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An Analysis of Using Online Video Lecture on Learning Outcome: The Mediating Role of Student Interaction and Student Engagement

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Abstract

The Malaysia Education Blueprint 2015-2025 (Higher Education) was published recently. One of shift is globalised online learning. Therefore, Polytechnics had taken the first step in the use of e-learning system by using flipped classroom method. The purpose of this study is to analyse the effects of using online video lecture on student interaction, student engagement and learning outcome in flipped classroom environment. This study has been conducted on 32 semester one Polytechnic Tuanku Sultanah Bahiyah students. A questionnaire was distributed and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The findings shows that the learning outcome dimension has a practical value of $R^2 = 0.813$. Thus, research model proven that using online video lecturer significantly predicted learning outcome. The findings also indicate that student interaction and student engagement not mediated the relationship between online video lecture and learning outcome. Practically, the findings of this study revealed the importance of developing interactive online video lecture and active learning activities in enhance student interaction and student engagement.

Keywords: Flipped classroom, Online video lecture, Student engagement, Student interaction and student learning outcome.

Contents

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1. Introduction

Malaysia Education Blueprint 2015 - 2025 (Higher Education) has published 10 shifts towards global trends that disrupt the landscape of higher education. These shifts address key performance issues in the higher education (HE) system, especially with regards to quality and efficiency (Ministry of Education Malaysia, 2015). The first four shifts focus on outcomes for key stakeholders in the higher education system, such as holistic, entrepreneurial, and balanced graduates, talent excellence, nation of lifelong learners, and quality TVET graduates. The other shifts focus on enablers for the HE ecosystem, such as financial sustainability, empowered governance, innovation ecosystem, global prominence, globalised online learning, and transformed HE delivery (MEM, 2015). This study was about shift 9, globalised online learning.

Using online video lecture in teaching and learning is one way to turn traditional teaching methods toward globalized learning. In facts, video lectures have been widely shared among educators worldwide through public video sharing sites such as TeacherTube, YouTube, or Vimeo (Sweet, 2012). This has thus encouraged many educators who no longer lecture but instead focus on learning activities in the classroom. The most commonly used method was a flipped classroom. Studies have been done which show that using video lecture outside the classroom has improved student achievement and enhanced student satisfaction towards learning (Davies *et al.*, 2013; Francl, 2013; Maxwell, 2014). Thus, students have become more engaged in class and students interaction has increased among peers and lecturers (Enfield and State, 2013; Wagner *et al.*, 2013; Vieira *et al.*, 2014).

1.1. Problem Statement

The Department of Polytechnic Education has provided a learning management system (LMS) and a Curriculum Information Document Online System (CIDOS) on the Polytechnic e-learning portal, http://.cidos.edu.my (Curriculum Development and Evaluation Division Department of Polytechnic Education, 2014). CIDOS had been used for several years as a learning platform that was developed by DPE (Krishnan *et al.*, 2011). However, it is not fully utilized by the lecturers because lecturer from each polytechnics had different problems with the facilities and administration (Bakhtiar and Yusmadi, 2012). Therefore, most polytechnic lecturers still use traditional teaching and learning methods. Information Communication and Technology (ICT) use was limited to power point slides for teaching material in class, and students use Microsoft Office for assignments, especially in calculation courses Sazilah *et al.* (2014); Siti *et al.* (2014a). A study done by Siti *et al.* (2014b) shows that Polytechnic behavioural engagement, agentic engagement, cognitive engagement, and emotional engagement do not have significant relationships with student achievement. Wan *et al.* (2014) also stated that students with lower achievement in the fundamentals of accounting do not have an accounting background. Moreover Hamed *et al.* (2010) stated that Polytechnic still needs to upgrade its facilities and management systems in order to transform its institution to University College. Therefore, the following research objectives have been established to find a solution to the above problems.

1.2. Research Objective

To analyse student interaction and student engagement mediates between the use of online video lecture and learning outcome (i.e. skills and satisfaction) in a flipped classroom environment.

1.3. Research Question

Does student interaction and student engagement mediates between the use of online video lecture and learning outcome (i.e. skills and satisfaction) in a flipped classroom environment?

1.4. Research Hypothesis

H1 - There is a direct positive relationship between using online video lecture and learning outcome (i.e. skills and satisfaction) in a flipped classroom environment.

H2 - Student interaction will fully mediate the relationship between online video lecture and learning outcome (i.e. skills and satisfaction). Specifically, (a) online video lecture is positively related to student interaction and (b) student interaction is positively related to learning outcome (i.e. skills and satisfaction) in flipped classroom environment.

H3 - Student engagement will fully mediate the relationship between online video lecture and learning outcome (i.e. skills and satisfaction). Specifically, (a) online video lecture is positively related to student engagement and (b) student engagement is positively related to learning outcome (i.e. skills and satisfaction) in flipped classroom environment.

1.5. Research Framework

This study understands the use of video lecture based on the Cognitive Theory of Multimedia Learning (CTML) by Mayer (2001). The study based on CTML found that the use of video lecture has a direct effect on the learning outcome (Chen *et al.*, 2014; Ibrahim *et al.*, 2014).

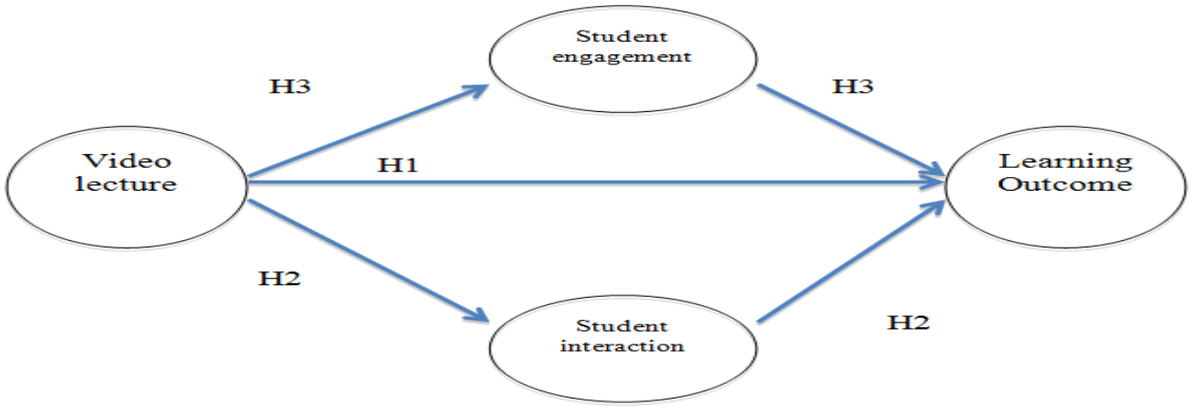

Figure-1. Research Framework

As shown in Figure 1, based on the main objective, to analyse student interaction and student engagement mediates between the use of online video lecture and learning outcome (i.e. skills and satisfaction) in a flipped classroom environment. Therefore, Polytechnics not only uses video lecture in teaching and learning for positive learning outcomes but also produces students who interact with learning materials, peers, and lecturers outside the classroom and also have behavior engagement, emotion engagement, cognitive engagement, and agentic engagement in the classroom.

2. Literature Review

2.1. Flipped Classroom

The flipped classroom is the reverse method of the traditional classroom. According to Bergmann and Sams (2012) lecturers use video lectures outside the classroom and use in-class time for doing assignments or active learning activities such as problem-based learning. Kim *et al.* (2014) also stated that flipped classrooms are also considered blended learning environments, using both online and face-to-face methods in teaching and learning. However, the online component of blended classrooms usually occurs during class time, along with student-teacher interaction (Torrisi-Steele and Drew, 2013). Results show that flipped classrooms have a positive impact on student satisfaction and achievement (Clark *et al.*, 2014). This has been supported by a study (Siti *et al.*, 2014a) that shows student achievement in flipped classroom is better than in traditional classrooms. Alternately, a study done by Missildine *et al.* (2013) showed that students had less satisfaction in the flipped model compared to traditional lecture because a flipped classroom required a greater workload for students. However, a study by Cynthia and Joseph (2014) shows that 74% had a positive experience with flipped classrooms, and 68% found that this model is effective to help them learn.

2.2. Video Lecture

In a flipped classroom, a video lecture will be prepared and watched by students before class (Rolf *et al.*, 2014). In this study, video lectures are recorded using education apps on an iPad and posted online at Blendspace.com with other learning material. In order to develop student knowledge by watching videos before class, Wu and Chen (2015) and Ibrahim *et al.* (2014) have suggested the Cognitive Theory of Multimedia Learning (CTML) in developing the video lecture. Assumptions used in learning through video are dual channels, limited capacity, and active processing by Mayer *et al.* (2001). Results show that the voice-over presentation type generates the highest cognitive load and sustained attention (Wu and Chen, 2015). These findings are similar to the study done by Pereira *et al.* (2014) which shows that lecturer and students would rather make videos with a microphone than a webcam. However, according to Siegle (2013) learning by just watching a video lecture without doing anything is less exciting. Hence lecturers need to create a video lecture that consists of a screen overflowing with multi-coloured words and flashing and moving images, to influence students mind to learning (Mayer and Moreno, 2003).

2.3. Student Interaction

Student Interaction in this study categorize based on Moore (1989) basic interaction student-student interaction, student-material interaction and student-teacher interaction. These provide the opportunity for students to construct and increase knowledge through active learning activities, that lead to student interaction with the presented material (Mayer and Moreno, 2003). Furthermore, these types of interactions had used by Kuo *et al.* (2014) as predictor towards students' satisfaction in online learning. According to Ibrahim *et al.* (2014) and Kuo *et al.* (2014) students construct knowledge thru video lecture as the main method of content delivery. Study done by Dufour *et al.* (2000) exploring how people interact with a digital video based on CTML, results suggest certain types of tools are useful for certain type of task. Although there is no interaction with students in flipped classroom, Marlowe (2012) had found that lecturer have individual time with the students. Therefore this study uses student interaction outside classroom as predictor that mediates the effects between online video lecture and student learning outcome (i.e. skills and satisfaction).

2.4. Student Engagement

According to Lawson and Lawson (2013) and Teoh *et al.* (2013) there is a reaction by students to the lecturer's teaching and learning process through active learning environment and student engagement occurred. Hence, there is different construct in student engagement measurement behavioral engagement, emotional engagement, cognitive engagement and agentic engagement (Reeve and Tseng, 2011). They also stated that student engagement in class

could be used as a predictor, which also a starting point toward the path of student achievement (Yazzie-Mintz, 2010). Nevertheless, there will be negative influences on academic achievement if there are difficulties in student engagement in learning process (Totura *et al.*, 2014) This supported by Marlowe (2012) that when she first started flipped classroom students would watch the videos but were not actively engaged in the viewing and learning process. Therefore, lecturer needs to create an active learning environment to lead high student engagement towards better academic achievement (Gebre *et al.*, 2013). According to Brecht (2012) by using the video lecture, students will be actively engaged in learning.

2.5. Learning Outcome

In The Fundamental Of Accounting Course Students Will Learn A Lot Of Technical Skills By Using A Variety Of Cases And Problems As Learning Tools To Them Develop Strong Problem-Solving Skills (Chiang *et al.*, 2014). According to Clark *et al.* (2014) Students With A Deep Understanding And Positive Experience Feel That They Had Learned The Material Before Class Followed By Enjoyment In Class Within The Learning Process. Contrarily, Ramlogan *et al.* (2014) Study Shows That, Live Lecture Alone May Prove To Be More Effective Compared To Video Instruction Alone In Clinical Training In Periodontology. Besides, Siriwardane *et al.* (2014) Findings Show That Skills, Knowledge, And Attitudes (KSAs) In Accounting Education Are Very Important To Have Succeeded In Accounting Technical Skill. Study On Improvement In Student Performance And Satisfaction In Flipped Classroom Found That Flipped Classroom Approach Required More Work, Not Perceive The Value Of Interactive Learning Approaches And Students Were More Satisfied With Lecture Only Compare To Lecture Capture Methods (Missildine *et al.*, 2013). However Study by Wilson (2013) and Murray *et al.* (2015) Shows That The Use Of Flipped Classroom Increase Students And Lecturer Satisfaction Towards The Implementation And Activities In The Classroom.

3. Methodology

This study used a cross-sectional design. A questionnaire-based survey was conducted on one class of semester one students from the Commerce Department, Politeknik Tuanku Sultanah Bahiyah. Students had taken DPA1013 Fundamental of Accounting for the January 2015 session, which consisted of 32 students in a flipped classroom by convenience sampling. In this study, one instrument was used. A structured questionnaire to determine student satisfaction with video lecture before class and after learning, student interactions, student engagement, and student skill, knowledge, and attitude (SKAs) in a flipped classroom was adapted from Roach (2014); Adler and Milne (2010); Reeve (2013) and Kuo *et al.* (2014). This instrument used a 5-point Likert scale that ranges from 1=strongly disagree, 2=disagree, 3=not agree or disagree, 4=agree, to 5=strongly agree, except for SKAs, 1=to no extent, 2=to small extent, 3=some extent, 4=to a fairly great extent, 5=to a great extent. Data from the respondents was analyzed using the Partial Least Squares Structural Equation Modelling (PLS-SEM) SmartPLS version 3.2.1 software. The reliability of measurement of the instrument used was assessed using the inter-item consistency reliability value.

Table-1. Reliability Value

Variable	Number of item	Cronbach's Alpha
Video Lecture	3	0.79
Students Skill	22	0.755
Student Interaction	10	0.843
Student Satisfaction	7	0.771
Student Engagement	15	0.811

As shown in Table 1, the Cronbach alpha values were above the criteria suggested by Nunnally (1978) (as cited in Ogunkola and Archer-Bradshaw (2013)) who indicated that a cut off value of 0.7 is acceptable. Therefore, the instrument used in this survey was reliable.

4. Data Analysis

According to Hair *et al.* (2014) there are five stages for applying PLS-SEM after data collection and examination. The first stage is PLS path model estimation, a consideration when running the analysis. The second is assessing the reflective and formative measurement model. The third is assessing the structural model. Fourth advance analysis, and finally, interpreting results and conclusions. According to Henseler *et al.* (2009) evaluation of the measurement model includes assessing the internal consistency reliability, convergent validity, and discriminant validity. As a result, once a valid and reliable measurement model is established, the structural model is assessed. According to Hair *et al.* (2014) the structural model assessment procedure includes estimating the path coefficients and assessing the level R^2 value, the effect size (f^2), and the prediction relevance (Q^2) and q^2 size effect.

Table-2. Inter-construct correlations and reliability measures

Cronbach Alpha	Composite reliability	AVE	Construct	Correlation among construct			
				Video lecture	Student Interaction	Student engagement	Learning outcome
0.893	0.934	0.825	Video Lecture	1.000			
0.942	0.451	0.662	Student interaction	0.244	1.000		
0.905	0.918	0.445	Student engagement	0.486	0.610	1.000	
0.935	0.943	0.513	Learning outcome	0.853	0.511	0.603	1.000

Table 2 shows the average variance extracted (AVE), Cronbach's alpha, and composite reliability (ρc) and discriminant validity among the construct. The AVE for video lecture is .825, student interaction is .662, student engagement is .445, and learning outcome is .513. All constructs exceeded the .40 threshold value (Hair *et al.*, 2014) indicating that these constructs explain more than half of the variance of its indicator relative to the amount of the measurement error. This indicates that all constructs were more highly related to its own measures than to other constructs. Table 1 also shows that the Cronbach's alphas for the four constructs were all above the recommended .70 threshold value according to Nunnally (1978) (as cited in Ogunkola and Archer-Bradshaw (2013)). Specifically, the Cronbach's alpha for video lecture was .893, whereas the Cronbach's alphas for student interaction, student engagement, and learning outcome were .942, .905 and .935, respectively. Similarly, the composite reliabilities for video lecture, student interaction, student engagement, and learning outcome also exceeded the cut-off value similarly to Cronbach Alpha (Hair *et al.*, 2014). Therefore, the internal consistency for the four constructs of this study was satisfactory.

To assess the discriminant validity, which implies that a construct is unique and captures phenomena not represented by other constructs in the model (Hair *et al.*, 2014) the two methods used were the Fornell-Larcker criterion and the indicators cross-loadings. According to Hair *et al.* (2014) discriminant validity at the construct and the indicator levels is established when the AVE for a construct is greater than the latent variable's highest squared correlation with any other latent variable (LV) and the loading of each indicator is greater than all of its cross-loadings.

Table-3. Reliability measures and squared correlations among constructs

Cronbach Alpha	Composite reliability	AVE	Construct	Square correlation among construct			
				Video lecture	Student Interaction	Student engagement	Learning outcome
0.893	0.934	0.825	Video Lecture	1.000			
0.942	0.451	0.662	Student interaction	0.060	1.000		
0.905	0.918	0.445	Student engagement	0.236	0.372	1.000	
0.935	0.943	0.513	Learning outcome	0.728	0.261	0.364	1.000

In this study, Table 3 shows that there was sufficient support for discriminant validity at the construct level because the AVEs for all three constructs were higher than the squared correlations among constructs, except for learning outcome with the video lecture construct.

Following is a reliability and validity measurement model assessing the structural (i.e., inner) model.

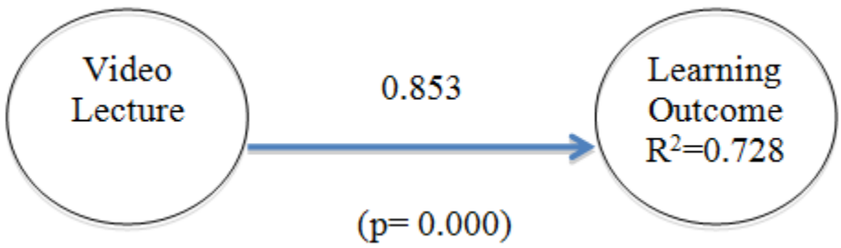

Figure-2. Direct effect

Figure 1 shows the results of the structural model for direct effect with a R^2 value for learning outcome of 0.728, which is considered moderate. While, Figure 2 shows the results for indirect effects.

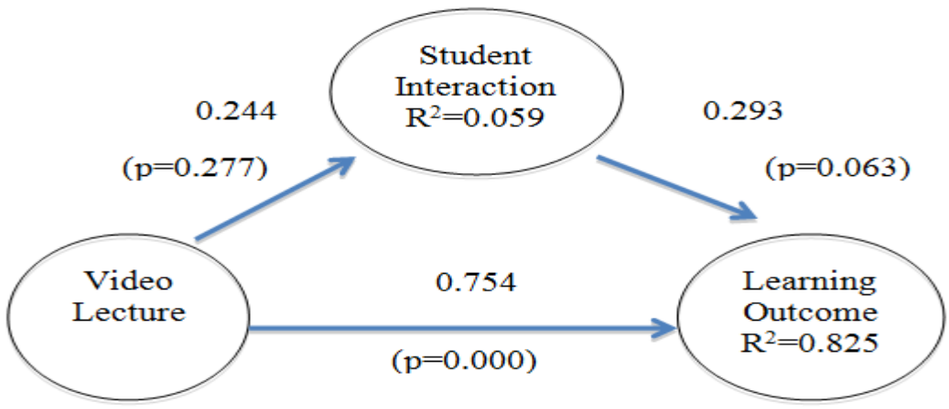

Figure-2(a). Indirect effect (student interaction)

The results of the indirect effect in Figure 2(a) show that the R^2 value for learning outcome was 0.825 and the R^2 value of student interaction was 0.059.

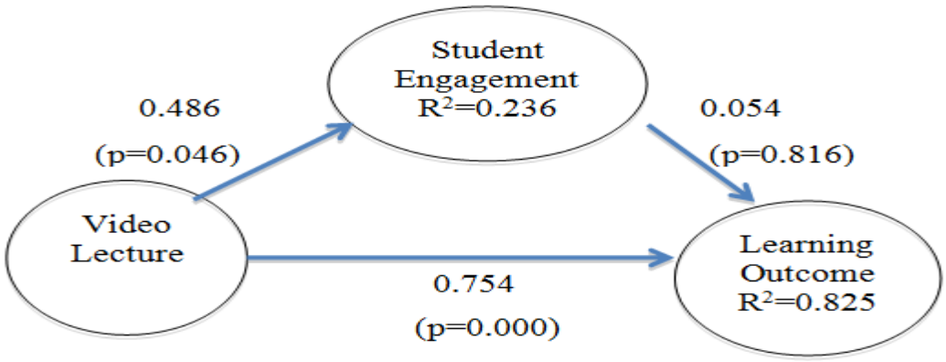

Figure-2(b). Indirect effect (student engagement)

Meanwhile, Figure 2(b) shows that the R^2 value for learning outcome was 0.825 and the R^2 value of student engagement was 0.236. According to Hair *et al.* (2014) a R^2 value of 0.75 and above is considered substantial, whereas a R^2 value of 0.50 is considered moderate, and a R^2 value of 0.25 and below is considered weak. In this study, the R^2 value for learning outcome was high whereas the R^2 value for student interaction and student engagement was weak.

The PLS algorithm Path was used to obtain coefficients. The bootstrapping technique with 1000 resamples was used to test whether or not these paths were significant. The bootstrapping results showed that video lecture -> student engagement and video lecture -> learning outcome paths coefficients were significant at the .05 level. Because both the direct effects and the indirect effects were significant, and given that the path coefficient between video lecture and learning outcome was smaller in the mediated model (B = 0.754, p > .05) than in the basic model (B = 0.853 p >.05), there is empirical evidence that student interaction and student engagement was not mediated in the relationship between video lecture and learning outcome. Also, the results of the Sobel test showed that the mediating effect was not significant (z = 0.312, p > .05). The effect of adding another predictor as a mediator (i.e. student interaction and student engagement) was assessed by calculating the effect size using the Figure 3 equation.

$$f^2 = \frac{R^2_{\text{include}} - R^2_{\text{exclude}}}{1 - R^2_{\text{include}}}$$

Figure-3. Effect size equation

Source: Pavel *et al.* (2009)

In Figure 3, equation R^2 included refers to the value of the endogenous variable when the mediator is included in the model, and R^2 excluded refers to value of the endogenous variable when the mediator is excluded from the model (Pavel *et al.*, 2009). Based on f^2 rule of thumb, the effect size was considered large ($f^2 = 0.554$). The results show that student interaction and student engagement has a large effect on the structural model. In order to assess the model's capability to predict, a blindfolding procedure was used. The predictive relevance values, Q^2, for student interaction, student engagement, and learning outcome were 0.011, 0.060, and 0.338, respectively. These three values are larger than 0, and as a result the model has predictive relevance.

5. Results and Discussion

This study to analyse student interaction and student engagement mediates between the use of online video lecture and learning outcome (i.e. skills and satisfaction) in a flipped classroom environment. Consistent with the positive norm of previous studies (Wilson, 2013; Murray *et al.*, 2015) the results of this study showed that there was a direct positive relationship between online video lecture and learning outcome. This finding suggests that students who use online video lecture are more likely to have a higher learning outcome. Therefore, hypothesis 1 was supported.

However, this is not consistent with CTML. The results showed that student interaction not mediate the relationship between online video lecture and learning outcome. Specifically, online video lecture is not significant positively related to student interaction and student interaction is not significant positively related to learning outcome. Therefore, when students learn using online video lecture, they do not have interaction between material, peers, and lecturer outside the classroom. Consequently, when students not interact outside the classroom, they do have less satisfaction and less skill in a flipped classroom environment. Therefore, hypothesis 2 was rejected. However, student interaction has a large effect on explaining the measurement of learning outcome variance.

Furthermore, student engagement not mediated the relationship between online video lecture and learning outcome. Specifically, student engagement was not mediated the relationship between using online video lecture and learning outcome. However, online video lecture is significant positively related to student engagement. Instead, student engagement is not significant positively related to learning outcome. When student learn by using online video lecture more, the more they engage inside the classroom but they have less satisfaction and skills in flipped classroom environment. Therefore hypothesis 3 was rejected. However student engagement has large effect on explaining the measurement of learning outcome variance.

The findings of this study have several implications. First, the results provide some support for using active learning activities in flipped classroom. Bergmann and Sams (2012) had proposed reserving the lecture for outside class and engaging in outside activities in the classroom, which might lead to positive learning outcomes but not

student interaction outside classroom or student engagement in the classroom. The findings of this study showed that using online video lecture and doing accounting tutorial and exercises, without doing active learning activities, such as role play, games and interactive question and answer session in a fundamental of accounting course, might yield no interaction outside the classroom or engagement during in-class activities. The effect, however, still does not affect the teaching and learning process and students' achievement, especially when they use video lecture and do a lot of tutorial and exercises to achieve a higher learning outcome. Therefore, the lecturer needs to prepare detailed, innovative lesson plans before and in the class and provide students with activities while they watch the online video lecture outside class, not only completing tutorials but more active learning activities such as games and role play in the class.

This study also revealed that student interaction and student engagement is an unused circumstance in teaching and learning fundamental of accounting. Specifically, student interaction and student engagement was not found to mediate the relationship between using online video lecture and learning outcome. This finding indicates to the lecturer that they need to create more active learning activities outside and inside the classroom in order to increase student interaction and engagement in a flipped classroom environment. Using online video lecture without active learning activities preserves a traditional environment in teaching and learning.

The present study has two limitations. First, only one class was selected with a small sample. Hence, future studies are encouraged to select more samples so that the hypothesis and relationship can be established. Last, this study only used quantitative data analysis. Therefore it could not show student interaction outside the classroom and student engagement inside the classroom mediates between the use of online video lecture and learning outcome. Hence, this study suggested to used mixed method design in order enable researchers to gain greater insight into the important predictor of research variable (Creswell, 2012).

6. Conclusion

Although this study used a simple framework, it was able to show that student interaction and student engagement as predictor variables on the relationship between using online video lecture and learning outcome. The PLS results showed that the R^2 for the ultimate dependent variable (i.e., learning outcome) was 0.825, which means that 83% of the variance in the dependent variable was explained by the independent variables. Hence, future research should increase the sample to identify whether there is a mediating effect in using online video lecture and learning outcome. Finally, students need time to adapt to flipped classrooms with active learning activities in order to have student interaction and engagement mediation between using online video lecture and learning outcomes (Bond *et al*., 2012; Brecht, 2012). Therefore, Polytechnics not only uses ICT in teaching and learning for positive learning outcomes but also produces students who interact with learning materials, peers, and lecturers and have behavior engagement, emotion engagement, cognitive engagement, and agentic engagement.

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