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KEY ELEMENTS INFLUENCING COLLABORATIVE LEARNING SUCCESS IN ONLINE MENTORING PROGRAMS

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Abstract:

This study investigates the contributing factors that influence students' perceived learning gains in the e-peer mentoring program implemented for low-performing students within a collaborative learning environment. It was conducted among diploma students enrolled in Calculus I at Universiti Teknologi MARA (UiTM) Cawangan Kelantan to determine which aspects of the mentoring experience most significantly support students' academic improvement during the e-peer mentoring program. Grounded in existing literature, six key variables: student motivation, problem-solving skills, knowledge skills, mentoring training, self-efficacy, and mentor credibility were identified as fundamental contributors to the success of e-peer mentoring program initiatives. A quantitative approach was used, involving 83 students who participated in the program. Data were collected using a set of questionnaires and then analysed using statistical techniques such as descriptive statistics, Pearson correlation, and multiple regression analysis. The statistical findings revealed that all six factors had significant positive correlations with students perceived academic benefit ($p < 0.05$). The

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regression model was statistically significant ($F(2, 80) = 40.834, p < 0.05$), with an R^2 value of 0.505, indicating that over half of the variance in perceived gains could be explained by the model. Among the six predictors, student motivation ($\beta = 0.465, p = 0.001$) and knowledge skill ($\beta = 0.324, p = 0.002$) were identified as the most influential factors. These results highlight the critical role of internal drive and content mastery in supporting meaningful student engagement during the e-peer mentoring program. This study provides practical implications for educators and instructional designers aiming to enhance digital mentoring programs to better support at-risk learners.

Keywords:

e-Peer Mentoring, Student Motivation, Problem-Solving Skills, Knowledge Skills, Mentor Training, Self-Efficacy, Mentor Credibility

Introduction

Collaboration has been widely used in many fields and has become the trend since the 21st century, shifting from individual work to group efforts to overcome any arising issues or goals. By working together, many great things can be accomplished, as quoted by Henry Ford, the founder of the automobile industry: *"Coming together is a beginning, keeping together is progress and working together is success"* (Ponde, 2021). Collaboration was used as one of the pedagogical instruments in the education system, known as collaborative learning which involves a group of students working together to solve a task or problems given to them. Collaborative learning is used to achieve an educational goal that depends on the student's participation in the teaching and learning activity switching from teacher-centred learning to student-centred learning. This approach is proven practical by many educators to facilitate students to maximise students' critical thinking and preserve knowledge for a longer time than individual learning (Salma, 2020).

Peer mentoring is a type of collaborative learning between peers (students with similar age groups and experience), and e-peer mentoring is a mentoring system where technology and online platforms are used. The mentoring system has evolved as technology has been used and now can be conducted remotely via video call, text messages, online conferencing, and many other suitable mediums. Technology provides opportunities for greater flexibility in the learning activity, provides cost-effectiveness, and the medium used is less intimidating compared to a face-to-face setting. Peer mentoring serves as an academic and emotional support system for students to ensure their survival in the higher education system. Peer mentoring and peer learning showed more significant positive outcomes for reducing anxiety and stress (Pointon-Haas et al., 2024) and there is strong linkage between peer mentoring and reduction of stress level among students (Lalwania & Kartsonaki, 2024).

Peer mentoring was first introduced as a prevention strategy to reduce the failure rate for core mathematics courses in UiTM Cawangan Kelantan in 2016. The programme showed the improvement and reduction of failure rate to less than 10% after the program was conducted. The program was then extended and switched from face-to-face to an online platform (e-peer mentoring) beginning in 2021 as a support system for students learning during the COVID-19 pandemic since many university students struggling mentally during pandemic COVID-19 (Deep & Chen, 2025; Ren, Sotardi, & Brown, 2025). Post-COVID-19, the program was

extended to promote active participation and teamwork among students since almost all courses have assessments related to group work.

The e-peer mentoring model was explained in the research by Rasat, Ismail, Othman, Suhaimin & Abd Manaf (2023). The process of handling the program involves the selection of mentors and mentees, the training of mentors by educators, exposing both mentors and mentees to familiarise them with the goals of the peer mentoring program, and the last process is the monitoring stage to evaluate the result of mentoring activities for improvement purposes.

In this type of learning activity, the communication that occurs between students can activate their mental functions to maximize thinking and reasoning and unconsciously enrich their potential and enhance their knowledge. As each student is accountable for each other's learning, it will automatically promote active participation, as they not only absorb the knowledge as input but also have accountability to contribute to others' learning. Through this activity, students can clarify their understanding, have deep discussions, make arguments to clarify the misunderstanding, and collaborate with other students to enhance their interpretation and understanding in mathematics courses. Other benefits of collaborative learning include celebration of diversity, acknowledgement of individual differences, interpersonal development, and more opportunities for personal feedback (Chandra, 2015).

There are also lots of challenges that need to be addressed to ensure the success of online peer mentoring. This type of learning is considered successful if the goal of the program is achieved. Many factors contribute to the effectiveness of this type of learning method, and some of them are the learning environment (Wu, 2023), the knowledge skills possessed by all members in the group (Gkioka, 2025), individual and collective motivation (Sainsbury & Walker, 2012), the learning motivation of members, the level of trust between members in the group, and many more.

In this paper, the focus is on determining all potential factors that contribute significantly to the effectiveness of the e-peer mentoring conducted from the perspective of the mentee (lower-performing students). This research was conducted based on the feedback obtained from the e-peer mentoring program to determine two objectives, which are first, to determine the relationship between student motivation, problem-solving skills, knowledge skills, peer mentoring training, self-efficacy, and mentor credibility towards the effectiveness of the e-peer mentoring program, and second, to determine the most important factors that affect the effectiveness of the e-peer mentoring program. All the factors considered are represented by the following theoretical framework.

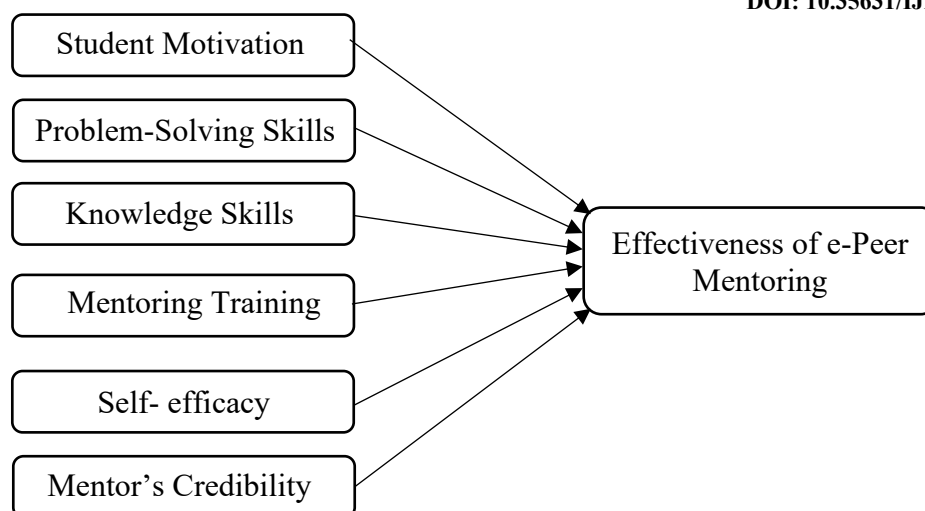


Figure 1: Theoretical Framework

Source: Data Collection from Questionnaire

Literature Review

The increasing integration of technology into educational contexts has led to the rise of e-peer mentoring programs, where mentoring takes place through digital platforms. These programs aim to provide support, guidance, and learning opportunities to mentees, like traditional peer mentoring, but with the added convenience and accessibility of online platforms. However, the effectiveness of e-peer mentoring programs is contingent upon various factors, particularly the mentee's characteristics. This literature review explores the role of six key variables, which are student motivation, problem-solving skills, knowledge skills, peer mentoring training, self-efficacy (self-confident), and mentor's credibility to determine the success and effectiveness of e-peer mentoring programs.

Motivation

Motivation is a critical factor that influences the effectiveness of any mentoring program. Students are expected to have self-motivation to meet the expected goals by playing their role and engaging with others in the group setting. In the context of e-peer mentoring, motivation plays an essential role in the mentee's engagement and commitment to the process. Research indicates that mentees with high levels of intrinsic motivation are more likely to actively engage in the mentoring relationship, seek guidance, and apply feedback effectively (Deci & Ryan, 2008). Furthermore, motivated mentees tend to demonstrate higher persistence in completing tasks and achieving goals, which enhances the overall outcomes of the mentoring experience (Zimmerman, 2000). In e-peer mentoring programs, where interactions are often mediated by technology, mentees' motivation can determine how well they leverage the digital tools available for communication and learning.

Problem-Solving Skills

In collaborative learning, problem-solving skills also contribute to the effectiveness of group activity. It can handle the decision-making process after considering all possible alternatives before choosing the best solution from the available selection. Problem-solving skills refer to the skill to discover the solutions to a problem, either problem-solving handling conflicts during group activity, or skills needed to solve Mathematics problems. Problem-solving skills are essential in the mentoring process, as they enable mentees to navigate challenges and apply

learnt strategies effectively. In e-peer mentoring, where communication may be less direct than in traditional face-to-face mentoring, mentees with strong problem-solving abilities are better equipped to manage and overcome obstacles without constant guidance (Schunk, 1991). Studies show that mentees with developed problem-solving skills tend to take greater initiative in their learning, ask relevant questions, and utilise the support provided by mentors more effectively (Ericsson, Krampe, & Tesch-Römer, 1993). In an online context, this skill is even more crucial, as mentees may need to independently navigate resources, technologies, and self-directed learning opportunities provided through e-peer mentoring platforms.

Knowledge Skills

The knowledge skills possessed by students in the e-peer mentoring program refer to the mentee's good understanding of how the mentoring system works, their conceptual knowledge of identifying what they will benefit from in the program, and their understanding of their role in the mentoring relationship to achieve the expected goal. Since the mentoring program involve students with different abilities to perform in Mathematics tasks, it is important for students to self-manage themselves in the appropriate direction and use the collaboration to their advantage. A mentee's existing knowledge base significantly impacts their ability to benefit from mentoring, especially in an e-peer mentoring setting. Mentees who possess a certain level of prior knowledge in the area being mentored are more likely to engage deeply with the mentoring process and apply the insights provided by their mentor. In e-peer mentoring programs, mentees with a stronger foundational understanding can interact more effectively with digital resources, ask meaningful questions, and comprehend feedback with greater ease (Topping, 2005). Furthermore, research suggests that mentees who enter a mentoring relationship with a higher level of subject-specific knowledge tend to have more successful mentoring outcomes, as they are better able to synthesise new information and integrate it into their existing knowledge structures (Ross, Bruderle, & Meakim, 2015).

Mentoring Training

Effective peer mentoring begins with well-structured training programs designed to prepare mentors for the diverse needs of mentees. This structured mentor preparation ensures that mentors possess the interpersonal, academic, and technical skills needed to support mentees, especially in a virtual context. Mokhampanyane (2022) suggested that continuous development and training for mentors are essential to keep them updated with current trends in peer mentoring at universities globally. This training can enhance the mentors' effectiveness and ensure they provide the best support for their mentees. Similarly, Gehreke, Schilling, & Kauffeld (2024) reported that structured peer mentoring programs positively impact students' academic and social integration.

Self-Efficacy

Moreover, self-efficacy, defined as one's belief in their ability to succeed, also plays a pivotal role in mentee development. According to Bandura (1977), Social Cognitive Theory self-efficacy influences motivation and performance. Recent studies have demonstrated that mentees participating in peer mentoring programs exhibit increased self-efficacy, leading to better academic performance and persistence (Galamiton, 2025; Mokhampanyane, 2022; Morris, Agbonlahor, Winters, & Donelson, 2023). In the context of e-peer mentoring, the flexibility and accessibility of online interactions can further boost self-efficacy by allowing mentees to seek support as needed, fostering a sense of autonomy and control over their learning.

Mentor's Credibility

There is not much discussion on the influence of a mentor's credibility or professionalism on the effectiveness of a mentoring program compared to the outcome and benefits the program offers. In peer mentoring and collaborative learning environments, a mentor's credibility plays a vital role in ensuring successful outcomes. A mentor's credibility is the degree to which a mentee perceives their mentor as trustworthy, knowledgeable, and approachable. McCroskey and Teven (1999) emphasised that a mentor's credibility leads to greater trust and openness. In e-peer mentoring, establishing credibility through consistent communication and demonstrated knowledge is vital since the face-to-face interactions are limited. It significantly affects mentee satisfaction and learning outcomes. Collier (2017) highlighted that the development of a mentor's credibility is essential, as doubts regarding a mentor's motivation and competence may lead students to disregard their guidance. A mentor is considered approachable if they can influence their mentee by creating a supportive and open environment. Mentors with this trait are normally friendly, non-judgmental, and easy to talk to, and people feel comfortable when sharing challenges, questions, or insecurities with them. This credibility is crucial, as it establishes trust and encourages mentees to engage more actively in the mentoring process and hence contribute to the effectiveness of the program.

The literature study indicates that the efficacy of online mentoring programs, especially in promoting collaborative learning, is influenced by various interconnected aspects. Although prior research has highlighted the significance of mentee attributes, including motivation, problem-solving abilities, prior knowledge, self-efficacy, and perceptions of mentor credibility, alongside mentor-related factors such as structured training, gaps persist in comprehending how these components collectively impact learning outcomes in digital mentoring contexts. This study aims to investigate the critical factors affecting the performance of collaborative learning in e-peer mentoring programs, thereby addressing existing gaps and offering a framework for more effective implementation.

Research Methodology

This research is categorised as qualitative research whereas correlational research design has been used. Correlational research design examines the relationship between variables, which indicates how two or more variables are related to another variable (Salkind, 2012). The collaborative learning model for this research follows the research done by Rasat et al. (2023) involving four main stages. All students are divided into 5 groups, and each student in the group was assigned a task for a specific topic. Students with the same topics are gathered and guided by a mentor. After completing the discussion stage with the mentor, all mentees will then return to their original group to start the stage of transferring knowledge obtained from the previously discussed topic with other mentees. The last stages continued until all 5 topics given were discussed in all groups.

Population and Method of Data Collection

The respondents for this research are 83 FSKM students at UiTM Cawangan Kelantan who took part in the e-peer mentoring program, which consists of students from Diploma in Mathematical Sciences (CS143) and Diploma in Computer Science (CS110) who enrolled in Calculus 1 (MAT183). Since there is a small population of 83 students, this research focuses on using all students as a census study. The source of data for this research is primary data, which were acquired through questionnaires which adapted from Noufou, Rezania, & Hossain

(2014). The questionnaire was designed using a 5-point Likert scale; strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

Research Findings

Normality Test

In statistics, the normality test is used to determine whether a data set is normally distributed. This research uses skewness to measure asymmetry of the probability distribution of a random variable about its mean. The skewness value can be positive or negative, or even undefined. Pallant (2011) stated that -1.0 to 1.0 is an acceptable range for the data to be normally distributed.

Table 1: Skewness Result

Skewness value
Skewness -0.416

Source: Data Analysis from Questionnaire

Based on Table 1, the measure of skewness is -0.416 and falls within the range of -1.0 and 1.0. Therefore, the data for this study are normally distributed.

Reliability Test

The reliability analysis was conducted by computing Cronbach's Alpha for each section. The acceptable alpha value in reliability analysis is 0.7 in the ability test case (Kline, 1999). Table 2 shows that the Cronbach's Alpha values for all variables are greater than or equal to 0.837. This indicates that the questions for the variables in the questionnaires are valid.

Table 2: Cronbach's Alpha Values

Variables	Cronbach's Alpha	No. of question
The Effectiveness of the e-Peer Mentoring Program	0.923	3
Student Motivation	0.837	3
Problem-Solving Skills	0.909	3
Knowledge Skills	0.939	3
Peer Mentoring Training	0.905	3
Self-efficacy	0.923	3
Mentor's Credibility	0.933	3

Source: Data Analysis from Questionnaire

Descriptive Statistics

The descriptive analysis of this research comprises the respondents' gender. Table 3 illustrates the percentages of distribution of frequency for the item gender. Total number of samples is 83, and 60.2% (50) of the respondents are females, while the balance 39.8% (33) are males.

Table 3: Gender

Example	Example	Example
Male	33	39.8
Female	50	60.2
Total	83	100

Source: Data Analysis from Questionnaire

Inferential Statistics

In determining the objectives, a series of tests needs to be done. A correlation test is performed to determine the relationship between student motivation, problem-solving skills, knowledge skills, peer mentoring training, self-efficacy, mentor credibility, and the effectiveness of the e-peer mentoring program. Based on Table 4 below, this research found that all variables have a significant positive relationship towards the effectiveness of the e-peer mentoring program ($p < 0.05$). The r -value for student motivation, knowledge skills, peer mentoring training, and self-efficacy are 0.608, 0.663, 0.627, and 0.607, respectively. This shows that these variables have a high positive relationship with the effectiveness of the e-peer mentoring program. In addition, problem-solving skills and a mentor's credibility have moderate positive relationships with the effectiveness of the e-peer mentoring program since the r -values are 0.462 and 0.546, respectively.

Table 4: Pearson Correlation Result

Variable	The Effectiveness of the e-Peer Mentoring Program		Level
	Pearson Correlation	Significant	
Student Motivation	0.608	0.000	High
Problem-Solving Skills	0.462	0.000	Moderate
Knowledge Skills	0.663	0.000	High
Peer mentoring training	0.627	0.000	High
Self-efficacy	0.607	0.000	High
Mentor's credibility	0.546	0.000	Moderate

Source: Data Analysis from Questionnaire

Table 5 displays the model summary for the regression model. The value of R Square is 0.505 shows that 50.5% variation in the effectiveness of the e-peer mentoring program is due to the independent variable: student motivation and knowledge skills.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	0.711 ^b	0.505	0.493	0.43570

b. Predictors: (Constant), Student Motivation, and Knowledge Skills

Source: Data Analysis from Questionnaire

F -statistics were carried out to find the overall strength of the model. Table 6 shows that the value of the F -statistics is 40.834 and the p -value is less than 0.05, indicating that the data used in the research fit the model.

Table 6: ANOVA Result

ANOVA ^a						
	Model	Sum of Squares	df	Mean Square	<i>F</i>	Sig.
2	Regression	15.504	2	7.752	40.834	0.000c
	Residual	15.187	80	0.190		
	Total	30.691	82			

a. Dependent Variable: The Effectiveness of the e-Peer Mentoring Program

b. Predictors: (Constant), Student Motivation, and Knowledge Skills

Source: Data Analysis from Questionnaire

Table 7 displays the regression model result that shows only two independent variables that significantly influence the effectiveness of the e-peer mentoring program, which are student motivation and knowledge skills ($p < 0.05$).

Table 7: Regression Model Result

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
2	(Constant)	0.452	0.456		0.991	0.325
	Student Motivation	0.509	0.109	0.465	4.675	0.001
	Knowledge Skills	0.387	0.119	0.324	3.255	0.002

a. Dependent Variable: The Effectiveness of e-Peer Mentoring Program

Source: Data Analysis from Questionnaire

Four variables which are problem-solving skills, peer mentoring training, self-efficacy, and mentor's credibility were removed from the model using the stepwise selection method since the p-values are greater than 0.05. Therefore, the final regression model is shown below.

$$Y = B_0 + 0.509X_1 + 0.387X_3$$

The effectiveness of e-peer mentoring
 $= 0.452 + 0.509$ (Student Motivation) $+ 0.387$ (Knowledge Skills)

Conclusion

The results of this research found that there are significant positive relationships between student motivations, problem-solving skills, knowledge skills, peer mentoring training, self-efficacy, and mentors' credibility towards the effectiveness of the e-peer mentoring program since all the p-values are less than 0.05. In addition, out of these six factors, only the student motivation and knowledge skills are perceived as the most important factors that affect the effectiveness of the e-peer mentoring program. This suggests that motivated students with the skills to gain knowledge will help them to improve their performance, so that the experience of helping each other will become UiTM students' organisational culture in the future. Future research could be conducted by using larger samples from other mathematics courses, such as differential equations, and involving all students to improve the generalisability of the results.

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