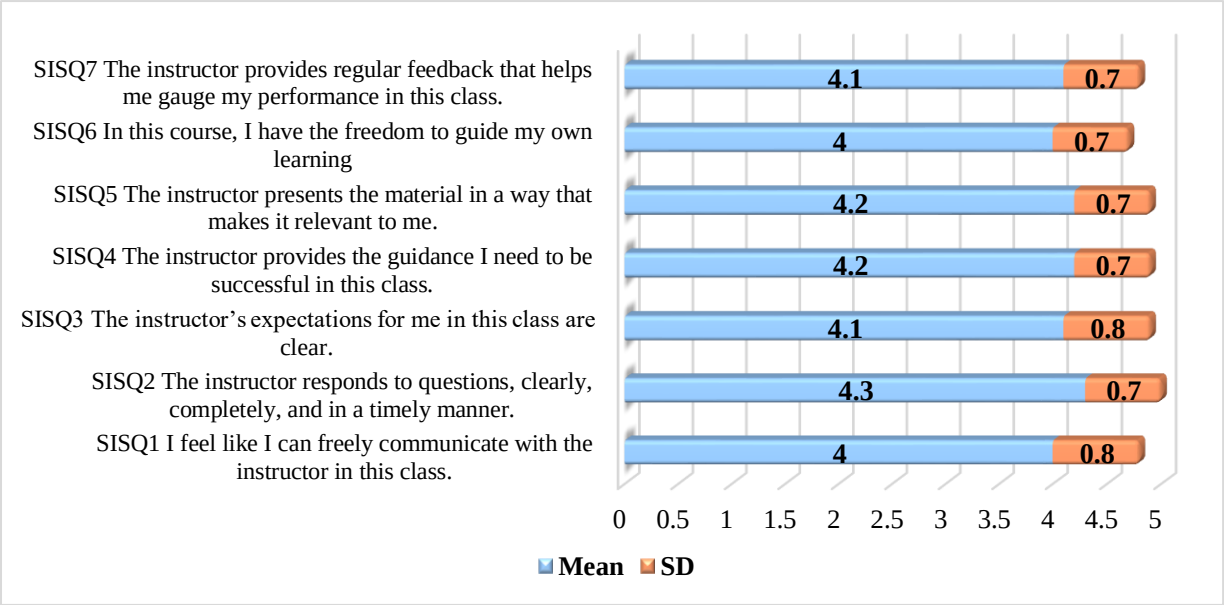

Fig. 8 Mean for Instructor Support

According to [31], 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 strong positive correlation from 0.5 to 1.0. This means that there is also a strong positive relationship between support and expectancy components.

CONCLUSIONS

Summary of Findings and Discussions

This study explored the relationship between social support and key motivational components expectancy and value in the context of online Polymer Chemistry learning among undergraduate students in Universiti Teknologi MARA Malaysia. Findings from the study offer several important insights into how motivation is sustained in a high-cognitive STEM environment through the lens of expectancy-value theory and McClelland's Theory of Needs.

Research Question 1 investigated learners' perceptions of expectancy components. Overall, students reported moderate to high self-efficacy and control of learning beliefs. They felt confident in completing core tasks but expressed slightly lower confidence when engaging with complex or abstract content in online formats. These findings align with [3] who also found that STEM learners require stronger internal motivation and clarity of learning design due to the abstract nature of their subjects. The results support McClelland's concept of the need for achievement (nAch) and indicate that perceived capability remains a vital driver for student motivation in chemistry-based online education.

Research Question 2 examined the value components, including intrinsic and extrinsic goal orientation and task value. The highest motivation was observed in extrinsic goal orientation, where students emphasized grades, recognition, and future career goals as primary motivators, echoing the findings of [25] and [26]. Task value was also notably high, with students perceiving the course as important and relevant. These findings suggest that online learners in STEM are deeply driven by pragmatic and achievement-oriented values, consistent with [10], who stated that task value and perceived utility strongly influence engagement, especially in career-relevant subjects.

Research Question 3 focused on students' perceptions of social support. Students reported high levels of instructor support and peer interaction, though one item, which is feeling disconnected from instructors, revealed a gap in perceived social presence. These results resonate with [28] and [27], who highlight the essential role of instructor feedback and communication in sustaining motivation. The high levels of peer

support affirm the findings by [7] and [23], reinforcing the idea that affiliation and social connection remain central to learner persistence in online spaces.

Research Question 4 explored the relationship between social support and the other motivational components. Statistical analysis confirmed strong positive correlations between social support and expectancy (r = .723), and between social support and value (r = .778). These findings are in accordance with [6] and [12], who demonstrated that social connection and supportive learning environments significantly influence motivational beliefs. The results further validate [24] assertion that social support is a foundational motivational driver in online learning. In line with [11], these findings emphasize the significance of modeling, interaction, and presence, even in virtual environments, especially in practical-based subjects like Polymer Chemistry.

Implications and Suggestions for Future Research

Theoretical and Conceptual Implications

The study confirms the relevance of McClelland's Theory of Needs (1965) [9] and the Expectancy-Value Theory [10] in the context of online STEM education. It extends these theories by demonstrating that social support (affiliation) not only sustains motivation but also enhances students' expectancy beliefs and task valuation in content-heavy, lab-intensive subjects. The findings suggest a theoretical bridge between cognitive motivation and social-emotional support systems in virtual learning environments. Moreover, the integration of psychomotor and affective needs into motivational theories may be essential when addressing practical-based online instruction like Chemistry.

Pedagogical Implications*:*

Given that social support significantly influences both expectancy and value, instructors must prioritize interaction, feedback, and relational presence in online environments. For subjects like Polymer Chemistry, where students deal with abstract and experimental content, a pedagogy of presence is critical. This includes regular live sessions, instructor-initiated check-ins, timely feedback, and opportunities for collaborative learning. Institutions should also invest in training faculty to design online Chemistry content that blends cognitive and social strategies, including virtual labs, peer tutorials, and group simulations to support learner autonomy while nurturing social connectedness.

Suggestions for Future Research

Future studies should investigate longitudinal effects of social support on learner motivation across different stages of an academic program, particularly comparing novice and advanced STEM learners. Additionally, qualitative studies can provide deeper insights into how students experience support and value in different instructional designs, such as fully asynchronous versus hybrid models. Another important direction is exploring how cultural values and language context influence students' interpretation of motivation and affiliation in online learning, particularly in the Malaysian and Southeast Asian setting. Finally, further research could examine the integration of psychomotor skills in online chemistry labs and how it correlates with motivational shifts over time.

ACKNOWLEDGMENT

The authors gratefully acknowledge the support provided by Universiti Teknologi MARA (UiTM). Special appreciation is extended to Prof. Dr. Noor Hanim Rahmat for her guidance in data processing, analysis, and in the preparation of this manuscript.

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