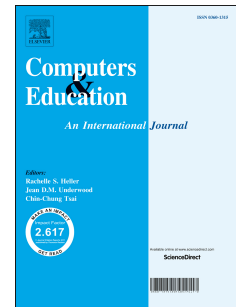# Accepted Manuscript

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Please cite this article as: Al-Rahmi W.M., Alias N., Othman M.S., Marin V.I. & Tur G., A model of factors affecting learning performance through the use of social media in Malaysian higher education, *Computers & Education* (2018), doi: 10.1016/j.compedu.2018.02.010.

A Model of Factors Affecting Learning Performance through the Use of Social Media in Malaysian Higher Education

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A Model of Factors Affecting Learning Performance through the Use of Social Media in Malaysian Higher Education

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Abstract

This study attempted to mitigate the gap in literature concerning the use of social media for active collaborative learning and engagement and its effect on the research students' learning performance in the context of Malaysia. A questionnaire based on Constructivism Theory and the Technology Acceptance Model was employed as the main data collection method, which was distributed to 723 research students in five Malaysian research universities. Based on the obtained results, male and female students' satisfaction of social media use for collaborative learning and engagement positively affected their learning performance, although in the case of females, they were not fully satisfied with perceived ease of use and usefulness. The study concludes that overall, active collaborative learning and engagement through social media enriches the learning activities of students and facilitates group discussions, and hence, their use should be encouraged in learning and teaching processes in higher education institutions.

1. Introduction

In the current times, social networking sites have transformed into popular e-learning platforms for knowledge-sharing and engagement in active collaborative learning (Rau et al., 2008). These sites can be invaluable in assisting the development of optimum social connections among learners and hence allowing ideas-sharing, interaction and engagement to create products and be recipients of accurate and regular feedback (Greenhow, 2011; Al-Rahmi & Zeki, 2017). For instance, social networking sites have been used as a virtual classroom, in lieu of the traditional

classroom, particularly to learn language, and as a platform upon which communication and entertainment are provided for college students (Blattner & Fiori, 2009). They have also been employed to promote and hone the creativity and communication skills of students (Kabilan et al., 2010). Some concrete educational experiments include the use of Twitter in the university classroom (Tur et al., 2017) or the assessment of the level of presence and acceptance of digital learning among undergraduate medical students, which was high specifically when it comes to mobile applications (Gutmann et al., 2015).

Based on the socio-cultural theory of learning, proposed by Vygotsky (1978), people learn via social interaction and ideas and experience-sharing. Moreover, in Vygotsky's latest study on social construction as a learning mechanism (cited in Bivens, 1990), social processes encourage the cognitive change through social interaction. Hence, in this study, the constructivism theory and the technology acceptance model (TAM) are adopted for the measurement of learning performance among research students and their use satisfaction of social media in active collaborative learning in order to improve their overall learning performance.

A significant number of research has been dedicated to social media networks, with the more recent stream focused on the use of social media, in terms of privacy (Mohamed & Ahmad, 2012), psychology (Wang et al., 2012), health (Lauckner et al., 2013), marketing (Fuciu & Groski, 2013), culture (Al-Omoush et al., 2012), and society (Lee, 2013). Despite the massive number of such studies, studies that examined the use of social media as tools of effective learning performance via active collaborative learning in higher education, and the way it can enhance the learning quality in Malaysia are still scarce. Focus has been confined so far to the developed countries of the U.S., Australia and the U.K. This is one of the reasons for the driving force behind this study, which aims to fill the gap in literature by examining the factors of active collaborative learning and engagement that affect students' learning performance in Malaysian Higher Educational Institutions. More specifically, the study concentrates on the students' social media use for the purpose of active collaborative learning and engagement, and its effect on the students' satisfaction based on students' perceptions of its usefulness and ease of use. These are two of the major factors that influence technology acceptance/rejection based on TAM. TAM is considered to be one of the most extensively utilized models in examining attitudes towards social media technology use. Along with TAM, this study also employs the constructivism theory, which addresses interaction and its effect on the active collaborative learning and

engagement of students. Both theories are used to measure the learning performance among students that is still largely untouched by studies in the Malaysian context.

1.1 Problem Statement

The present research' statements can be divided into three parts, with the first being the lack of investigation into social media use for active collaborative learning and engagement, while considering the related interactive and perceptual factors as highlighted by prior studies (e.g., Nemetz et al., 2012; Argan, 2010). The second part is related to the lack of the use of instrument models to measure the relevant factors in one study (Lin & Lu, 2011; Yeh et al., 2011; Lee et al., 2012), and the lack of examination of intention towards social media use for collaborative learning and engagement, while considering the interactive and perceptual factors (Nemetz et al., 2012; Argan, 2010; Lin & Lu, 2011). The third part relates to the potential to model acceptance of social media with constructivist theory as the underpinning model of constructs, considering both interactive and perceptual factors existing in the social media in the educational context (Zakaria et al., 2010; Selwyn & Grant, 2009; Madge et al., 2009). Added to the above, there is scarcity of models used to understand social media use and its effects on learning performance in the Higher Educational Institutions of Malaysia (Zakaria et al., 2010; Selwyn & Grant, 2009; Madge et al., 2009).

2. Social Media in Education

Majority of studies examined social media tools individually, like MySpace, Facebook or Twitter as education innovations as this research trend appears logical judging from the generalization of the term social media itself. This shows that social media technologies have not permeated the realm of education in the true sense. According to a related study conducted by Roblyer et al. (2010), in the higher education context, students are more susceptible to using Facebook and other social media websites to reinforce the processes of learning compared to others who have a higher tendency towards using traditional learning methods. Tess (2013) reviewed social media in higher education classes and reached to the conclusion that majority of the universities possess the infrastructure and support for the use of social media, but their instructors are not as adept at using the same for the purpose of instruction.

Generally speaking, in high schools, social networking sites are utilized as social learning resources that provide students with the opportunity to validate and appreciate their creativity and support to their peers, and to provide and obtain the support of the schools. In this context, the factors examined in literature include faculty use (Al-rahmi et al., 2014; Al-rahmi et al., 2015a; Ajjan & Hartshorne, 2008; Chen & Bryer, 2012; Roblyer et al., 2010; Veletsianos, 2012), student engagement (Junco et al., 2012; Al-Rahmi et al., 2015b), and the effect on academic achievement (Junco, 2012; Junco et al., 2011; Al-Rahmi et al., 2015b).

Aside from the above studies, Pomerantz et al. (2015) examined the development and revision of social media policies throughout higher education, while considering the dynamic changes in social media realm, academic freedom issues, and the premises of inter-operability with policies at the unit and campus levels. They found social media to be a vital technology promoting the voice of students and their control over their learning process. The productive use of web based tools and applications that can be used for the development of learning environments can be exemplified by Flickr, wikis, podcasts, blogs and digital voice recorders.

3. Research Model and Hypotheses

The study model examines the factors of active collaborative learning, engagement and satisfaction and their effects on the students and researchers' learning performance through social media in the case of students of Malaysian Higher Educational Institutions (see Figure 1). Accordingly, both constructivism theory and TAM are adopted to achieve the study objectives. The study proposes that social media integration is related to active collaborative learning and engagement of researchers. It offers a global comprehensive model of the impact on students' learning by social media services, going beyond the limitations of studies focused on single services or platforms.
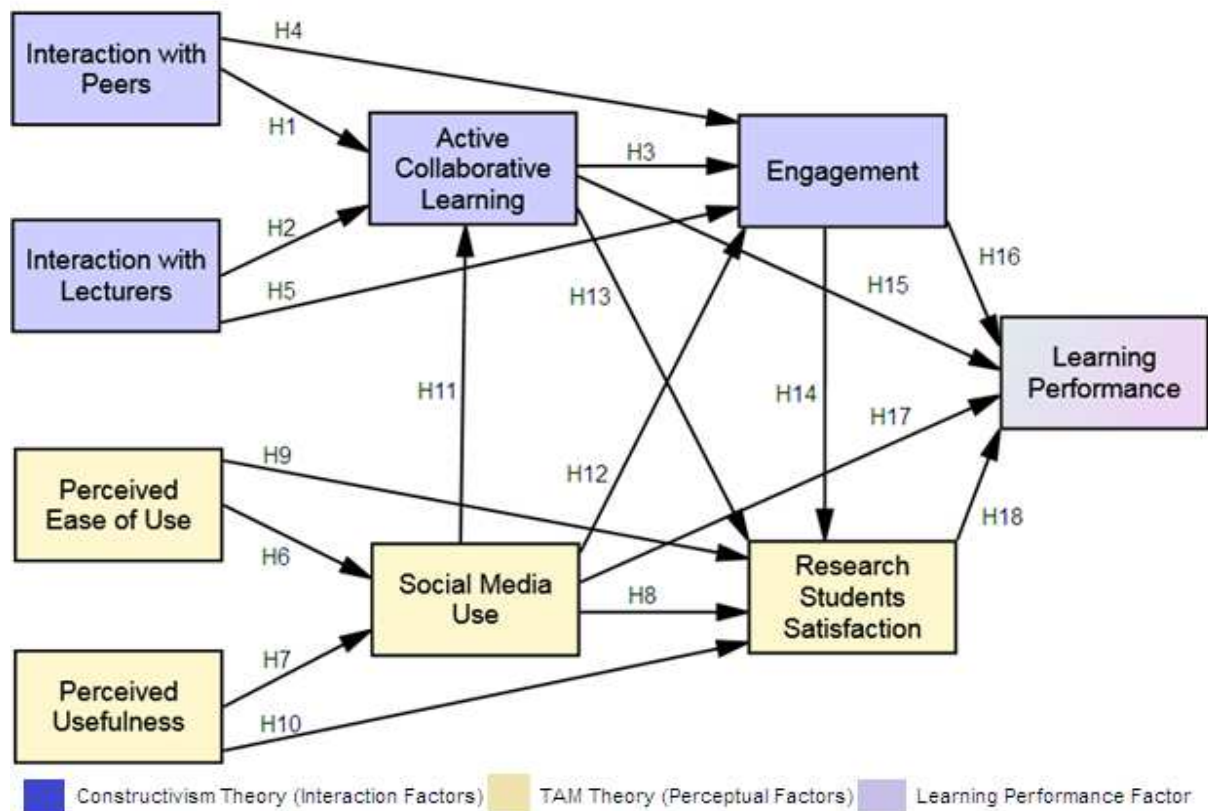
Figure 1: Research Model and Hypotheses

3.1 Interaction among Students and Lecturers

The social media tools allow teachers to facilitate message-exchanges with their students. According to a recent study (Kabilan et al., 2010), Facebook is one of the top tools that can be utilized to improve communication, promote a positive learning attitude, encourage learning and learning tasks adoption seriously and maximize the students' social capital via virtual communications. There are some studies that examined the use of Facebook for the teaching and learning processes (e.g., Wang et al., 2012; Roblyer et al., 2010), but few of them mention that this social networking tool can be used as a complementary and innovative learning-teaching method in Higher Educational Institutions. Thus, it is crucial for educators to be aware of the academic and social background of their students prior to drawing up the lesson plans and the pedagogy, and the types of assessment to use in the process of teaching. According to Chen's (2015) study, participants with assimilating and diverging learning styles outperformed those with accommodating and converging learning styles, and this calls for the invaluable use of

Facebook in learning. In fact, the social media use in the Higher Educational Institutions is perceived to increase the engagement between instructions and students (Greenhow & Gleason, 2012). This result is also evidenced by Fusch (2011), who found that the learning tools are just as important as the learning aims in that they need to have a social presence, entailing interacting learning and facilitating active collaborative learning. Based on the above discussion, the following hypotheses are proposed to be tested:

H1: There is a significant relationship between interaction with peers and active collaborative learning.

H2: There is a significant relationship between interaction with lecturers and active collaborative learning.

H4: There is a significant relationship between interaction with peers and engagement.

H5: There is a significant relationship between interaction with lecturers and engagement.

3.2 Active Collaborative Learning

Collaborative learning and engagement through the use of social media was evidenced by Al-Rahmi et al. (2015c) to have a positive and significant relationship with the group participants' interaction. In this regard, social constructivism creates compositions in writing classes that are linked to active collaborative learning as evidenced in Hewett's (2009) research. Added to this, Li et al. (2012) also reported that majority of the students increased in their interest towards writing when exposed to active collaborative learning through a wiki, and this relates to positive learning perceptions (Rohrbeck et al., 2003). The extensive reach of wiki technologies has brought about their application in motivating the participation of learners in active collaborative learning (Zorko, 2009). In a related current study, Balakrishnan and Lay (2016) examined the factors that influence the intentions of students to make use of social media for learning on the basis of various learning styles namely engagement, collaborative and independent styles, through the use of social media acceptance model. Also, according to Ratneswary and Rasiah (2013), the use of Facebook as an exchange tool is perceived to be a less threatening and versatile learning space that improves active collaborative learning and develops robust students-lecturer connection in a manner that is considerably engaging. Based on the above, the researcher proposes the following hypotheses:

H3: There is a significant relationship between active collaborative learning and engagement.

H15: There is a significant relationship between active collaborative learning and learning performance.

H13: There is a significant relationship between active collaborative learning and students' satisfaction.

3.3 Engagement

Engaging in collaborative activities entails the use of ideas, sharing, and comprehending different points of view (Barron, 2003). The expansively employed social media offers an insight into the different ways in which individuals can interact with each other through knowledge-sharing and in turn, this integrates online interaction into daily lives (Shirky, 2011). Additionally, literature has also evidenced that the social media networking use leds to positive learning outcomes and engagement experience (e.g., Lockyer & Patterson, 2008; McCarthy, 2010; Baird & Fischer, 2006; Junco et al., 2011). The focus remains on social media network as this is considered to be an online tool that provides considerable advantages to better outcomes and experience via cognitive engagement and social interaction (Lockyer & Patterson, 2008). To this end, active collaborative learning is enabled to provide resources, maximize engagement in the curriculum and provide knowledge transfer network (Baird & Fisher, 2006). Majority of studies have been carried out to confirm if students that are provided with engagement opportunities in terms of wiki-based communities tend to outlearn those that are taught through traditional methods (Li & Zhu, 2011). These studies have noted the positive effects of wikis use in the learning realm, which includes maximized collaboration, interaction with peers and learning motivation. Therefore, the following hypotheses are proposed for testing;

H14: There is a significant relationship between engagement and students' satisfaction.

H16: There is a significant relationship between engagement and learning performance.

3.4 Technology Acceptance Model

In this study, the Technology Acceptance Model (TAM) is employed as the underpinning model as it proposes that perceived usefulness and ease of use are the top factors of new technology that can influence the attitudes of individuals towards technology use, and predict its use and adoption intentions. Among the many proposed technology models, TAM is the most widely used theoretical technology model. It was initially developed by Davis et al. (1989) to explain

the reason behind the computer technology adoption/rejection. The model has its basis on the notion that individual's perceived usefulness and perceived ease of use of social media will affect his attitude and his intention towards social media networks use.

3.5 Perceived Ease of Use, Perceived Usefulness and Social Media Use

Davis's (1989) proposed TAM consists of factors namely attitude, perceived usefulness and perceived ease of use. While attitude refers to a learned predisposition to positively/negatively react towards a specific thing (Fishbein & Ajzen, 1975), perceived usefulness refers to the degree to which an individual perceives that the use of a particular system would influence his performance on the job (Davis, 1989). Finally, perceived ease of use refers to the degree to which an individual believes that the use of a particular system does not require much effort (Davis, 1989). TAM is a model that is considered flexible as it covers other variables that can explain technology acceptance (Featherman & Pavlou, 2003; Goode & Harris, 2007; King & He, 2006; Lee et al., 2003; Venkatesh & Davis, 2000). Along with TAM, other theories can thus be utilized (e.g., constructivism theory) to explain interaction and engagement, active collaborative learning through social media, in the context of Malaysian Higher Educational Institutions.

In this study, satisfaction is measured in terms of social media use for the purpose of active collaborative learning and engagement. The study model adopted consists of the TAM-related factors and other related interactive factors that are expected to affect satisfaction and predict indicators for future social media use, among research students in Malaysian Higher Educational Institutions. For the purpose of the present study, satisfaction refers to the pleasant experience gained from using social media technology. Therefore, the following hypotheses are proposed:

H6: There is a significant relationship between perceived ease of use and social media use.

H7: There is a significant relationship between perceived usefulness and social media use.

H8: There is a significant relationship between social media use and students' satisfaction.

H9: There is a significant relationship between perceived ease of use and students' satisfaction.

H10: There is a significant relationship between perceived social usefulness and students' satisfaction.

H11: There is a significant relationship between social media use and active collaborative learning.

H12: There is a significant relationship between social media use and engagement.

H17: There is a significant relationship between social media use and learning performance.

3.6 Students' Satisfaction

In Jung et al.'s (2002) study, participating undergraduate students in online collaborative tasks were satisfied with their learning in comparison to those who were non-participants. In this regard, the satisfaction of learners with active collaborative learning is described as the degree to which the learner positively views his/her active collaborative experiences (Dewiyanti et al., 2007). Khalifa and Lam (2002) confirmed that active collaborative learning calls for maximized interactive capabilities to increase learner satisfaction. Also, active collaborative learning circles and the satisfaction of students with them are significant issues that have been examined by the research in the literature (e.g., Santhanam, Sasidharan & Webster, 2008; So & Brush, 2008; Wu et al., 2010).

Along a similar finding, Schroeder, Minocha and Schneider (2010) and Dunn (2013) revealed that social media improved students' learning experience by maximizing their motivation and engagement, and the interaction between students and between students and the lecturer, and by offering students with the required skills for employability, and maximized satisfaction. Different authors (e.g., Junco et al., 2011; Karpinski et al., 2013; Al-Rahmi et al., 2015d) report that social media in the educational realm has a positive impact on the enhancement of students' academic performance and on the enrichment of the learning environment. Furthermore, social media use facilitates positive relationship between academic performance of students and their satisfaction (Cao & Hong, 2011). Therefore, this study proposes that:

H18: There is a significant relationship between students' satisfaction and learning performance.

3.7 Learning Performance

Studies in the literature that examined the influence of social media use on the learning performance of students indicated that students perceive that Facebook is suitable to be used in their interaction with their teachers and they can socialize through it (Baran, 2010). Additionally, the use of social media networking influences positively the connection between students learning performance and their satisfaction (Cao & Hong, 2011). In education, the use of social networking sites enhances the active collaborative learning of students (Ractham & Firpo, 2011; Liao, Huang, Chen & Huang, 2015).

In particular, Selwyn and Grant (2009) and Arnold and Paulus (2010) highlighted the potential of such learning approach. Meanwhile, Al-Rahmi et al. (2015e) and Karpinski et al. (2013) revealed that networking in education can improve the students' learning performance and the learning environment. This is possible by stressing on the needs of the students and their formative assessment, and by creating a classroom community, promoting engagement of students, increasing their achievement, and managing information and knowledge-sharing among them. This was confirmed by Ainin et al. (2015) who found a positive relationship between the learning performance of students and the use of Facebook. On the whole, the use of social media networking in learning is the core focus of this research, where such network is included in the learning environment in the context of Malaysia Higher Educational Institutions.

4. Research Methodology

This study evaluated the questionnaire content by obtaining the assistance of two experts. Permits were also obtained from five Malaysian research universities to collect data – the universities include University of Malaya (UM), National University of Malaysia (UKM), Universiti Sains Malaysia (USM), Universiti Teknologi Malaysia (UTM), and Universiti Putra Malaysia (UPM). This study also obtained approval from the Faculty of Computing of Universiti Teknologi Malaysia (UTM). The selected study sample consisted of social media users for active collaborative learning and engagement, particularly postgraduate students. The survey items were measured using a 5-point Likert scale, with the items consisting of interactive factors, TAM variables and demographic items. The survey was distributed manually and the respondents were asked to fill them in to obtain their feedback on social media networks use for active collaborative learning and engagement, and their view of its influence on their satisfaction and learning performance. Data collected were analyzed with IBM SPSS, and Structural Equation Modeling (SEM- Amos) are used as the main statistical technique utilized in this research by two steps; the first step as follows construct validity of the measurements, convergent validity of the measurements, discriminant validity of the measures and second step is analysis of the structural model. The approach was recommended by Hair et al. (2012).

4.1 Sample Characteristics

A total of 915 questionnaires were distributed, from which 822 were returned by the respondents, indicating a 90% return rate. The questionnaires were manually analyzed and after this process it became evident that 43 questionnaires were incomplete and thus, had to be excluded. Therefore, the remaining questionnaires numbering 779 were entered into SPSS, only to find that 19 had missing data and 37 had outliers. Excluding the above cases from the questionnaires, the remaining questionnaires for data analysis were only 723. The exclusion was supported by Hair et al. (2012), who stated that outliers are eliminated as they may lead to inaccurate statistical outcomes. Out of the 723 questionnaires, 329 (45.5%) were male and 394 (54.5%) were female. From the respondents, 96 (13.3%) were in the age range of 21-24, 305 (42.4%) were in the age range of 25-30, and 192 (26.6%) were over 35 years of age. As for the educational degrees held by the respondents, 103 (14.2%) were in Master-taught course, 121 (16.7%) respondents were in the Master mixed mode program, 104 (14.5%) respondents were in Master full research program, whereas 395 (54.6%) were in a PhD program. Majority of the respondents (95%) used social media network - Facebook, Twitter, LinkedIn, ResearchGate and forums - for active collaborative learning and engagement, and the remaining (5%) did not do so.

4.2 Data Collection and Measurement

As mentioned, 915 questionnaires were distributed to the students in the February 2014 school semester, from which 723 questionnaires were found to be usable. According to Ajjan and Hartshorne (2008), social media enhances the perceived interaction quality among researchers and between researchers and their supervisors. In this regard interaction refers to a significant aspect of the training process that promotes the researchers' pro-activity in class during active collaborative learning (So & Brush, 2008; Al-Rahmi et al., 2014; Al-Rahmi et al., 2015b). This holds true for both perceived ease of use and perceived usefulness and social media use (Kim, 2008). It can therefore, be stated that the above factors (Yu et al., 2010) enhance the researchers/students' performance in universities through active collaborative learning (Yampinij et al., 2012) and in turn, enhance learning performance (Al-Rahmi et al., 2015a; Al-Rahmi et al., 2015b).Peer interaction was gauged through six items adopted from Liu (2003) and McMillan and Hwang (2002), while interaction with lecturers was gauged through four items adopted from the same authors. As for active collaborative learning, it was measured through four items

adopted from So and Brush (2008), and engagement by three items adopted from Gallini and Moely (2003) and Medlin and Green (2009). Moving on to perceived ease of use and perceived usefulness, they were measured through four items adopted from Davis (1989) and Kim (2008). The use of social media was also measured through four items, but such items were adopted from Kim (2008) and Lee et al. (2003), and students' satisfaction's four items were adopted from Moore (2009). Lastly, students' learning performance was measured by four items adopted from MacGeorge et al. (2008).

5. Result and Discussion

The related factors affected engagement and active collaborative learning in light of researchers' satisfaction in social media use in the context of Malaysian universities with a Cronbach's Alpha reliability coefficient of 0.977. The present study evaluated discriminant validity based on three criteria; first, index among variables less than 0.80 (Hair et al., 2012), the AVE value of each construct equal to or more than 0.5, and square of AVE of each construct is greater than the inter-construct correlations (IC) related with the factor (Fornell & Larcker, 1998). Added to the above criteria, the constructs, items and crematory factor analysis results with factor loading of 0.5 or over, are considered acceptable, with Cronbach's Alpha ≥0.70 and composite reliability ≥0.70 (Hair et al., 2010).

5.1 Measurement and Model Analysis

The measurement model was examined through uni-dimensionality, reliability, convergent validity and discriminant validity. In relation to this, Hair et al. (2010) and Kline (2011) suggested the model estimation to be estimated through the maximum likelihood estimation procedures by using the goodness-of-fit guidelines, like the normed chi-square, chi-square/degree of freedom, incremental fit index (IFI), Tucker-Lewis coefficient (TLI) comparative fit index (CFI), the parsimonious goodness of fit index (PGFI), the root-mean-square residual (RMR) and the root mean square error of approximation (RMSEA) as proposed by Byrne (2010) as well as Hair et al. (2012). Table 1 contains the summary of the goodness-of-fit indices used to evaluate the measurement model.

Table 1: Summary of Goodness-of-Fit Indices for the Measurement Model

Type of measure	Acceptable level of fit	values
Chi-square ($\chi2$)	$\leq$ 3.5 to 0 (perfect fit) and ($\rho > .01$)	978.225
Normed Chi-square ($\chi2$)	Value should be greater than1.0 and less than 5.0	2.515
Root-Mean Residual (RMR)	Close to 0 (perfect fit)	.035
Incremental Fit Index (IFI)	Value should be equal to or greater than 0.90.	.939
Tucker Lewis Index (TLI)	Value should be equal to or greater than 0.90.	.932
Comparative Fit Index (CFI)	Value should be equal to or greater than 0.90.	.939
Root mean square error of approximation (RMSEA)	Value below 0.10 indicates a good fit and below 0.05 is deemed a very good fit.	.046

5.2 Structural Model Analysis

The influence of learning performance (interactive and perceptual factors) on the intention of students (male and female) towards social media use for active collaborative learning and engagement were examined by employing a path modeling analysis. The results are illustrated and are compared between the two groups (male and female) and discussed in conjunction to the hypothesis testing results.

5.3 Analysis and Discussion of the Female Student Group

The validity and reliability values for the female student group on the learning performance via interactive and perceptual factors are presented in Table 2. The proposed hypotheses were tested with the help of CFA in the next SEM step. The results showed acceptable values of AVE, CR and CA, confirming discriminant validity. The hypotheses of the nine key constructs are displayed in Figure 2. The results supported all 17 hypotheses, with only one rejected. More specifically, social media use for collaborative learning (0.424), students' satisfaction of social media use (0.364), and active collaborative learning (0.205), have the highest direct impact on learning performance. Figure 2 indicates that the perceived ease of use and students' satisfaction proposed hypothesis was rejected (0.059). The social media variables covered interaction with peers (INT_P), interaction with lecturers (INT_L), engagement (EN), perceived ease of use (PE), perceived usefulness (PU), social media use (IU), active collaborative learning (ACL), students' satisfaction (SS) and lastly, learning performance (LP).

Table 2: Validity and reliability for overall for the female students group

|	INT_P	INT_L	EN	PE	PU	ACL	SMU	RS	LP	AVE	CR	CA
INT_P	0.755									0.570	0.888	0.887
INT_L	0.423	0.832								0.693	0.870	0.845
EN	0.584	0.500	0.680							0.562	0.810	0.852
PE	0.417	0.581	0.539	0.683						0.567	0.813	0.839
PU	0.439	0.474	0.488	0.512	0.702					0.592	0.827	0.855
ACL	0.609	0.503	0.462	0.551	0.615	0.685				0.569	0.722	0.837
SMU	0.402	0.422	0.519	0.605	0.541	0.613	0.643			0.514	0.807	0.827
RS	0.474	0.497	0.626	0.65	0.646	0.591	0.616	0.744		0.515	0.808	0.822
LP	0.587	0.528	0.603	0.517	0.670	0.623	0.594	0.513	0.768	0.547	0.850	0.849
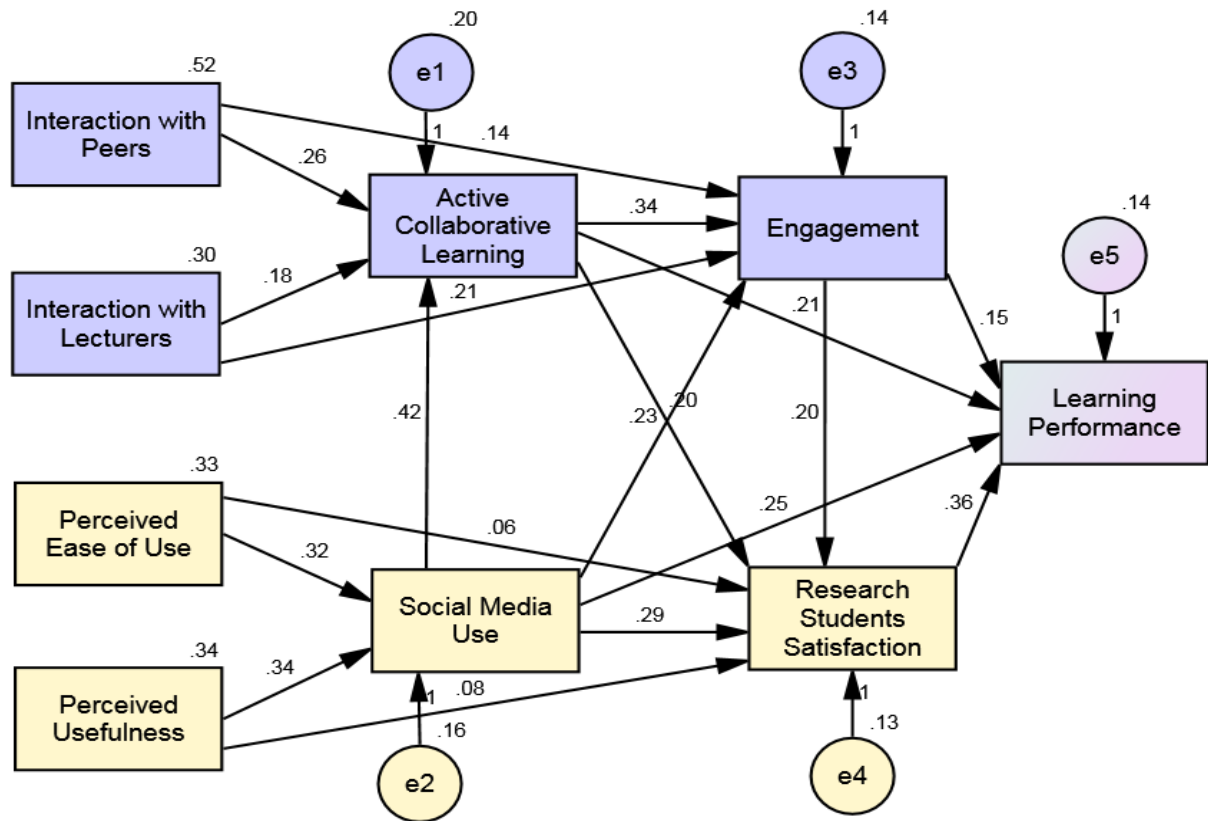
Figure 2: Results for the proposed model for the female students group

5.4 Analysis and Discussion for the Male Students Group

For the male students group, the validity and reliability values regarding learning performance via interactive and perceptual factors are presented in Table 3. Like the former group, the CFA was carried out to test the hypotheses and the results showed that the values of AVE, CR and CA are all acceptable, indicating that discriminant validity is confirmed. Figure 3 illustrates that all

the hypotheses concerning the relationship among the nine key constructs were acceptance, with the following having the greatest direct influence on learning performance; collaborative learning (0.453), research students' satisfaction (0.364), and active collaborative learning (0.205), engagement (0.157).

Table 3: Validity and reliability for overall for the male students group

|	INT_P	INT_L	EN	PE	PU	ACL	SMU	RS	LP	AVE	CR	CA
INT_P	0.730									0.532	0.871	0.869
INT_L	0.409	0.829								0.687	0.868	0.837
EN	0.556	0.455	0.646							0.517	0.779	0.823
PE	0.498	0.613	0.587	0.661						0.537	0.794	0.821
PU	0.447	0.588	0.437	0.552	0.692					0.578	0.818	0.848
ACL	0.426	0.548	0.507	0.548	0.496	0.720				0.519	0.761	0.828
SMU	0.558	0.453	0.581	0.431	0.570	0.411	0.610			0.572	0.779	0.800
RS	0.546	0.623	0.579	0.540	0.614	0.593	0.572	0.640		0.510	0.805	0.811
LP	0.568	0.607	0.618	0.558	0.590	0.661	0.552	0.575	0.717	0.581	0.811	0.810
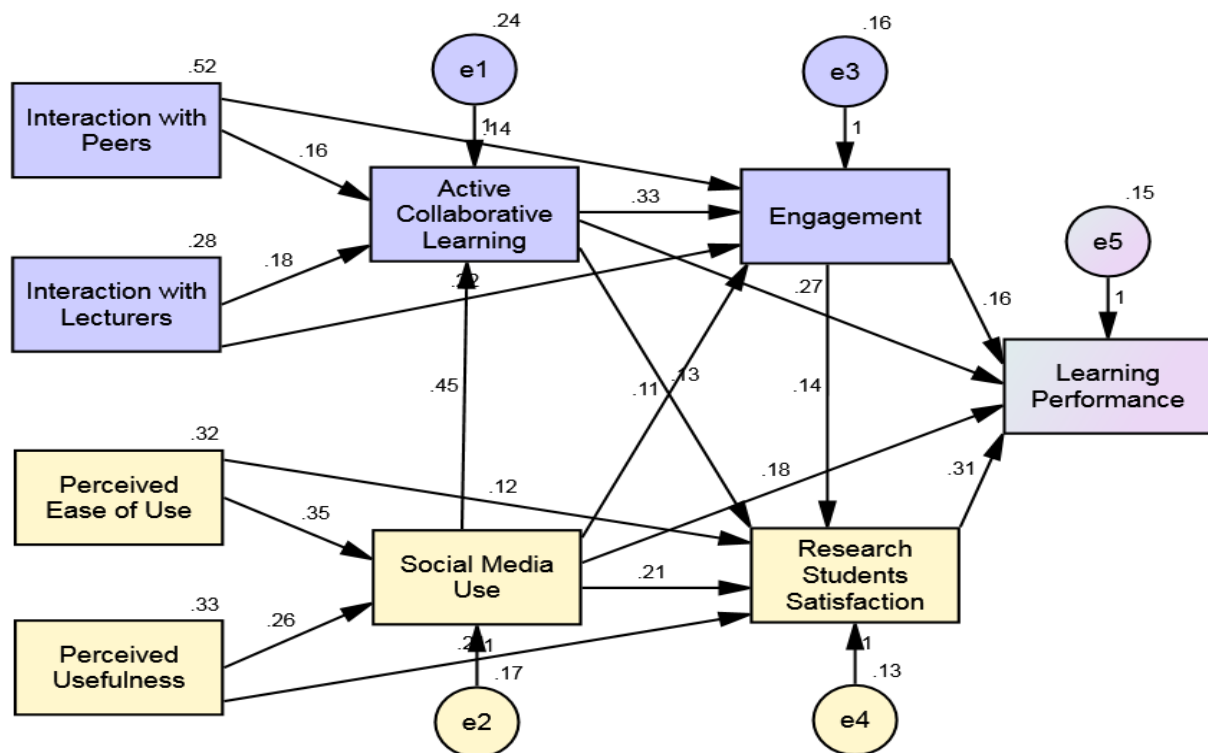
Figure 3: Results for the proposed model for the male students group

5.5 Analysis and Discussion of All Hypotheses Testing (Male and Female)

As mentioned, the CFA was carried out to test the proposed hypotheses, after which the values of AVE, CR and CA obtained were deemed acceptable, establishing discriminant validity. The overall values for both male and female group are presented in Table 4.

Table 4: Validity and reliability for overall for all students group

|	INT_P	INT_L	EN	PE	PU	ACL	SMU	RS	LP	AVE	CR	CA
INT_P	0.811									0.658	0.920	0.879
INT_L	0.514	0.766								0.587	0.876	0.844
EN	0.538	0.630	0.766							0.568	0.876	0.897
PE	0.403	0.575	0.644	0.786						0.677	0.890	0.861
PU	0.551	0.644	0.623	0.642	0.725					0.552	0.888	0.875
ACL	0.455	0.475	0.575	0.650	0.662	0.792				0.673	0.882	0.865
SMU	0.419	0.539	0.644	0.551	0.650	0.601	0.732			0.536	0.821	0.816
RS	0.486	0.601	0.725	0.634	0.679	0.692	0.627	0.749		0.592	0.885	0.879
LP	0.591	0.561	0.630	0.538	0.661	0.604	0.641	0.615	0.766	0.596	0.884	0.881
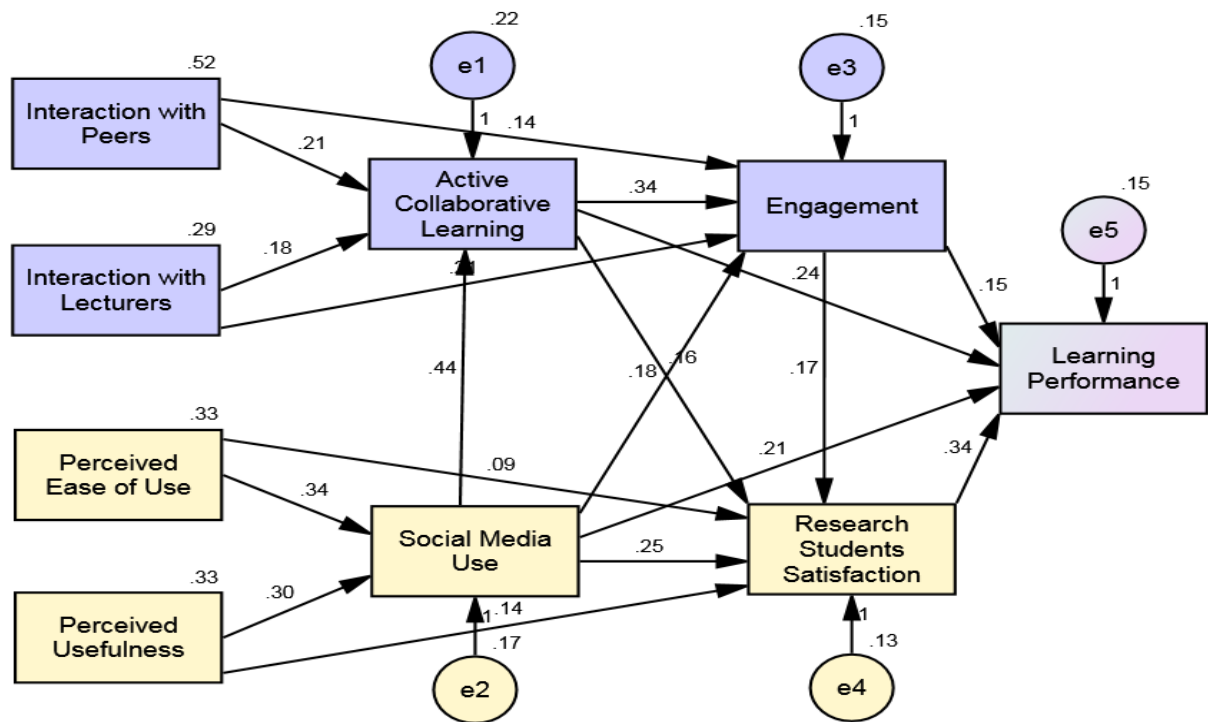
Figure 4: Results for the proposed model for all students group

The obtained results indicated support for the study model and the proposed hypotheses that addressed the variables relationships. Table 5 lists the values of unstandardized coefficients and

standard errors of the structural model that shows that the key statistics of the model are good, indicating model validity and the hypotheses confirmation.

Table 5: Hypothesis testing results of structural model

H	Independent	Relationship	Dependent	Estimate	S.E.	C.R.	P	Result
H1	GM	⟶	ACL	.215	.024	8.922	0.000	Supported
H2	SU	⟶	ACL	.181	.032	5.652	0.000	Supported
H3	ACL	⟶	EN	.338	.031	10.923	0.000	Supported
H4	GM	⟶	EN	.139	.021	6.631	0.000	Supported
H5	SU	⟶	EN	.210	.027	7.760	0.000	Supported
H6	PE	⟶	SMU	.337	.027	12.651	0.000	Supported
H7	PU	⟶	SMU	.300	.026	11.389	0.000	Supported
H8	SMU	⟶	RS	.252	.035	7.163	0.000	Supported
H9	PE	⟶	RS	.095	.026	3.649	0.000	Supported
H10	PU	⟶	RS	.143	.025	5.658	0.000	Supported
H11	SMU	⟶	ACL	.436	.036	12.146	0.000	Supported
H12	SMU	⟶	EN	.179	.033	5.498	0.000	Supported
H13	ACL	⟶	RS	.158	.031	5.176	0.000	Supported
H14	EN	⟶	RS	.170	.033	5.205	0.000	Supported
H15	ACL	⟶	LP	.237	.033	7.150	0.000	Supported
H16	EN	⟶	LP	.152	.036	4.270	0.000	Supported
H17	SMU	⟶	LP	.212	.035	6.005	0.000	Supported
H18	RS	⟶	LP	.341	.039	8.807	0.000	Supported

Note: SE: standard error C.R.: Critical Ratio or t-value and P: P-value.

The direct assumptions are the first ones addressed. According to Table 5 and Figure 2, the use of social media has a positive and significant effect on active collaborative learning (β = 0.436, p < 0.001), indicating that the first hypothesis (H11) is supported. In other words, there is a significant relationship between social media use and active collaborative learning and it influences the interaction among the postgraduate students and between them and their lecturers. The next direct effect is students' satisfaction, and based on the results, it has a positive and significant relationship with the students' learning performance (β = 0.341, p < 0.001) indicating that the 18th hypothesis (H18) is accepted. In short, there is a significant relationship between the postgraduate students' satisfaction with their learning performance in their social media use. Added to the above results, perceived ease of use was found to be positively and significantly related with social media use (β = 0.337, p < 0.01), indicating support for the sixth (H6) hypothesis in that a significant relationship exists between perceived ease of use and social

media use. This explains the reason behind the postgraduate students use social media for information sharing or active collaborative learning.

The results also confirmed that active collaborative learning positively and significantly relates to engagement ($\beta = 0.338$, $p < 0.001$) and thus, the third hypothesis (H3) is accepted. Therefore, postgraduate students can obtain more resources and access information shared through collaborative learning and engagement, which eventually enhances their learning performance.

With regards to perceived usefulness, it was found to be positively and significantly related with social media use ($\beta = 0.300$, $p < 0.001$), indicating support for the seventh hypothesis (H7). This shows that the postgraduate student's perceived usefulness of social media will improve their active collaborative learning. The results also indicated that social media use positively and significantly related to the postgraduate students' satisfaction ($\beta = 0.252$, $p < 0.001$), indicating support for the eighth hypothesis (H8). This shows that the postgraduate students are satisfied with using social media for collaborative learning and engagement.

Moreover, a positive and significant relationship was found between active collaborative learning and learning performance ($\beta = 0.237$, $p < 0.001$), showing support for the H15. In other words, the postgraduate students' use of active collaborative learning through social media positively affects their learning performance.

Furthermore, the first hypothesis (H1) proposed a positive and significant relationship between interaction with peers and collaborative and learning, and the results supported such hypothesis ($\beta = 0.215$, $p < 0.001$). In other words, active collaborative learning enables interaction among peers through information exchange, knowledge sharing and discussion among group members.

The results also show a positive and significant relationship between social media use and learning performance ($\beta = 0.212$, $p < 0.001$), indicating that the 17th hypothesis (H17) is supported. This indicates that social media use increases and enhances the learning performance of postgraduate students through collaboration and engagement. Moving on to the fourth hypothesis (H5), it proposed a significant relationship between interaction with lecturers and engagement and the results supported the hypothesis ($\beta = 0.210$, $p < 0.001$). Through interaction with lecturers, the postgraduate students' engagement is enhanced.

In relation to the above result, the second hypothesis (H2) was also confirmed ($\beta = 0.181$, $p < 0.001$) indicating a positive and significant relationship between interaction with lecturers and

active collaborative learning. By allowing interaction of postgraduate students and lecturers, active collaborative learning is improved through the use of social media.

Meanwhile, in the 12th hypothesis (H12), it was proposed that a significant and positive relationship exists between social media use and engagement and the results support it (β = 0.179, p < 0.001). This indicates that the use of social media increases the likelihood of engagement among the postgraduate students. In relation to this, the 14th hypothesis proposed a significant relationship between engagement and postgraduate students' satisfaction. Based on the results in Table 2, H14 is supported (β = 0.170, p < 0.001). Engagement among the postgraduate students as precipitated through social media leads to their satisfaction.

In Table 5, active collaborative learning is illustrated to have a positive and significant relationship with postgraduate students' satisfaction (β = 0.158, p < 0.001), and thus, the 13th hypothesis (H13) is supported. In other words, the use of the postgraduate students' of the social media for collaborative learning increases their satisfaction, and ultimately, their learning performance.

As for the 16th hypothesis (H16), the results supported its proposition that a positive and significant relationship exists between postgraduate students' engagement and learning performance (β = 0.152, p < 0.001). Through their active engagement using social media, the postgraduate students' problem skills can be developed and ultimately, their learning performance will be enhanced. Table 5 also indicates that perceived usefulness positively and significantly relates to the postgraduate students' satisfaction (β = 0.143, p < 0.05), and thus the 10th hypothesis (H10) is supported. The perceived usefulness of the postgraduate students regarding the use of social media for collaboration and engagement positively relates to their satisfaction.

The fourth hypothesis (H4) was also confirmed by the results that showed a positive and significant relationship between interaction among postgraduate students and engagement (β = 0.139, p < 0.001). The more there is interaction among the group members in using social media, the more they will have a tendency to have a high engagement to their curriculum and eventually, their learning performance will be improved.

The final hypothesis is hypothesis 9, which proposed the positive and significant relationship between perceived ease of use and postgraduate students' satisfaction. Based on the results (β =

0.095, p < 0.01), the hypothesis is supported indicating that the ease of use that the postgraduate students experience with the social media will increase their learning satisfaction.

In sum, the entire hypotheses are supported by the results of this study, which contradict the majority of the prior studies that reported the higher use of social media leading to low learning performance (e.g., Junco, 2012; Kirschner & Karpinski, 2010; Madge et al., 2009) but are consistent with others (e.g., Ainin et al., 2015; Yu et al., 2010; Al-Rahmi et al., 2015a; Al-Rahmi et al., 2015c; Al-Rahmi & Zeki, 2017) that showed a positive impact on student learning performance. It is notable that the majority of the postgraduate students responded positively to their courses through social media, particularly in collaboration and information exchange, in comparison to face-to-face courses.

5.6 Discussion and Implications

The results of this study provide an insight into the learning performance of postgraduate students and the relationship with their interaction with group members, supervisors, their engagement, perceived ease of use, perceived usefulness, social media use, active collaborative learning and their satisfaction. The use of social media facilitates an environment that is characterized by active collaborative learning and engagement that can help the researchers (i.e. Master/PhD) to work in groups, to accomplish tasks, and to effectively complete their work.

Added to the above, the use of social media also brings about an easy rapport among the group members explaining their satisfaction with it for active collaborative learning and this enhances their learning performance. This also applies to the rapport between the students and their lecturers/supervisors, where the social media allows exchange of information and clarified instructions. These results are aligned with others who reported the social media use positively influence on learning performance (e.g., Li et al., 2012; Kabilan et al., 2010).

Also, online active collaborative learning is shown to have a higher effectiveness than face-to-face collaborative learning (Al-Rahmi et al., 2015a; Al-Rahmi et al., 2015d; Al-Rahmi & Zeki, 2107), as evidenced by the research skills development through the former and ideas-exchange among researchers. Social media is also utilized by the researchers to obtain required resources from their peers as well as instructions from their supervisors. Comparatively, empirical evidence suggested that students on campus needed more support in utilizing complementary social media active collaborative learning options in comparison with face-to-face conferences,

also, Lecturers may have significant roles in supporting students when moving to the utilization of social media in assisting brief questions, solutions and coordination in showing such media for active collaborative learning and engagement (Hrastinski and Aghaee, 2011; Al-Rahmi & Zeki, 2107; Al-Rahmi et al., 2014; Al-Rahmi et al., 2015f).

On the basis of the results and the findings of this study, social media use can lead to the development of a positive and a learning conducive environment that is invaluable for the engagement and learning experience of students and researchers, and teaching experience of lecturers and supervisors. It enriches the learning environment by promoting the interaction and engagement of students and by facilitating group discussions and finalization of research and work projects. On the whole, research students can avail of the social media for active collaborative learning and engagement to improve their learning performance as evidenced by this study and prior studies (e.g., Al-Rahmi et al., 2015b; Al-Rahmi et al., 2015c; Janssen et al., 2010; McCarthy, 2010; Lockyer & Patterson, 2008). In relation to this result, Balakrishnan and Lay (2016) reported the significant effect of students' intentions to use social media on their performance, particularly in their engagement more than their collaboration.

As consequence, this study contributes to literature by proposing a model that integrates constructivism with TAM – the integration of which proved useful in understanding the following a) active collaborative learning and engagement via social media and its influence on the learning performance of students in Malaysian universities, b) social media use for active collaborative learning and engagement and their influence on the learning performance of students in Malaysian universities, and c) development of a theoretical model addressing social media and other related technologies.

6. Conclusion and Future Work

The findings of this research support the effective use of social media influence for collaborating learning and engagement on learning performance. The findings also showed that satisfaction, perceived ease of use, perceived usefulness of social media among students influence positively their collaborative learning and engagement, and ultimately, their learning performance. Moreover, the results showed that learning in a group with peers are beneficial to researchers and students as this could contribute to the quality outcome of the group. In so doing, the students are enabled to produce ideas and opinions effectively in group discussions and in their interactions

with each other and with their supervisors/instructors. The use of TAM and social constructivism theory in examining collaborative learning and engagement through social media use was also validated by the findings. On the whole, active collaborative learning and engagement through social media enriches the learning activities of students and facilitates group discussions.

While this study has produced interesting findings, it does, however, have certain limitations. One such limitation is that in this study the sample size was limited to public universities in Malaysia. However, this study targeted only the research universities in Malaysia. Therefore, the findings of this research do not reflect the behavior of other sectors such as private universities, armies, or school teachers. Other limitations in this study are that it uses only questionnaires – there is no data triangulation- and it is based on students´ perceptions, which could differ with teachers´ ones and from what the students actually do, and that it does not considers differences among research fields. Future studies are recommended to replicate the study in other countries, with different cultures and consider further these other limitations.

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Acknowledgments

Highlights

- The study analyses social media for active collaborative learning and engagement.
- A questionnaire was applied to 723 research students in five Malaysian universities.
- Students' satisfaction of social media positively affected their learning performance.