

EVALUATION OF A DIGITAL PROJECT-BASED MATHEMATICS LEARNING APPROACH IN HIGHER EDUCATION: AN ANALYTICAL PROCEDURE IN STRUCTURAL EQUATION MODELLING

*(Penilaian Pendekatan Pembelajaran Matematik Berasaskan Projek Digital
dalam Pendidikan Tinggi: Prosedur Analitik dalam
Pemodelan Persamaan Struktur)*

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ABSTRACT

Due to the rapid changes in technology, implementing digital project-based or technology-enabled learning approaches are the new initiatives in higher education. Learning mathematics through conventional methods often leads to disengagement and lack of motivation among students. To encounter the problems raised in conventional learning environment, a video assignment project was implemented to enhance collaborative learning. This paper aims to explore the students' perception and attitude towards the video assignment project. In this study, data was collected from 202 students of whom have completed the video assignment project in mathematics using a questionnaire developed based on Technology Acceptance Model (TAM). Two-step analytical procedures in structural equation modelling by using partial least squares were applied in analysing the data. Results showed that the students' perspective on the enjoyment in completing the project, ease of use regarding technology in video creation and the perceived usefulness of the project were the contributing factors that lead to a positive attitude towards the video assignment project. Positive correlations were also found among these variables. The implications of this work were important for both educators and researchers where the research findings indicated that the video assignment in mathematics could be a useful learning approach that engage students in active learning, develop a wide range of soft skills and increase their interest in leaning mathematics.

Keywords: mathematics; structural equation modelling; Technology Acceptance Model

ABSTRAK

Disebabkan oleh perubahan pesat dalam teknologi, pelaksanaan pendekatan pembelajaran berasaskan projek atau teknologi digital merupakan inisiatif baharu dalam pendidikan tinggi. Pembelajaran matematik melalui kaedah konvensional selalunya membawa kepada ketidakterlibatan dan kekurangan motivasi dalam kalangan pelajar. Untuk mengatasi masalah yang dibangkitkan dalam persekitaran pembelajaran konvensional, projek tugas video telah dilaksanakan untuk meningkatkan pembelajaran kolaboratif. Kertas kerja ini bertujuan untuk meneroka persepsi dan sikap pelajar terhadap projek tugas video. Dalam kajian ini, data telah dikumpul daripada 202 pelajar yang telah menyiapkan projek tugas video dalam matematik menggunakan soal selidik yang dibangunkan berdasarkan Model Penerimaan Teknologi (TAM). Prosedur analisis dua langkah dalam pemodelan persamaan struktur dengan menggunakan kuasa dua terkecil separa telah digunakan dalam menganalisis data. Keputusan menunjukkan bahawa perspektif pelajar tentang keseronokan menyiapkan projek, kemudahan penggunaan teknologi dalam penciptaan video dan persepsi kegunaan projek adalah faktor penyumbang yang membawa kepada sikap positif terhadap projek tugas video. Kolerasi positif juga didapati antara pemboleh ubah ini. Implikasi kerja ini adalah penting untuk pendidik dan penyelidik di mana dapatan kajian menunjukkan bahawa tugas video dalam matematik boleh menjadi pendekatan pembelajaran berguna yang melibatkan pelajar

dalam pembelajaran aktif, membangunkan pelbagai kemahiran insaniah dan meningkatkan minat mereka dalam pembelajaran matematik.

Kata kunci: matematik; pemodelan persamaan struktur; Model Penerimaan Teknologi

1. Introduction

In conventional teaching and learning environment in mathematics, lecturer acts as the main instructor to transfer knowledge to students. This method often relies on a one-size-fits-all approach, where the instructor acts as the primary source of knowledge and the students are expected to absorb the information passively. This approach can lead to disengagement and lack of motivation among some students, especially those who require more interactive and participatory learning experiences. As a result, students who do not have self-discipline or motivation often hold less responsibility in this traditional learning approach. Promoting students' learning motivation, self-efficacy, and learning achievement in mathematics have been recognised as a challenging issue and it was discussed in many studies (Abubakar *et al.* 2024; Schukajlow *et al.* 2023; Hung *et al.* 2014; Peters 2013; Vukovic *et al.* 2013).

In the current study, a group of lecturers from a public university in Malaysia has implemented a video assignment project in mathematics courses to enhance collaborative learning. This project was also aimed to expose students to an alternative learning method in the conventional instructional settings. The students who participated in this video assignment project were asked to form a team that consisted of three to four members who took the same mathematics course. Each team was required to complete a video related to mathematics application.

There were few studies detailing evidence on students' perspective on video assignment project in mathematics (Loch & Lamborn 2015; Huang *et al.* 2020; Gouia & Gunn 2016). In response, this study aims to explore the students' perception and attitude towards the project using a survey study. In relation to the purpose of this study, the following research question is addressed: What are the students' perceptions and attitude towards the video assignment project in mathematics?

To address the research question, we proposed a research model to examine students' perception and students' attitude towards the video assignment project based on Technology Acceptance Model (TAM). A questionnaire based on the proposed research model was developed and it was used as the survey instrument in this study. In addition, descriptive statistics of the study variables from the survey were also analysed.

By introducing video assignment project as a project-based learning approach that emphasises collaborative learning and active learning, it can help address some of the problems associated with traditional teaching and learning approaches. It could also promote greater engagement and motivation among students. The results of this study provide an insight into what are the students' perception and attitude towards the video assignment project in mathematics, and how the project benefits students in terms of acquiring various skills and knowledge throughout the project. Thus, the research findings could lead to an improvement in teaching and learning methods.

2. Literature Review

Educators have tried to propose various effective learning methods in conventional instructional settings. These approaches can take many forms, including group discussions,

project-based learning, and experiential learning (Kokotsaki *et al.* 2016; Efstratia 2014). By actively participating in their own learning, students can develop a deeper understanding of the mathematics lesson and a greater sense of ownership over their learning. Bell (2010) stated that project-based learning is an innovative method to learning that imparts a wide range of skills essential for success in the twenty-first century.

By introducing project-based learning, students are able to drive their own learning, work collaboratively to study and create projects that demonstrate their understanding. Students learn to solve problems, complete tasks, learn new knowledge and skills by working collaboratively to complete a project in a group. This could promote active learning and student engagement. It also helps students to develop important social and interpersonal skills such as communication, teamwork, conflict resolution, and problem-solving skills. These skills are essential for them to work in a team effectively when they enter industry after graduation (Acero *et al.* 2022).

Due to the rapid changes in technology, implementing digital project-based or technology-enabled learning approaches were the new initiatives in higher education sector (Knoblauch 2022; Gan *et al.* 2015). A study by Greene and Crespi (2012) suggested that video creation project was a tool to enhance student learning experience as students found it entertaining, and it also helped to reinforce concepts that they were exposed to in the class.

2.1. Project-based learning in mathematics

Project-based learning is an education that is based on the participation of the learners in the learning process. It is also an education that is integrated into the learners' real life. And, it is an education that connects learning to the learners' own experience. The connection between the theory and practice was a significant key while designing the project-based learning (Viro *et al.* 2020). To prepare the students with some essential skills for their future, project-based learning has been adopted in many institutions as it focuses on learner-centered teaching strategy (Helm & Katz 2016; Kolmos & De Graaff 2014; Somerville *et al.* 2005).

There are numerous studies highlighting the positive impacts of implementing project-based learning in mathematics area (Lazic *et al.* 2021; Anazifa & Djukri 2017). The knowledge learned in such a process is more valuable to the learners since it is related to their experiences and the learners understand the significance of learning (Lazic *et al.* 2021). In this approach, learners are able to understand the theory of mathematics as well as feel motivated to complete the tasks through inquiry based and constructive investigation. Project-based learning helps learners to develop higher-order thinking skills such as critical thinking. As presented in literature, students benefited from project-based learning as they participated actively in the learning process.

In the current study, the video assignment project that was implemented involved project-based learning and it aimed to expose students with an alternative learning method in mathematics.

2.2. Previous studies related to video assignment

The higher education system has experienced a great transformation with the assistance of rapid advances in Information and Communication Technologies (ICTs). Along with this growth, the learning and teaching methodologies are improved by incorporating technology in the classroom to produce outstanding outcomes. One of technology tools applies is the digital video in which educators used it as the teaching supplementary. Not limited to this, the assessment approach nowadays is designed to expose learners to video assignment for the purpose of twenty-first century learning.

Several attempts have been made to explore the effectiveness of video assignments on students for various subjects (Sumardi *et al.* 2020; Campbell & Cox 2018; Pappas *et al.* 2017; Eligar & Banakar 2016; Raju *et al.* 2015; Stockwell *et al.* 2015). Taken together, these results suggest that video assignments can help students to improve their communication skills, cultivate creativity, promote problem solving skills and enhance their competency in using ICTs. Although extensive research has been carried out on video assignments created by students, few works have been able to focus on mathematics subjects. Besides, most studies to date have tended to discuss on preparation of video as a teaching material by the mathematics educators (Murtafiah *et al.* 2020; Nielsen 2020; Purwaningsih *et al.* 2020) rather than students. Hence, there is a lack of study detailing evidence on students' perspective on students' video creation in mathematics course.

Taking this into account, this paper aims to address this research gap by exploring the students' perception and attitude towards the production of video project in mathematics by university students.

2.3. Technology Acceptance Model

In this study, Technology Acceptance Model (TAM) was used as the theoretical grounding to examine the relationship between students' perception of the video assignment project and their attitude towards the project. TAM was widely used to explain the behaviour and intention of using technologies (Davis 1989). TAM is based on the users' behaviour that is influenced by their perceived usefulness and perceived ease of use regarding a technology. There are many studies that have applied TAM as their research framework. For instance, Cheng (2018) applied TAM to measure students' intentions to use a wiki and their subsequent behaviour in doing so. The framework of TAM is shown in Figure 1.

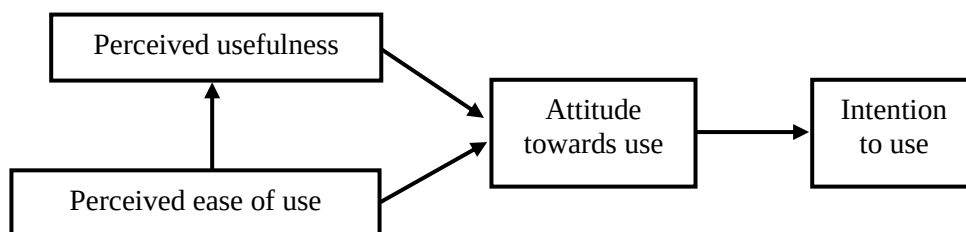


Figure 1: The framework of TAM (Cheng 2018; Davis 1989)

Some recent studies have integrated users' perceived enjoyment into TAM to examine the acceptance level regarding a technology. Figure 2 depicts the research model of the study in Lee *et al.* (2005). The model included perceived enjoyment as an intrinsic motivator into TAM.

Another study by Pappas *et al.* (2017) also integrated positive emotions (perceived enjoyment) into TAM. The researchers conducted a study on students who have experience in "with-video assignment" in their studies. The researchers adapted TAM to examine factors that influence students' intention to adopt the "with-video assignment". The theoretical model that was used in the study is shown in Figure 3.

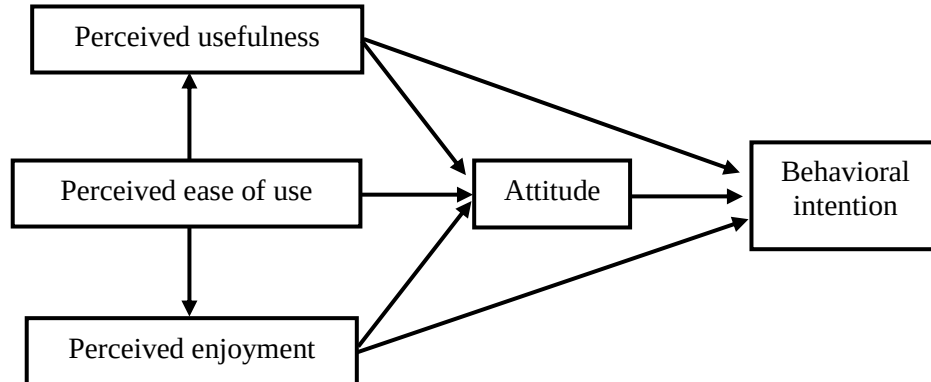


Figure 2: The research model of integrated TAM in Lee *et al.* (2005)

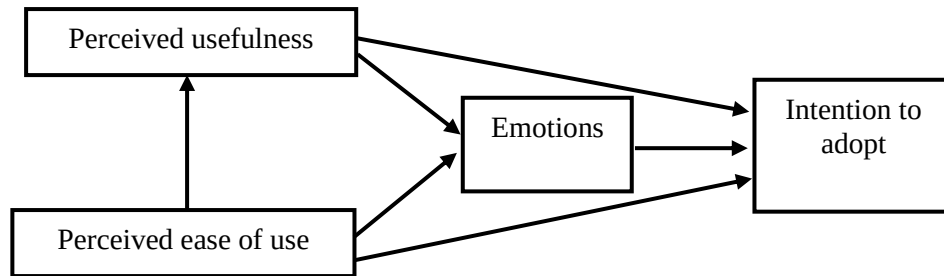


Figure 3: The research model of integrated TAM in Pappas *et al.* (2017)

The research model and hypotheses in the current study based on TAM are presented in the next section Methodology.

3. Methodology

3.1. Research model and hypotheses

Using the theoretical background of integrated TAM, the proposed research model for this study is shown in Figure 4.

The original framework of TAM (Davis 1989) consists of two constructs named “perceived usefulness” and “perceived ease of use” that influence the users’ behaviour and intention of using technologies. The current research model was mainly adapted from Lee *et al.* (2005) and Pappas *et al.* (2017) that integrated positive emotions (perceived enjoyment) into the original framework of TAM. Hence, there are three constructs named “perceived usefulness”, “perceived ease of use” and “perceived enjoyment” in the research model for the current study (Figure 4). The meaning of the constructs in the context of this studied is further defined here.

The original “perceived usefulness” in TAM refers to “the degree to which a person believes that using a particular system would enhance his or her performance” (Davis 1989). In the context of this study, the construct “perceived usefulness” referred to students’

perception on the benefit of the video assignment project in which technology for video creation was used to complete the project.

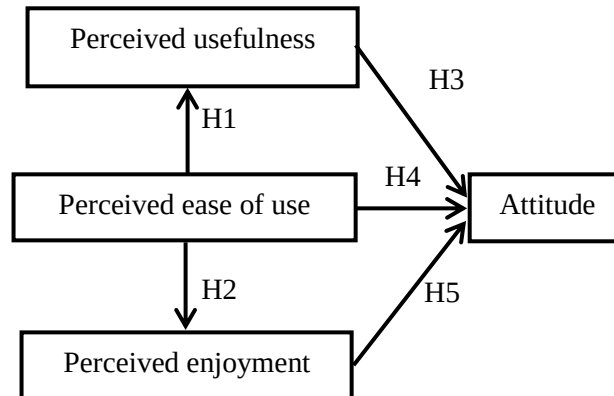


Figure 4: Proposed research model for the current study

The original “perceived ease of use” in TAM refers to “the degree to which a person believes that using a particular system would be free of effort” (Davis 1989). In the context of this study, the construct “perceived ease of use” intended to study how students’ perceived ease of use regarding technology for video creation in this project.

The third construct “perceived enjoyment” referred to students’ perception on enjoyment of the video assignment project. The “perceived enjoyment” was from an intrinsic motivational perspective. Intrinsic motivation refers to the fact of doing some activities for their own satisfaction where the activity itself is intriguing, engaging or satisfying.

According to Weissman and Beck (1978), attitude can be defined as a person’s tendency to evaluate an object in a certain way that mainly shapes the behaviours of the person. In the context of this study, the fourth construct “attitude” carried the meaning of “attitude towards the video assignment project”.

Based on the research model in this study, the following hypotheses were proposed:

- H1: Students’ perceived ease of use regarding technology for video creation has a significant effect on the perceived usefulness of the video assignment project
- H2: Students’ perceived ease of use regarding technology for video creation has a significant effect on the perceived enjoyment of the video assignment project
- H3: Students’ perceived usefulness of the video assignment project has a significant effect on the attitude towards the project
- H4: Students’ perceived ease of use regarding technology for video creation has a significant effect on the attitude towards the video assignment project
- H5: Students’ perceived enjoyment of the video assignment project has a significant effect on the attitude towards the project

3.2. Questionnaire development

An online self-administered questionnaire was used to investigate the students’ perception of the video assignment project. The questionnaire consisted of three sections. The first section

was related to the respondents' demographic information, i.e., gender, background of study, and experience in making video.

The second section was regarding the respondents' perception and attitude of the project. There were 15 close-ended questions in the second section (Table 1). Each question was measured using a five-point Likert scale, where "1 = strongly disagree" and "5 = strongly agree". The questions were corresponding to the four constructs of the research model, i.e., perceived ease of use (PE), perceived usefulness (PU), perceived enjoyment (PM), and attitude towards video project (AT). The items were adapted from several studies (Pal & Patra 2020; Pappas *et al.* 2017; Wu & Chen 2017; Lee *et al.* 2005; Davis 1989).

Table 1: Survey items related to the respondents' perception and attitude of the video assignment project

Construct	Item	Measure	Adapted From
Perceived ease of use (PE)	PE1	I find it easy to complete the video project.	Pal and Patra (2020); Davis (1989); Pappas <i>et al.</i> (2017)
	PE2	The instructions given on how to do the video project is clear and understandable.	
	PE3	In general, it is easy for me to learn how to make video.	
Perceived usefulness (PU)	PU1	I find that video project is useful for my studies in mathematics.	Pal and Patra (2020); Davis (1989); Pappas <i>et al.</i> (2017)
	PU2	I find that video project enables me to improve my soft skills such as communication skills, teamwork, responsibilities etc.	
	PU3	I find that video project would improve my capability in English expression.	
	PU4	I find that video project would increase my knowledge in making video.	
Perceived enjoyment (PM)	PM1	I find that the video project is exciting.	Pappas <i>et al.</i> (2017); Lee <i>et al.</i> (2005)
	PM2	I find that the video project is enjoyable.	
	PM3	The process of making video is pleasant.	
	PM4	I find that I easily lost track of time while making the video.	
Attitude towards video project (AT)	AT1	I believe that video project is a good assignment.	Wu and Chen (2017); Pal and Patra (2020)
	AT2	I believe that video project is advisable to continue.	
	AT3	I am satisfied with the video project.	
	AT4	I will tell others and share the video that I created.	

The third section of the questionnaire consisted of open-ended question that asked respondents to list down video editing tools that were used to make the video in the project.

3.3. Procedure and data collection

A group of educators from a university in Malaysia has implemented a video assignment project in year 2023. The participants of the project were the first-year undergraduate students who took mathematics courses. The video assignment project encouraged students to learn up-to-date technology skills and promote creativity in learning. To complete the project, the students worked together as a team to create video related to mathematics application. The video assignment project that was carried out in this study was a project-based learning approach to promote teamwork, engage students, and to improve student's learning experiences. The process to complete the project provided an opportunity for students to exchange knowledge in mathematics as well as develop various skills. This project has also

created an environment for students to participate actively in learning mathematics. The demographics of the respondents are summarized in Table 2. The targeted participants of this study were those first-year diploma students.

Table 2: Demographics of respondents

Items	Type	Frequency (N = 202)	Percentage (%)
Gender	Male	95	47.0
	Female	107	53.0
Field	Engineering	74	36.6
	Business management	128	63.4
Experience in making video	1 - 3 months	122	60.4
	4 - less than 6 months	20	9.9
	6 - less than 12 months	41	20.3
	1 - 2 years	19	9.4
	More than 2 years	0	0.0

A total of 202 students participated in this study. The participants were selected through purposive sampling of engineering and business management students who were required to take mathematics courses in the first semester of their study, Calculus I and Business Mathematics respectively. From the demographics characteristics as shown in Table 2, there were 95 male respondents and 107 female respondents. The respondents consisted of 74 engineering students and 128 business management students. In terms of experience in making video, more than half of the respondents (60.4%) had 1 – 3 months of experience, 9.9% of respondents had 4 – 6 months of experience, 20.3% of respondents had 6 – 12 months of experience, and 9.4% of respondents had 1 – 2 years of experience. None of them had more than two years of experience in making videos.

In this video assignment project, the students were asked to form a team that consisted of three to four members who took the same mathematics course. Each team was required to complete a video related to mathematics application. Throughout the project, students obtained guidance from lecturers' weekly mathematics lesson. Apart from that, the students acquired various video production skills from open sources through self-study and group discussion.

At the end of the project, the students produced the videos with a length of 5-10 minutes. Then, they were asked to answer an online self-administered questionnaire anonymously. The responses of this questionnaire were analysed using structural equation modelling (SEM) to investigate the students' perception of the video assignment project. Descriptive statistics of the study variables were also analysed.

4. Findings

The constructs (PE, PU, PM, AT) as given in Table 1 were latent variables of the proposed research model in the study. Latent variables are those variables that cannot be directly measured. Direct measurement of the concept for perceived ease of use, perceived usefulness, perceived enjoyment, and attitude towards the video assignment project were not possible. However, the latent variables are assumed to be the underlying generators of the observed variables (Kong *et al.* 2022). In this section, the data collected from the questionnaire were

analysed using structural equation modelling (SEM). Two-step analytical procedures in structural equation modelling were applied in analysing the collected data (Anderson & Gerbing 1988). Firstly, the construct reliability, convergent validity and discriminant validity of the measurement model were assessed. Secondly, the structural model was evaluated by investigating the direction and strength of the relationships between the theoretical constructs. The assessment on the measurement model was to ensure that the conclusion on the structural model was drawn from a measurement instrument that was reliable and with adequate discriminant validity.

4.1. Assessment of the measurement model

The proposed research model as shown in Figure 4 was the proposed measurement model in this study. The measurement model was assessed in terms of reliability, convergent validity, and discriminant validity. The analysis was done by using SPSS 21 and SmartPLS 3 software packages.

Firstly, the reliability of the measurement model was assessed by examining the item reliability and construct reliability (CR). The item reliability was assessed by using Cronbach's Alpha (α). Secondly, the convergent validity of the constructs was assessed by average variance extracted (AVE). Thirdly, to assess the discriminant validity, the square root of AVE for each latent variable was compared to the correlation coefficients of the latent variable with other latent variables.

Table 3 summarizes the results of the measurement model. The first measure of reliability was done by checking the Cronbach's Alpha values for all multi-item constructs. All reported alpha values (0.773, 0.826, 0.801 and 0.865) were greater than 0.7. The results showed that the reliability of the constructs was good as all Cronbach's Alpha values exceeded the threshold limit of 0.7 (Hair *et al.* 2014).

Table 3: Construct reliability and convergent validity of the measurement model

Construct	Item	Factor Loading	Cronbach's Alpha (α)	Construct Reliability (CR)	Average Variance Extracted (AVE)
Perceived ease of use (PE)	PE1	0.792	0.773	0.868	0.688
	PE2	0.833			
	PE3	0.861			
Perceived usefulness (PU)	PU1	0.783	0.826	0.883	0.654
	PU2	0.825			
	PU3	0.814			
	PU4	0.812			
Perceived enjoyment (PM)	PM1	0.900	0.801	0.874	0.645
	PM2	0.903			
	PM3	0.850			
	PM4	0.500			
Attitude (AT)	AT1	0.848	0.865	0.909	0.715
	AT2	0.905			
	AT3	0.871			
	AT4	0.752			

The second measure of reliability was done by factor analysis. The factor loading for each item was checked (Table 3). If there is any item with factor loading less than 0.5, the item should be excluded from further analysis (Hair *et al.* 2014). The results showed that all factor loadings exceeded the required value of 0.5 (Table 3). Furthermore, the construct reliability for each construct (0.868, 0.883, 0.874 and 0.909) was greater than 0.7. Hence, the results indicated a high internal consistency reliability among the constructs (Fornell & Larcker 1981).

As shown in Table 3, the AVE for each construct (0.688, 0.654, 0.645 and 0.715) was also reported to be greater than 0.5 and hence exceeding the threshold limit for convergent validity (Fornell & Larcker 1981).

To assess the discriminant validity of the measurement model, the results depicted in Table 4 were discussed. The diagonal elements in Table 4 were the square root of AVE for each latent variable. The off-diagonal elements were the correlation coefficients of the latent variable with other latent variables.

The results in Table 4 show that the square root of AVE for each latent variable was greater than the correlation coefficients of the latent variable with other latent variables. This was confirmed by observing that the diagonal element was always the largest value compared to the off-diagonal values at the same column or same row. This result suggested that there was an adequate discriminant validity of the measurement model.

Table 4: Correlation matrix of the constructs (Fornell Larcker Criterion of discriminant validity)

Construct	PE	PU	AT	PM
PE	0.829	0.601	0.584	0.548
PU	0.601	0.809	0.672	0.574
AT	0.584	0.672	0.846	0.772
PM	0.548	0.574	0.772	0.803

4.2. Analysis of the structural model

In this study, all hypotheses related to the proposed research model (Figure 4) were tested by using structural equation modelling via partial least squares. Table 5 summarizes the hypotheses testing results that include direction of each path, standardized path coefficients (β), path significance (p -value), and result of each hypothesized relationship.

Figure 5 illustrates the results of the hypothesized model. Each construct was represented by a circle. The coefficient of determination (R^2) for each dependent variable was given in the circle while the standardized path coefficients (β) was given along the line connecting the circles.

From the results of path analysis as given in Figure 5, all the five hypotheses were supported by the data as the p -value for all hypotheses were less than the significance level 0.01 (Table 5). The R^2 for each dependent variable represents the amount of variance explained by the independent variables. The standardized path coefficients indicate the strength of the relationship between the independent variable and the dependent variable.

Table 5: Summary of hypothesis tests

Hypothesis	Path	Path coefficient (β)	p - value	Result
H1	PE $\rightarrow$ PU	0.601	< 0.01	Supported
H2	PE $\rightarrow$ PM	0.548	< 0.01	Supported
H3	PU $\rightarrow$ AT	0.295	< 0.01	Supported
H4	PE $\rightarrow$ AT	0.110	< 0.01	Supported
H5	PM $\rightarrow$ AT	0.542	< 0.01	Supported

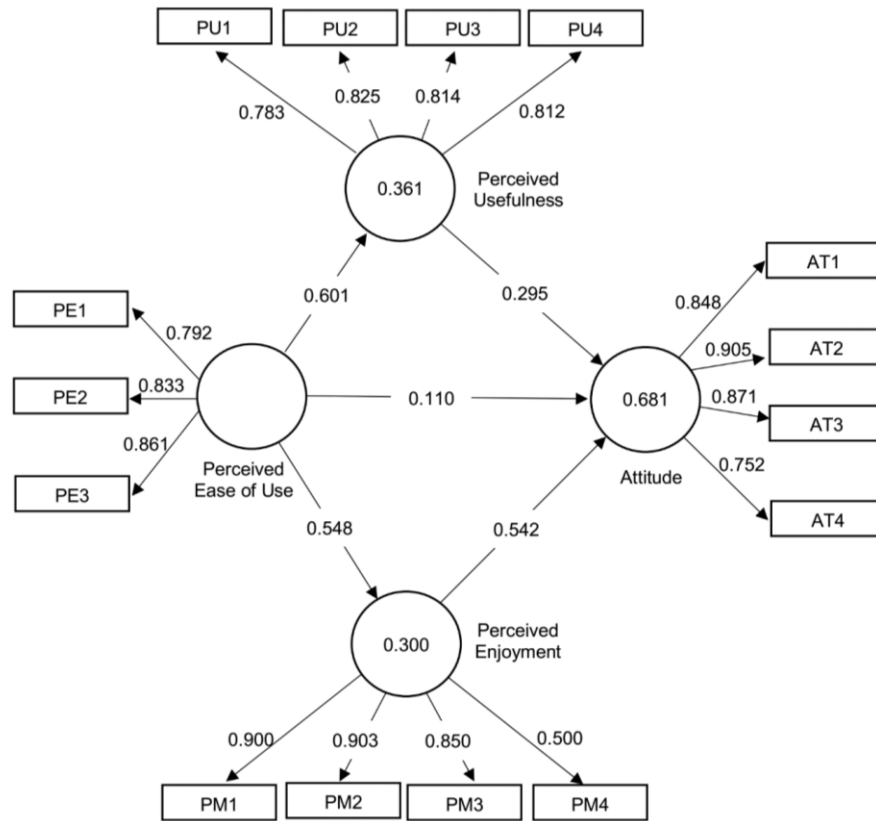


Figure 5: Partial least square structural equation modelling (PLS-SEM) model for the current study

The results indicated that attitude was significantly determined by the variables perceived usefulness, perceived ease of use, and perceived enjoyment. These three variables explained 68.1% of variance in attitude as the reported value for R^2 was 0.681. The value of standardized path coefficient for perceived enjoyment ($\beta = 0.542$) was the highest. Then, it followed by perceived usefulness ($\beta = 0.295$) and perceived ease of use ($\beta = 0.110$). Positive

coefficients indicated that these three independent variables have positive effects on the dependent variable, i.e., attitude.

The results also showed that perceived ease of use explained 30% of the variance in perceived enjoyment. Perceived usefulness was also significantly determined by the perceived ease of use, resulting in an R^2 of 0.361.

Furthermore, referring to the off-diagonal elements of the correlation matrix in Table 4, the values of all correlation coefficients were positive. Therefore, positive correlations were found between all these variables.

In this section, the analysis of the structural model based on the data in the current study had explained the relationship between the students' attitude towards the video assignment project and the other variables, i.e., perceived usefulness, perceived enjoyment, and perceived ease of use.

4.3. Descriptive statistics of the study variables

Table 6 gives the descriptive statistics for the study variables collected through the questionnaire. Each question of the items was measured using five-point Likert scale, where "1" represents strongly disagree and "5" represents strongly agree.

Table 6: Descriptive statistics for the study variables

Construct	Item	Mean Score	Standard Deviation	Minimum	Maximum	Construct Mean
Perceived ease of use (PE)	PE1	3.78	0.79	2	5	4.03
	PE2	4.27	0.69	1	5	
	PE3	4.04	0.76	2	5	
Perceived usefulness (PU)	PU1	4.16	0.68	2	5	4.26
	PU2	4.31	0.67	2	5	
	PU3	4.26	0.67	2	5	
	PU4	4.32	0.64	3	5	
Perceived enjoyment (PM)	PM1	4.14	0.71	2	5	3.96
	PM2	4.14	0.69	3	5	
	PM3	3.98	0.77	2	5	
	PM4	3.60	0.98	1	5	
Attitude (AT)	AT1	4.20	0.71	2	5	4.08
	AT2	4.10	0.69	2	5	
	AT3	4.16	0.70	3	5	
	AT4	3.86	0.79	2	5	

The results showed that the construct mean for attitude is 4.08 (Table 6). All four items in the construct attitude have means of 4.20, 4.10, 4.16 and 3.86. This inferred that the students showed a positive attitude towards the video assignment project.

Similar trend was observed in the mean values for the other three constructs (PE, PU, PM) and the corresponding items. The item means ranges from 3.60 to 4.32 while the means of these three constructs are PE = 4.03, PU = 4.26, PM = 3.96. The analysis of the descriptive statistics revealed that the students have positive perception on perceived ease of use regarding technology for video creation, perceived usefulness of this project and perceived enjoyment in this project.

It is observed that construct perceived usefulness (PU) has the highest mean (4.26) among these constructs. There were four items (PU1, PU2, PU3, PU4) related to the perceived usefulness in the questionnaire. The students were asked to evaluate their perceived usefulness of this project based on the usefulness for their study in mathematics (PU1), soft skills (PU2), English usage (PU3), and knowledge in making video (PU4).

Referring to the descriptive statistics of the item PU1 “I find that video project is useful for my studies in mathematics” in the survey, it showed a positive perception on item PU1 as the mean score (4.16) is high (Table 6). In this project, students were asked to explore the real-life application in mathematics and presented it in the video. The students need to learn to search for data, understand the problem, and think of the solution. Through this project, students were given the opportunity to develop the ability of conceptualizing, logical reasoning, using strategy, analytical thinking, decision-making and synthesizing to solve the problem. These were the key components in critical thinking as recommended by Rahman (2019).

Refer to Table 6, the mean score for item PU2 “I find that video project enables me to improve my soft skills such as communication skills, teamwork, responsibilities etc.” is 4.31. Thus, most students agreed that the project enables them to enhance their soft skills. Throughout the video assignment project, good communication and seamless coordination of each task played an important role to ensure the success of the project. Therefore, by completing this project in teamwork, students get the opportunity to develop some important soft skills. Apart from the core knowledge relevant to the field of study for each student, soft skills development is an important learning process for them to succeed at work in future. This is due to the fact that actual work environment in every field involves human relationships (Acero *et al.* 2022). As recommended by many researchers, students should develop a number of essential soft skills that include communication skill, social skill, positive self-concept (Lippman *et al.* 2015); negotiation skill, communication skill, action co-ordination, emotional competence, responsibility, and leadership (Acero *et al.* 2022).

The mean score for item PU3 “I find that video project would improve my capability in English expression” is 4.26. It showed that most students had positive perception that the project was a platform for them to improve the proficiency of English. As reported in The Star (2023), an educationist expressed that graduates must possess the necessary skills and knowledge before they entered the workforce in the field they intended to enter. The educationist stated that English language, people skills, teamwork, and digital skills were the important skills that could improve graduates’ employability. The proficiency of English could be improved through formal lesson as well as frequent practise daily. Therefore, by having a project to produce video in English language, this was inevitably a great opportunity for the students to improve their English proficiency with a purpose. This finding agrees with the previous work by Abdullah *et al.* (2020). The study reported that higher education students should possess and polish on cross-cultural skill as collaboration between countries has increased. Hence, mastering the universal language would be useful for them to discuss their idea to the world and hence improve their communication and collaboration skills.

The item PU4 in the questionnaire asked students regarding their opinion on whether they could increase their knowledge in making video through this project. The mean score for item PU4 is 4.32 (Table 6), which is the highest value among the four items in the construct perceived usefulness. Therefore, most of the participants agreed that this project could improve their ability in finding information on video making techniques and applied it creatively to complete the video. The positive perception for the item PU4 was aligned with the importance of information literacy. As discussed in Behrens (1994), information literacy

is the ability to use information and the possession of the knowledge of information. Information literacy refers to the ability to locate, assess, organise, utilise, and communicate information in all its forms, especially when it comes to circumstances requiring judgement, problem-solving, or knowledge acquisition. Silber-Varod *et al.* (2019) also reported that information literacy is highly important in this twenty-first century as competencies in technological literacy are now regarded as essential for efficient use of digital technologies in educational environment.

In this study, there was an open-ended question in the questionnaire that required respondents to list down the software, Apps or any video editing tools that were used to make the video in this project. The students were allowed to list more than one video editing tool for this question. Each student listed one to three tools in the response. Based on the survey results, Canva was the favourite video editing tool as 106 students used the tool to design and make the video. Canva was a useful tool to design the slides for the videos as there were many templates to be chosen. CapCut was the second favourite tool as listed by 99 students. Many found that CapCut was a user-friendly tool to edit the video as it was very easy to use. Microsoft PowerPoint was the third favourite tool as it was listed by 12 students. The students used PowerPoint to design the presentation slide as well as to record their voice with the recording function in PowerPoint. There were also several other video editing tools that were used by students. The video editing tools that were listed by the students were Inshot, Filmora, Instagram, OBS Studio, Phone camera, Powtoon, Screen Recorder, VN Video Editor, Adobe Premiere Pro, DaVinci Resolve, KineMaster, Teleprompter, TikTok, Video Cutter, YouTube and Zoom. Some of them combined a few applications either available on phone or website to complete their videos. The video production technique was not formally included in the first-year syllabus for the students in the current study. Therefore, the video assignment project provided an opportunity for students to learn how to use technology to create video and hence enhance their information literacy and creativity. The results also showed that students freely chose their choice of video creation tools that they found it easy to use to complete the project. This finding is in agreement with the work by Anas (2019) where the study reported that allowing students freely choose the video recording tools encouraged students' creativity and give a positive impact to the project.

5. Discussion

5.1. Students' perception and attitude towards the project

To address the research question, a research model based on TAM to examine the students' perceptions and attitude towards the video assignment project was proposed in this study. Using analytical procedures in structural equation modelling, the direction and strength of the relationships between the theoretical constructs were established. Results showed that the students' attitude towards the project was significantly determined by the students' perceived usefulness of the project, perceived ease of use, and perceived enjoyment of the project. The coefficient of determination of the model was $R^2 = 0.681$ (Figure 5). Hence, the proposed model explained 68.1% of the variance in the attitude accounted for by the students' perceived usefulness, perceived ease of use, and perceived enjoyment of the project. The previous reported result in Lee *et al.* (2005) was compared. The R^2 associated with attitude in Lee *et al.* (2005) was 0.610. The research model in the study was an integrated TAM. The findings from the study showed that the perceived usefulness, perceived ease of use and perceived enjoyment had strong impacts on students' attitude to use a technology-based medium in learning. Due to the similarity of the research model and the method used to

analyse the data, the results were compared with the current work. It was found that the variance explained by the attitude in the current study ($R^2 = 0.681$) was better than the result obtained in Lee *et al.* (2005).

Furthermore, the results also showed that these three variables had positive effects on attitude as the coefficients associated with each of these variables were positive (Figure 5 and Table 5). This implied that having a positive perceived usefulness of the project would lead to a positive attitude towards the project. The students' perspective on the enjoyment in completing the project and the ease of use regarding technology in video creation were also the contributing factors that lead to a positive attitude towards the project.

We attribute the positive correlation of these variables was due to the inclusion of motivational perspectives in the research model. The construct "perceived enjoyment" and "perceived usefulness" in this study were the motivational perspectives that affected the attitude. Referring to the values of standardized path coefficient, the result revealed that perceived enjoyment ($\beta = 0.542$) was the strongest factor that influenced attitude. Then, the next factor was perceived usefulness ($\beta = 0.295$). Lastly, it was perceived ease of use ($\beta = 0.110$). In the context of this study, the "perceived enjoyment" was referred to "the degree to which the video assignment project is perceived to be enjoyable in its own right, apart from any anticipated performance consequences". The need to include motivational perspectives to provide a wider view to explain the users' behaviour was supported in many studies (Pappas *et al.* 2017; Legris *et al.* 2003; Venkatesh *et al.* 2002). These findings are also similar to the study conducted by Tajibayeva *et al.* (2023). According to Tajibayeva *et al.* (2023), the presence of both technological and human infrastructure is essential for the practical use of technology. Although having access to technology is a prerequisite, it is frequently not an adequate requirement for the use of technology. In this regard, it is important to identify the psychological drivers that explain the users' behaviour on adopting the technology.

In the context of the current study, the "perceived usefulness" was referred to "the degree to which a person believes that the video assignment project would enhance his or her performance". The perceived usefulness was an extrinsic motivational perspective. As stated in Lee *et al.* (2005), extrinsic motivation refers to behaviours that are engaged in response to something other than their own satisfaction such as recognition or reward. Campbell and Cox (2018) have conducted a study on student authored video as a personalised learning assignment. The findings concluded that students appreciated the assignment and most of the students indicated they learned more about the subject matters while they were preparing and creating the content for the video. The key elements found in the assignment such as autonomy in searching for new knowledge and information from different sources for the content of video, collaboration, freedom of incorporating various technologies for video creation have motivated them to value the assignment. The findings are in line with the positive correlation between the motivational perspectives and the attitude as established in our research model.

The descriptive statistics of the study variables in this survey study shows that students had positive perceived usefulness of the video assignment project. The project in this study involved project-based learning. Students' perceptions reflected that by working collaboratively in this video assignment project, they can benefit from the diverse perspectives, knowledge, and experiences of their peers. They can also learn to take responsibility for their own learning while also supporting the learning of others. They agreed that the project was a platform for them to learn various soft skills, improve mathematics learning, increase ICTs knowledge in video creation and enhance English proficiency. This finding is in agreement with those previous work by Anazifa and Djukri (2017) in which the

study reported that adopting project-based learning in mathematics improved student's creativity and critical thinking as well as their problem-solving skills. Additionally, other values such as cooperation, organization, and time management were integrated through project-based learning (Chen & Yang 2019). These findings are also similar to the study by Cardoso-Espinosa, Cortés-Ruiz and Zepeda-Hurtado (2021) where the researchers concluded that the outcomes of project-based learning enhanced the students' soft skills in terms of time management, collaborative work, self-regulation, and decision-making. Working as a group requires the learners to interact, communicate and tolerate each other, which are the fundamental soft skills required in facing their future. In this twenty-first century, universities are gradually focusing on developing students' soft skills in addition to professional academic knowledge. Students who can work in a team and practicing a wide range of soft skills have great potential to excel in work after they graduate from university (Acero *et al.* 2022; Abdullah *et al.* 2020).

Apart from the various benefits obtained from this video assignment project, students also feel the enjoyment through this learning approach in mathematics. This finding is supported by other studies (Hafner & Miller 2011; Greene & Crespi 2012; Aksel & Gürman-Kahraman 2014). The study by Hafner and Miller (2011) reported that the students perceived making a video project is novel, fun, challenging and meaningful. Another study by Greene and Crespi (2012) discussed the experience gained by the business students in creating their video assignment based on educational theory. They found that it is enjoyable and pertinent in which the concept learned during learning activities in class can then be applied throughout the video preparation process. In another study presented by Aksel and Gürman-Kahraman (2014) concluded that video project assignments positively affect students to learn foreign language. As an added benefit, they also receive ICTs knowledge in the process of producing videos and allowing them to learn in a creative way.

A study was done by UNESCO (2022) where more than 100 youths from 43 countries were consulted on how they see higher education in future. From the report's findings, youths stated that higher education should be innovative in terms of the flexibility of teaching and learning modality type, and the use of technology in learning. They were inspired by technological development and hence demonstrated a more positive than negative perspective towards the adoption of technology. Therefore, the students' perspective in this video assignment project is in line with the findings in the UNESCO (2022).

5.2. Contribution, implication and recommendation

In this study, the implementation of video assignment project in mathematics was shown to have numerous benefits for students to improve various soft skills such as problem-solving skills and critical thinking. It also increased their ICTs knowledge in video creation and information literacy. Students were also able to polish their communication skill and improve their capability in English usage throughout the project. Hence, the video assignment project could be an alternative learning approach in mathematics learning, and this learning approach can be explored by practitioners from different disciplines and background.

In addition, the results in this study that was based on TAM revealed that students' attitude was depended on three main factors, namely perceived ease of use, perceived usefulness and perceived enjoyment. Pedagogical implication of this study suggests that students are more likely to participate in the project if the technologies in video creation is easy to use and enjoyable. Moreover, students are also more likely to engage in the project if they are made aware of the potential usefulness and advantage of the project tasks.

Here, we present a few recommendations to implement similar projects that involve video creation as group assignment in mathematics subject. First, lecturers or instructors should be flexible in allowing students to choose the technologies that they find it most convenient and easy to employ to accomplish the project. This could ensure that students could have better learning experiences in terms of enjoyment and motivation to complete the tasks. Second, the lecturers could initiate a sharing session for students to present their thoughts on what they have learned throughout the project. This could help students learn to reflect on their learning and appreciate the benefits gaining from the project. The implementation of student reflection is a way to help student to take ownership of subject knowledge, develop their self-awareness and improve their metacognition.

However, this study has some limitations. The data in this study was collected from students taking two mathematics courses named Calculus I and Business Mathematics from a university in Malaysia. Other researchers could also include students taking other mathematics courses in other universities to verify the results of this study. In addition, only three constructs based on TAM were used in the research model in this study. For further improvement, other researchers may integrate more constructs into TAM and test for the possible relevance in the context of their investigation.

6. Conclusion

In this study, a research model was developed using the theoretical background of Technology Acceptance Model (TAM) to examine the students' perceptions and attitude towards the video assignment project in mathematics subject. TAM has been widely used to study the behaviour of using technologies. In this study, a new attempt was made to adopt TAM to explore the students' behaviour towards the video assignment project as a form of an alternative learning approach. Through analytical procedures in SEM, the relationship between constructs in the context of this study was established. The results of the current study reconfirmed the relationship between the constructs in TAM but was adopted in a new context of investigation.

The results of this study also showed that incorporating video assignment project as a project-based learning approach can be a powerful way to engage students in active learning, develop a wide range of soft skills, and promote collaborative learning in mathematics. By encouraging students to participate in active learning approach, this could indirectly improve students' motivation and engagement. This is an alternative mathematics learning method apart from conventional lecturer-centered teaching strategy in classroom. In conclusion, the video assignment project implemented in mathematics subject was beneficial to students in many aspects and some of the skills developed throughout the project were not easily acquired from conventional learning environment. This could inadvertently help produce graduates with professional academic knowledge and sufficient soft skills required by industry.

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References

Abdullah N.S., Sumarwati S., Abd Aziz M.I., Ziden A.A., Abd Razak N. & Jalil S.A. 2020. Life and career skills

- amongst technical and vocational education and training (TVET) students. *International Journal of Innovation, Creativity and Change* **11**(12): 637-654.
- Abubakar B., Kajuru Y.K., Musa M. & Ginga U.A. 2024. Mathematics curriculum implementation and evaluation as predictors of motivation and performance of students among colleges of education in Nigeria. *Journal of Education Research and Library Practice* **4**(8): 105-114.
- Acero Y.C.J., Castrillón A.M.S. & León R.B. 2022. Aspects that develop soft skills-a way for inclusion in engineering programmes. *World Transactions on Engineering and Technology Education* **20**(1): 13-18.
- Aksel A. & Gürman-Kahraman F. 2014. Video project assignments and their effectiveness on foreign language learning. *Procedia-Social and Behavioral Sciences* **141**: 319-324.
- Anas I. 2019. Behind the scene: Student-created video as a meaning-making process to promote student active learning. *Teaching English with Technology* **19**(4): 37-56.
- Anazifa R.D. & Djukri D. 2017. Project-based learning and problem-based learning: Are they effective to improve student's thinking skills? *Jurnal Pendidikan IPA Indonesia* **6**(2): 346-355.
- Anderson J.C. & Gerbing D.W. 1988. Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin* **103**(3): 411-423.
- Behrens S.J. 1994. A conceptual analysis and historical overview of information literacy. *College & Research Libraries* **55**(4): 309-322.
- Bell S. 2010. Project-based learning for the 21st century: Skills for the future. *The Clearing House* **83**(2): 39-43.
- Campbell L.O. & Cox T.D. 2018. Digital video as a personalized learning assignment: A qualitative study of student authored video using the ICSDR model. *Journal of the Scholarship of Teaching and Learning* **18**(1): 11-24.
- Cardoso-Espinosa E.O., Cortés-Ruiz J.A. & Zepeda-Hurtado M.E. 2021. The development of mathematics and soft skills at the graduate level through project-based learning in times of COVID-19. *TEM Journal* **10**(4): 1638-1644.
- Chen C.H. & Yang Y.C. 2019. Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review* **26**: 71-81.
- Cheng E.W.L. 2018. Choosing between the theory of planned behavior (TPB) and the technology acceptance model (TAM). *Educational Technology Research and Development* **67**(1): 21-37.
- Davis F.D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* **13**(3): 319-340.
- Efstratia D. 2014. Experiential education through project based learning. *Procedia-social and Behavioral Sciences* **152**: 1256-1260.
- Eligar V. & Banakar R.M. 2016. Facilitating competency and skill development through video assignment. *Journal of Engineering Education Transformations* **29**(3): 110-117.
- Fornell C. & Larcker D.F. 1981. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* **18**(1): 39-50.
- Gan B., Menkhoff T. & Smith R. 2015. Enhancing students' learning process through interactive digital media: New opportunities for collaborative learning. *Computers in Human Behavior* **51**: 652-663.
- Greene H. & Crespi C. 2012. The value of student created videos in the college classroom - An exploratory study in marketing and accounting. *International Journal of Arts & Sciences* **5**(1): 273-283.
- Gouia R. & Gunn C. 2016. Making mathematics meaningful for freshmen students: Investigating students' preferences of pre-class videos. *Research and Practice in Technology Enhanced Learning* **11**(2): 1-8.
- Hafner C.A. & Miller L. 2011. Fostering learner autonomy in English for science: A collaborative digital video project in a technological learning environment. *Language Learning & Technology* **15**(3): 68-86.
- Hair J.F., Hult G.T.M., Ringle C.M. & Sarstedt M. 2014. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Los Angeles: Sage publications.
- Helm J.H & Katz L.G. 2016. *Young Investigators: The Project Approach in The Early Years*. New York: Teachers College Press.
- Huang M.C.L., Chou C.Y., Wu Y.T., Shih J.L., Yeh C.Y.C., Lao A.C.C., Fong H., Lin Y.F. & Chan T.W. 2020. Interest-driven video creation for learning mathematics. *Journal of Computers in Education* **7**(3): 395-433.
- Hung C.M., Huang I. & Hwang G.J. 2014. Effects of digital game-based learning on students' self-efficacy, motivation, anxiety, and achievements in learning mathematics. *Journal of Computers in Education* **1**(2-3): 151-166.
- Knoblauch C. 2022. Experiential learning in digital contexts - A case study. *Innovative Approaches to Technology-Enhanced Learning for the Workplace and Higher Education: Proceedings of 'The Learning Ideas Conference' 2022*, Cham: Springer International Publishing, pp. 181-191.
- Kokotsaki D., Menzies V. & Wiggins A. 2016. Project-based learning: A review of the literature. *Improving Schools* **19**(3): 267-277.
- Kong X., Jiang X., Zhang B., Yuan J. & Ge Z. 2022. Latent variable models in the era of industrial big data: Extension and beyond. *Annual Reviews in Control* **54**: 167-199.
- Kolmos A. & De Graaff E. 2014. Problem-based and project-based learning in engineering education: Merging

- models. In Johri A. & Olds B.M. (eds.). *Cambridge Handbook of Engineering Education Research*: 140-160. New York: Cambridge University Press.
- Lazic B., Knežević J. & Maričić S. 2021. The influence of project-based learning on student achievement in elementary mathematics education. *South African Journal of Education* **41**(3): 1-10.
- Lee M.K.O., Cheung C.M.K. & Chen Z. 2005. Acceptance of internet-based learning medium: The role of extrinsic and intrinsic motivation. *Information & Management* **42**(8): 1095-1104.
- Legrís P., Ingham J. & Collette P. 2003. Why do people use information technology? A critical review of the technology acceptance model. *Information & Management* **40**(3): 191-204.
- Lippman L.H., Ryberg R., Carney R. & Moore K.A. 2015. *Workforce Connections: Key soft skills that foster youth workforce success: Toward a consensus across fields*. Washington, DC: Child Trends.
- Loch B. & Lamborn J. 2015. How to make mathematics relevant to first-year engineering students: Perceptions of students on student-produced resources. *International Journal of Mathematical Education in Science and Technology* **47**(1): 29-44.
- Murtafiah W., Suwarno S. & Lestari N.D.S. 2020. Exploring the types of a material presentation by teachers in mathematics learning during the COVID-19 pandemic. *Journal of Physics: Conference Series*, IOP Publishing, pp. 1-8.
- Nielsen K.L. 2020. Students' video viewing habits during a flipped classroom course in engineering mathematics. *Research in Learning Technology* **28**: 1-12.
- Pal D. & Patra S. 2020. University students' perception of video-based learning in times of COVID-19: A TAM/TTF perspective. *International Journal of Human-Computer Interaction* **37**(10): 903-921.
- Pappas I.O., Giannakos M.N. & Mikalef P. 2017. Investigating students' use and adoption of with-video assignments: lessons learnt for video-based open educational resources. *Journal of Computing in Higher Education* **29**(1): 160-177.
- Peters M.L. 2013. Examining the relationships among classroom climate, self-efficacy, and achievement in undergraduate mathematics: A multi-level analysis. *International Journal of Science and Mathematics Education* **11**: 459-480.
- Purwaningsih E., Sari A.M., Yuliati L., Masjkur K., Kurniawan B.R. & Zahiri M.A. 2020. Improving the problem-solving skills through the development of teaching materials with STEM-PjBL (science, technology, engineering, and mathematics-project based learning) model integrated with TPACK (technological pedagogical content knowledge). *Journal of Physics: Conference Series*, IOP Publishing, pp. 1-7.
- Rahman M.M. 2019. 21st century skill "problem solving": Defining the concept. *Asian Journal of Interdisciplinary Research* **2**(1): 64-74.
- Raju U.S.N., Kadambari K.V. & Reddy P.V.S. 2015. A new method of assessing the students using video assignments. *2015 IEEE Global Engineering Education Conference (EDUCON)*, IEEE, pp. 771-773.
- Schukajlow S., Rakoczy K. & Pekrun R. 2023. Emotions and motivation in mathematics education: Where we are today and where we need to go. *ZDM-Mathematics Education* **55**(2): 249-267.
- Silber-Varod V., Eshet-Alkalai Y. & Geri N. 2019. Tracing research trends of 21st-century learning skills. *British Journal of Educational Technology* **50**(6): 3099-3118.
- Somerville M., Anderson D., Berbeco H., Bourne J.R., Crisman J., Dabby D., Donis-Keller H., Holt S.S., Kerns S., Kerns D.V., Martello R., Miller R.K., Moody M., Pratt G., Pratt J.C., Shea C., Schiffman S., Spence S., Stein L.A., Stolk J.D., Storey B.D., Tilley B., Vandiver B. & Zastavker Y. 2005. The Olin curriculum: Thinking toward the future. *IEEE Transactions on Education* **48**(1): 198-205.
- Stockwell B.R., Stockwell M. S., Cennamo M. & Jiang E. 2015. Blended learning improves science education. *Cell* **162**(5): 933-936.
- Sumardi S., Adzima R. & Wijaya A.N. 2020. Digital video project: An authentic assessment to assess students' speaking skills. *Indonesian Journal of EFL and Linguistics* **5**(1): 59-74.
- Tajibayeva Z., Nurgaliyeva S., Aubakirova K., Ladzina N., Shaushekova B., Yespolova G. & Taurbekova A. 2023. Investigation of the psychological, pedagogical and technological adaptation levels of repatriated university students. *International Journal of Education in Mathematics, Science, and Technology* **11**(3): 755-774.
- The Star 2023. *More doing higher studies for brighter prospects*. <https://www.thestar.com.my/news/nation/2023/05/20/more-doing-higher-studies-for-brighter-prospects>
- UNESCO 2022. *The higher education we want: Youth voices on the futures of higher education*. United Nations Educational, Scientific and Cultural Organization. <https://www.iesalc.unesco.org/en/2022/09/26/what-do-youth-say-about-higher-education-in-the-future/>
- Venkatesh V., Speier C. & Morris M.G. 2002. User acceptance enablers in individual decision making about technology: Toward an integrated model. *Decision Sciences* **33**(2): 297-316.
- Viro E., Lehtonen D., Joutsenlahti J. & Tahvanainen V. 2020. Teachers' perspectives on project-based learning in mathematics and science. *European Journal of Science and Mathematics Education* **8**(1): 12-31.
- Vukovic R.K., Kieffer M.J., Bailey S.P. & Harari R.R. 2013. Mathematics anxiety in young children: Concurrent and longitudinal associations with mathematical performance. *Contemporary Educational Psychology* **38**(1): 1-10.

- Weissman A.N. & Beck A.T. 1978. Development and validation of the Dysfunctional Attitude Scale: A preliminary investigation.
- Wu B. & Chen X. 2017. Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. *Computers in Human Behavior* **67**: 221-232.

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