Task-Technology Fit and Technology Acceptance Model Application to Structure and Evaluate the Adoption of Social Media in Academia

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ABSTRACT The purpose of this article was to reduce the dissimilarities in the literature regarding the use of social media for training and its impact on students' academic performance in higher education institutions. The main method of data collection for task-technology fit (TTF) and the technology acceptance model (TAM) was a questionnaire survey. This research hypothesizes that TTF applied to social media for learning will affect technology, task, and social characteristics that in turn improve students' satisfaction and students' academic performance. It also posits that the behavioral intent to use social media for learning will affect comprehension efficiency, ease of use, and enjoyment, all of which also improve students' satisfaction and students' academic performance. The data collection questionnaire was conducted with 162 students familiar with social media. Quantitative structural equation modeling was employed to analyze the results. A significant relationship was found between technology, task, and social features with TTF for utilizing social media for academic purposes, all of which fostered student enjoyment and improved outcomes. Similarly, a clear relationship was found between comprehension efficiency, ease of use, and enjoyment with behavioral intentions to utilize social media for academic purposes that positively affected satisfaction and achievement. Therefore, the study indicates that TTF and behavioral intentions to use social media improve the active learning of students and enable them to efficiently share knowledge, information, and discussions. We recommend that students utilize social media in pursuit of their educational goals. Educators should also be persuaded to incorporate social media into their classes at higher education institutions.

INDEX TERMS Task-technology fit, technology acceptance model, social media.

I. INTRODUCTION

Application of social media in higher education and its advantages for TAM and TTF are examined. Social media usage among university and college students has received widespread attention from scholars worldwide, with several studies finding that social media affects both general learning and teaching efficiency. It has also been proven to be beneficial for teaching and learning foreign languages based on its natural suitability for improving students' oral and written skills through extended practice [1]. Nevertheless, the

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educational use of social media has also fomented academic concerns by impacting grade point averages, students' satisfaction, and overall academic achievement. Students performing research utilize social media for learning that can negatively affect their concentration and the productive use of their time. In a study by [2], researchers found that the time allotted to Facebook for social interaction is not always utilized effectively for educational goals. Research has shown that social media is used in Asian countries by many educators as a tool for informal TTF, primarily for social communication rather than toward students' satisfaction or academic achievement [3]. Similarly, Al-Rahmi *et al.* [4] stated that there was no significant relationship between

online activity and institutional learning. Despite conflicting findings, researchers generally agree that a broad understanding of the field combined with proper utilization of social media would enable the creation of better learner-focused systems in education [5], although previous frameworks and models related to social media have been shown to produce several significant negative impacts on student TTF with a TAM model on students' satisfaction and students' academic performance [6], [7]. In addition, a few scholars in Malaysia have undertaken studies related to social media in higher education from distinct perspectives and with different goals. Therefore, an investigation of both TTF and TAM factors that influence students' academic performance through social media is highly recommended [8], [9]. According to Madge *et al.* [10], 68.6% of the Malaysian population use the Internet, while 64% are active on social media. More than 13,000,000 people in Malaysia use Facebook, with this number rising by approximately 350,000 in the first six months of 2012 alone. These findings emphasize the importance of social media that must be further explored in depth to identify the reasons why people are so eager to participate on these platforms [11]. When focused on technology acceptance, scholars tend to utilize TAM to explore the ways in which people use a specific technology after accepting its benefits and the characteristics that affect their decisions. Despite TAM being a prominent and often mentioned model for more than twenty years, scholars share differing views on its practical efficiency and theoretical suppositions [12], [13]. Also noted are the limitations of TAM modeling; for example, the simple structure and two important defects inherit in the framework. Using the TTF model in complex circumstances, social networking sites can provide the same for a simple design framework. To date, there is insufficient research to evaluate the social media acceptance of the TTF model. When applied to social media, it may not be appropriate because it does not even consider social structure. To counter this shortcoming, the TTF model was expanded by integrating TAM for this study. Additionally, the TTF model concentrates on specific influences on task performance regardless of the intentional factors. The intent structure is included in the proposed framework in order to comprehend the effects of technology fit on the intentions of users. Conducting this study was necessary to determine the features and factors of social media and also the relationship between their application for TTF and TAM models that influence students' satisfaction and the students' academic performance of research students in Malaysian higher education institutions. Although several social media models are available, there is currently no model for evaluating students' satisfaction and students' academic performance. Therefore, there is a gap in the research on students' satisfaction when utilizing social media for TTF and TAM modeling in Malaysian higher education.

The objective of this study is to reduce the dissimilarities in the literature regarding the use of social media for training and its impact on students' academic performance in higher education institutions. This research contributes to the literature by presenting a model that reconciles TTF theory with the TAM model that is useful for interpretation. In addition, this study helps to integrate the TTF theory and the TAM model. This also aids social media and it's improving computer systems that foster greater interest in future use. The present study offered an extensive collection of human-produced tools that reinforce the design of advanced social technologies. In particular, the inherent features of Web 2.0 combined with Internet-based websites and applications support greater social engagement. This study recommends the TTF and TAM theories as contributors to a further understanding of the behavioral intentions of students and task-technology fit to utilize social media in order to enhance university-level students' academic performance. the accepted model of social media utilized in this research can be used to evaluate the practical usage of social media in relation to TTF as well as technology, task, and SOC to enhance the educational performance of both university students and those in other institutions one additional theoretical aspect of our study that we found to be remarkable was the dissemination of knowledge regarding the use of social media for the behavioral intent of using social media for learning through TTF that is likely to increase academic progress in higher education. Finally, TTF and the behavioral intentions of students to utilize social media for learning purposes enriched the academic activity of higher education students. These provide an important theoretical contribution to prior TAM research in which the impact of using social media for learning had not been taken fully into account.

II. SOCIAL MEDIA IN EDUCATION

Social media sites allow operators to communicate in a user-friendly way, create personal profiles, add family members or friends as contacts, become members of groups, develop and share content, identify other operators, and become influencers in specific fields of interest [14]. The Internet functionality that fosters this user interaction is commonly referred to as Web 2.0, an advanced form of multidirectional communication [15] that is much faster and easier to use compared to prior versions (Web 1.0) that were slow, static, and generally unidirectional. Web 2.0 facilitated a large variety of functions, as noted by Lin and Lu [16], including collaboration and communication for learning purposes through Facebook, YouTube, blogs, and forums. In recent times, "learning" in higher education has changed into a lifelong learning model based on dynamic and evolving abilities or skill sets [17]. Interaction and collaboration are now of utmost importance among employers [18], [19]. In a study by Nistor *et al.* [20], college students who actively engaged in interactive blogs, collaboration, and communication found them to be more positive in terms of peer interaction and academic success. In addition, Al-Rahmi *et al.* [1] indicated that university students expressed positive associations and improved cooperation in peer-to-peer networking and academic achievement through the use of social media platforms. Despite positive feedback regarding the use of social media
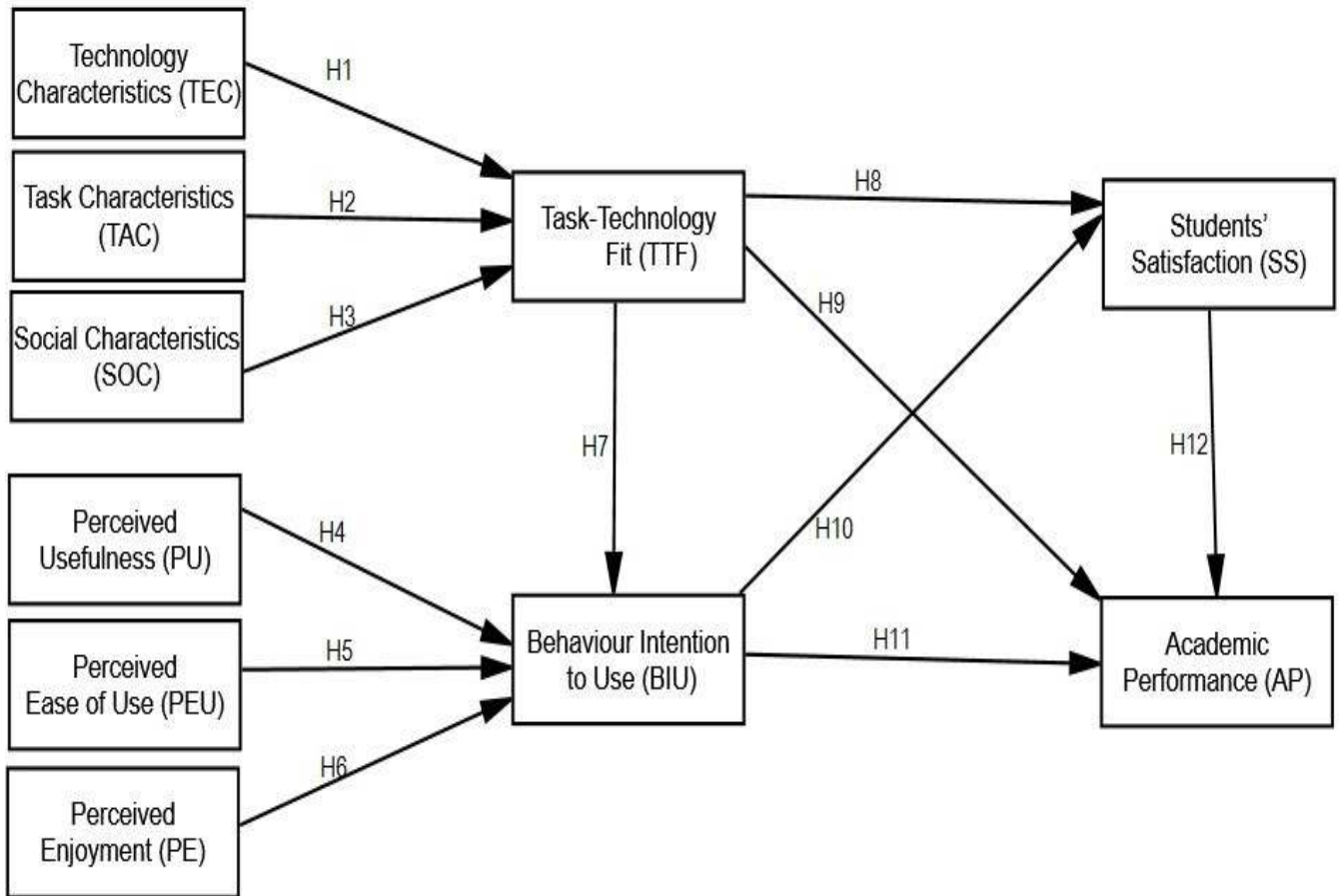
FIGURE 1. Research model and hypotheses.

among college or university students, it remains a controversial topic among scholars. Numerous studies have shed light on the efficiency of social media's impact on learning and teaching [21]. In various investigations, participation in social media exhibited beneficial impacts for learning foreign languages as it helps improve the written and verbal linguistic capabilities of learners [22]. Kaplan and Haenlein [23] claimed that university-level students consider Facebook as an advantageous and meaningful online platform for improving and supporting their English language studies. In related literature, some scholars suggest that the use of social media in higher education makes social learning easier in class settings [24], enhances The research model explores all features of TTF theory (technology, task, and social features), TAM (comprehended utility, ease of use, enjoyment, plus the intentions of students to collaborative learning and engagement [25], fosters active learning by providing instructors and students with methods to interact [26], offers extended social mass media opportunities for e-learning [27], and encourages learning activities that focus on student attempts to play leading roles in their own education [28]. Also, researchers have repeatedly discussed the values of continued connections for higher education that support lifelong student collaboration and communication [29]. This learning model

is now demanded by a majority of learners worldwide who can quickly access content and information updates for their courses, all of which can be easily retrieved thanks to these ever-present relationships and connections [30]. In general, many social networking portals have been used as sources of knowledge that allow students to appreciate or endorse their performance and to work with mentors to obtain support from relevant institutions or provide it themselves when possible. In this paper, the underlying studies feature the involvement of various departments [3], [31], participation of learners [24], and most importantly, academic achievement outcomes [24].

III. THEORETICAL MODEL AND HYPOTHESES
The theoretical model proposed in the present study is exploring all factors related to the TTF theory such as (task-technology fit, technology features, task features, and social features), beside the theory of TAM relevant factors as well, which are (comprehended utility, comprehended ease of use, comprehended enjoyment and intention of students to utilize social media). These mentioned factors are found to be consequently influence the satisfaction and academic performance of students at institutes of higher education and are being discussed in this section accordingly (observe Figure. 1).

A. TASK-TECHNOLOGY FIT (TTF)

TTF represents the level to which a specific technology supports a person's effort to perform a given job portfolio. In general, it can be used in any condition or circumstance where people use technology to perform specific tasks [32]. The compatibility of technological functions with the actual requirements of a task or set of tasks determines the usefulness of the technology. Experienced and logical users will select tools and techniques offering the highest net gain to help them do their jobs. Technologies that fail to provide adequate value (e.g., enhanced productivity or better results) are cast aside [33]. The TTF-MIS structure is theoretically measurable as part of IT-model usage patterns but is still under development. The main concepts of TTF and related models are outlined in Fig. 1 [34]. TTF predicts that team results will positively impact the extent of technology utilized to perform tasks with specific information, processing requirements, and task-specific coordination. In fact, TTF is frequently incorporated when developing team support systems [35]. When connecting TTF to social media in this research, usage refers to the new or continued utilization of technology, and this behavior involves the use of technology to perform tasks [36]. The purpose is a demonstration of one's willingness to perform a particular behavior and is also regarded as an immediate predictor of behavior [37]. In the TTF model, the use of technology relies on observing the technology related to the support tasks. Previous research has shown that perceived TTF can significantly affect the use of knowledge management systems [38]. In this research, the perceived TTF structure is defined as the individual's perception of the extent to which Facebook features the technology required by users during the performance of their workflow. This level was evaluated by analyzing the perceived influences of user ratings. It was therefore assumed that TTF was a leader in social media use. In view of the above discussion, the researchers propose the following hypotheses:

H7: There is a significant relationship between TTF and BIU.

H8: There is a significant relationship between TTF and SS.

H9: There is a significant relationship between TTF and AP.

B. TECHNOLOGY CHARACTERISTICS (TEC)

Technology properties relate to the level to which a technology has the characteristics to accomplish what is considered to be the appropriate fit [39]. A variety of available social media tools like Twitter, Facebook, and LinkedIn are built and designed for specific goals and objectives of different user groups. Choosing these tools can convey the influence of causal priming on expected behavior [40]. We examined how communication with others requires active use of Twitter and determined that using different Twitter features can provide such a relationship. We also investigated social media's five mediating impacts, including the use of blogs as a social

media platform. Task features were compared to task performance, and the conclusion was that media usage had a positive impact on task performance [41]. In a study by Chen and Bryer [42], the extent to which the integration of tools in terms of information and system quality affected the expected results was analyzed. Koo *et al.* [43] used the TTF model to study the factors affecting individual performance in enterprise resource planning and Wang and Lin [44] identified the influence of TTF and the allocation of team performance on repetitive tasks. Their frame used two types of technology features. In view of the above discussion, the researchers propose the following hypothesis:

H1: There is a significant relationship between TEC and TTF.

C. TASK CHARACTERISTICS (TAC)

Gao *et al.* [45] and Fuller and Dennis [46] studied the impact of mobile banking on individual performances using the TTF method. According to Abbas *et al.* [47], tasks are the behavioral requirements for achieving predetermined aims that are provided through a specific process of using information; that is, a task involves a set of specified activities and behaviors that must be accomplished to achieve a set of purposes. Tam and Oliveira [48] clarified that altering the input to the requested outputs causes physical work. In an organizational context, the primary task of the staff is to rotate the inputs that can link business concerns to the appropriate outputs to find solutions to their problems. In previous studies, tasks were defined as "task routing" in the organizational scenario [49]. Task characteristics (the perceived task needs of users) are generally determined as the action people take to convert inputs into outputs [36]. A task can further be defined as the act that one takes to achieve a goal through a series of actions. In view of the above discussion, the researchers propose the following hypothesis:

H2: There is a significant relationship between TAC and TTF.

D. SOCIAL CHARACTERISTICS (SOC)

Social influence and social capital are examples of social characteristics (SOC) that have been utilized as intermediaries in prior social media research to investigate the causality between input and outcome variables. Specifically, Perrow [50] utilized social impact as a mediator to investigate user contributions in various virtual societies. Other studies used social capital as a mediator to illustrate the goals and behavior of users. For example, Todd and Kent [51] investigated the role of "trust" in establishing a willingness of users to accept something or someone, while Dholakia *et al.* [52] and Shiue *et al.* [54] examined the impact of social relationships and social evasion in mediating team cohesion. Hsiao *et al.* [53] utilized social impact as a mediator to investigate user contributions in virtual societies. In view of the above discussion, the researchers propose the following hypothesis:

H3: There is a significant relationship between SOC and TTF.

E. PERCEIVED USEFULNESS (PU)

The technology adoption model shows that the greatest enticement for utilizing information technology is perceived usefulness [55], [56]. In accordance with Davis [57], perceived usefulness has the most important effect on one's behavioral intent to utilize information technology in general and also appears to be the driving force behind social media adoption in educational settings. They described perceived usefulness as one factor that forms a student's belief in the usefulness of social media that in turn impacts student attitudes, particularly in regard to participatory learning. Similar to Cheung *et al.* [55], perceived usefulness indicates to what degree the student feels that social media will improve their learning outcomes. After realizing that technology is helpful, the student then plans the implementation that would facilitate the most suitable usage. As stated in Ngai *et al.* [56], perceived usefulness has been consistently identified as a key factor in one's behavioral intent to utilize a system. Important correlations have been found in previous studies between perceived usefulness and the behavioral intention to use something [58]. As in [59], the perceived usefulness of social media tools for learning in higher education strongly affects behavioral intentions. Also, Venkatesh and Davis [58] studied the utilization of learning management systems and confirmed the significant relationship between behavioral intention and perceived usefulness. Based on these findings in previous literature, researchers consider perceived usefulness to be vital for defining the intentions of university students to incorporate social media as a tool for their studies. In view of the above discussion, the researchers propose the following hypothesis:

H4: There is a significant relationship between PU and BIU.

F. PERCEIVED EASE OF USE (PEU)

One definition of ''perceived ease of use'' is what a person considers as the capability level required to facilitate a task by using a particular system [60] and to reduce cognitive effort [55]. Al-Ammary [61] assumed this structure as a key element for characterizing the behavior of users toward technology. Although there is general agreement that ease of use and its perceived value have a positive impact on the social media attitudes of users, researchers have still not determined which comes first for explaining user positions regarding social media in the educational community [62]. One of the most important behavioral assumptions that affect user intentions to adopt any specific technology is its perceived ease of use [63]. According to Cheung *et al.* [55], many researchers have stated that this is a major factor in determining human attitudes toward technology. In addition, perceived ease of use has been reported to be important in terms of attitude [64], [65]. For example, Abdullah and Aziz [66] noted that perceived ease of use affects student attitudes toward behavior in using Libyan e-learning in higher education. This is consistent with Venkatesh and Davis [58] who found that perceived ease of use has a remarkable effect on tendencies to use learning management systems. Another recent study defined perceived ease of use as student perceptions of the amount of effort required to use media technologies for learning activities. Current scholars have also determined that behavioral intentions are affected by perceived ease of use [58]. In view of the above discussion, the researchers propose the following hypothesis:

H5: There is a significant relationship between PEU and BIU.

G. PERCEIVED ENJOYMENT (PE)

Perceived enjoyment is described by Allam *et al.* as the degree or level that a student considers pleasant when engaging in social media activities. It is a crucial indicator of user acceptance of technology and a predictor of intended use of a system or platform [68]. Prior research showed that perceived enjoyment influences attitudes [69]. If particular activities are enjoyable for users, they exhibit positive attitudes toward their use. Some researchers characterize social media as an information system that offers continuous and motivated engagement based on enjoyable use [70]. The expanded use of social media is also affected considerably by its perception as a stimulant [71], [72]. Also found was an enhanced degree of pleasure when technology was used in beneficial ways despite potential performance problems [73]. If social media users are found to enjoy a service in an empirical setting, they are more likely to find it more interesting [74]. Posting videos or pictures on social media sites, such as Facebook, Twitter, or WeChat, is considered entertaining. These platforms offer interesting posts and bring amusement, fun, and enjoyment to users [75]. In view of the above discussion, the researchers propose the following hypothesis:

H6: There is a significant relationship between PE and BIU.

H. BEHAVIORAL INTENTION TO USE (BIU)

Limited research has identified further extrinsic factors (e.g., the perceived enjoyment of a strong platform) that are relevant to other major TAM constructs for reinforcing the purposes of implementing technology [71], [76]. The general perception of behavioral intentions is that they form parts of attitudes. The intention of an individual to react in a particular way toward someone or something is called a behavioral intention [72]. As indicated in various studies, the behavioral intention to engage in direct and significant usage will affect actual system use of social media technology [77]. In a study by Kim [78], behavioral intentions were described as the student's intention to continue using social media and accepting the continued use of the apps for the future. The behavioral intention of that study was related to the extent to which students used social media platforms for ongoing collaborative learning. The direct influences of behavioral intentions on social media use for participatory learning was

shown in research conducted by Liao *et al.* [79] and Klopping and McKinney [80]. In addition, the main reason for using technology-based theories or models is based on the users' intent to use social media. Recent literature has shown that people who interact with systems through the Internet maintain positive outlooks and fully intend to use them [81]. In view of the above discussion, the researchers propose the following hypotheses:

H10: There is a significant relationship between BIU and SS.

H11: There is a significant relationship between BIU and AP.

I. STUDENTS' SATISFACTION (SS)

Students' satisfaction is defined as the degree to which social media can provide the information that students require. The majority of researchers have found that user feelings will influence their satisfaction after using a system [76], [82]. Previous research revealed significant effects of students' satisfaction on student performance in a social media adoption study [83]. In accordance with Hrastinski and Aghaee [84], a positive correlation exists between student learning performance and students' satisfaction through the use of social media as a means of collaboration-based learning. Based on an analogous finding [77], social media has been shown to improve student learning experiences by maximizing their motivation, engagement, interaction among students, and student-teacher communications through the provision and empowerment of students with skill sets that are necessary for job recruitment as well as to maximize their satisfaction. As noted earlier, Al-Rahmi *et al.* [85] have reported that social media for education improves students' academic performance and enriches the learning experience. In addition, positive relationships between student achievement and their satisfaction are facilitated by incorporating social media into their studies [86]. In view of the above discussion, the researchers propose the following hypothesis:

H12: There is a significant relationship between SS and AP.

J. STUDENTS' ACADEMIC PERFORMANCE (AP)

Students' academic performance can be defined as the educational outcomes from which a student, teacher, or institution achieves its predefined academic intentions [87]. As seen in the study by Liao *et al.* [79], social media for research continues to affect student progress. Indeed, a Facebook-based social group was found to play an important role in facilitating successful student advancement [79]. Nevertheless, there are no specific circumstances where the outcomes indicate a positive relation between social media use and students collaborative learning and engagement [1], [3], [79] and their integration with enhanced learning [80]. Al-Rahmi *et al.* [85] defined social media games as the basis for collaboration, interaction, and communication between research students, teachers, and advisors in related departments. In addition, Oradini and Saunders [86] established that social media actually has little effect on academic achievement. Moreover,

Kirschner and Karpinski [9] attempted to examine relationships between student progress and Facebook. Their results showed that there was actually a significant negative relationship between Facebook use and academic outcomes. Students admitted that they spent less time per week studying regularly than non-users. The maximum number of students required to use their Facebook accounts at least once per day for the study was the same as in Naqshbandi *et al.* [87]. Other studies conducted regarding the influence of social media use on student performance indicated that all students believed it was appropriate for their instructors to expand Facebook use [88]. Further, social media networks are perceived as being able to simplify the creation of positive relationships between students' academic performance and students' satisfaction [1], [4], [8].

IV. RESEARCH METHODOLOGY

Our study evaluated the collected questionnaires with the support of two experts ''see appendix''. Universiti Teknologi Malaysia facilitated the data collection. The selected research model included undergraduate and postgraduate social media users to examine ''behavior intention to use'' (BIU) and TTF in order to measure students' satisfaction and students' academic performance. The data were obtained using 5-point Likert scales, including demographic elements of the TAM and TTF variables. The questionnaire that was physically circulated asked all respondents to provide feedback on the use of social media for TAM or TTF and their opinions about its influence on students'satisfaction and students' academic performance. The data were collected randomly and analyzed using IBM SPSS and Structural Equation Modeling (SEM-AMOS). These are considered the most important statistical methods in our study and consisted of two stages. In the first, the validity of measures, measure convergence validity, and discriminant validity of the measure were conducted, and the structural model examination was performed in the second. This method was suggested by Hair *et al.* [89]. The sample size representative of the farmers in this study is 162 undergraduate and postgraduate students. It is determine based on the Krejcie and Morgan's sample size calculation which same as using the Krejcie and Morgan's sample size determination, which expressed as below equation [97]. The Krejcie and Morgan's sample size calculation was based on $p = 0.05$ where the probability of committing type I error is less than 5 % or $p < 0.05$. $S = X^2 NP(1-P) \pm d^2 (N-)) +X^2 P(1-P)$. whereby (S) is the required sample size, (N) the population size, (P) represents the population proportion (assumed to be 0.50 since this would provide the maximum sample size). (d) is the degree of accuracy expressed as proportion (0.05) and (X^2) is the table value of chi-square for 1 degree of freedom at the desired confidence level ($0.05 = 3.841$).

A. SAMPLE CHARACTERISTICS

Approximately 210 questionnaires were distributed, of which 193 were returned by respondents, thus representing a

response rate of 83.9%. These questionnaires were manually evaluated. Subsequently, 18 questionnaires were considered incomplete and therefore deleted from the sample. The remaining 175 questionnaires were entered into the SPSS software only to find that 6 had incomplete answers and 7 additional responses were removed as outliers. After these exclusions, 162 questionnaires were used for the analyses. This approach was similar to Hair *et al.* [89] that explained how outliers could be ignored because they presented the possibility of obtaining inaccurate statistical results. Of the 162 respondents, 40 (24.7%) were female and 122 (75.3%) were male. Regarding age, 144 (88.9%) were between 18 and 21 years old, fourteen (8.6%) were between 22 and 25, two (1.2%) were between 26 and 29, one (0.6%) was between 30 and 33, and one (0.6%) was over 34 years old. In terms of respondent educational levels, 152 (93.8%) were undergraduates and 10 (6.2%) were postgraduate students. Of these, 14 (8.6%) specialized in the social sciences, 18 (11.1%) in engineering, and 130 in science and technology (80% and 2%, respectively). Most respondents (94%) used ResearchGate, LinkedIn, Facebook, Twitter, and YouTube as social learning networks, while the remaining students (6%) did not report similar usage.

B. MEASUREMENT INSTRUMENTS AND DATA COLLECTION

As mentioned previously, 210 sample questionnaires were distributed among the students during the May 2017 semester, and 162 of the 193 collected copies were analyzed. Al-Rahmi *et al.* [1] explained that social media can enhance the engagement and expected interaction of students. In this study, this represents a significant part of the teaching process to improve the activities of classroom researchers during active learning collaboration [1], [90]. The perceived usefulness, perceived ease of use and social media usage were considered [1], [78]. These factors [91] did indeed enhance the activities of student researchers in universities via the TTF and TAM learning models [4] and in turn improved their students' academic performance [24]. Five items taken from Khan *et al.* [35] were used for (TTF) coefficient measurement, and the technology characteristics (TEC) measurements were performed from five points adopted from Yeh *et al.* [41]. The task characteristics (TAC) were measured from five points taken from Abbas *et al.* [47], and five items adopted from Hsiao *et al.* [53] were used for SOC measurements. In terms of perceived enjoyment (PE), perceived ease of use (PEU), and perceived usefulness (PU), six points were taken as a baseline adopted from Davis [57]. Behavioral intentions to use social media (BIU) were also rated based on the five points taken from Davis [57] and other factors. In addition, measurements of students' satisfaction (SS) were performed using five items, all of which were derived from Conway, Cao, and Hong [14]. Finally, students' academic performance (AP) was measured using six suggested indicators from MacGeorge [82].

V. RESULT AND ANALYSIS

TAM and TTF for learning were affected by associated factors related to behavioral intention to use higher education-based social media with a Cronbach's reliability coefficient of 0.931. This study evaluated the validity of the distinction based on three criteria: variable index values below 0.80 [92], average variance extracted (AVE) values of at least 0.5, and squared AVE greater than the factor-related inter-construct correlations (IC) [88]. Additionally, the factors loading values were at least 0.7 or greater. This was considered acceptable with a Cronbach's alpha value and composite reliability of 0.70 or greater [92].

A. ANALYSIS OF MEASUREMENT MODEL

SEM-AMOS was used as an important statistical tool for analyzing results using confirmatory factor analysis (CFA) in AMOS 23. This model was able to analyze convergent validity, consistency, one-dimensionality, and discriminant validity. Additionally, Fornell and Larcker [92] posited that the evaluation of the model when estimating the highest probability must be performed using goodness of fit strategies, such as normed fit indices (NFI), Chi-square, normed chi-square, Tucker-Lewis coefficients (TLI), relative fit indices (RFI), comparative fit indices (CFI), the parsimonious goodness of fit index (PGFI), incremental fit indices (IFI), root mean square residuals (RMR) and root mean square errors of approximation (RMSEA) [92]. Table 1 summarizes the goodness of fit indicators used to evaluate the models, and Fig. 2 presents the TTF measurement theory. The TAM measurement theory is presented in Fig. 3, and Fig. 4 shows the measurement of mediators and dependent variables.

B. VALIDITY AND RELIABILITY OF MEASURES MODEL

Levels of perception, including different indices for a variety of concepts, were examined discriminately; therefore, this satisfied the recommended references from Fornell and Larcker [92]. The data obtained from the measurement model are presented in the following sections. For validity [93], with respect to the AVE values obtained, all values exceeded 0.50 (p < 0.001), thereby indicating that the discriminant validity was the same for all constructs studied [93]. In addition, Fornell and Larcker [92] explained that the relationship of elements between constructs cannot be more than the square root of the mean variance that they share in one of the constructs. Moreover, obtained composite reliability values are shown to be clearly within the recommended value range of 0.70 and above.

C. STRUCTURAL MODEL ANALYSIS

TTF and TAM impact AP through social media use. All results are displayed on the basis of learning performance. They are also compared in the hypothesis testing discussion. Table 2 shows the validity and reliability results of AP using the model factors of TTF and TAM. The CFA was then performed in the SEM phase to analyze the proposed

TABLE 1. Summary of goodness fit indices for model measurement.

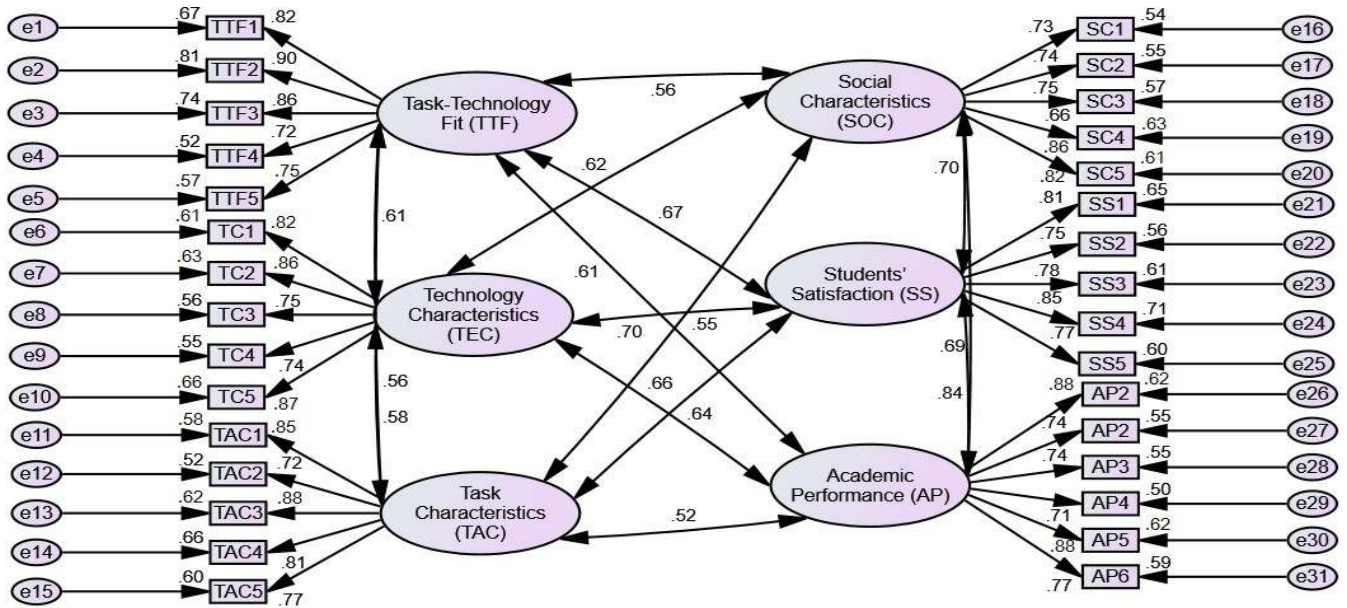| Type of measure	Acceptable level of fit	Values
Root-mean-Risdual (RMR)	Near to zero (Perfect Fit)	0.032
Normed Fit Index (NFI)	Value should be > 0.90	0.943
Relative Fit Index (RFI)	Value should be > 0.90	0.947
Incremental Fit Index (IFI)	Value should be > 0.90	0.953
Tucker Lewis Index (TLI)	Value should be > 0.90	0.959
Comparative Fit Index (CFI)	Value should be > 0.90	0.962

FIGURE 2. Measurement model (TTF theory).

hypotheses. Total Cronbach's alpha (CA), AVE, and composite reliability (CR) values were established. Therefore, the discriminant validity was also accepted. In addition, the obtained CR values shown were solidly in the range of 0.954 to 0.837 and all exceeded 0.70. In addition, the CA values were all between 0.934 and 0.832. AVE values were between 0.681 and 0.593 and therefore above the suggested value of 0.50. This illustrates that the total loading factor was negligible and exceeded 0.50, thus satisfying the mentioned references [92], [93]. All hypotheses among the ten major constructs are shown in Fig. 5, and 12 hypotheses were accepted. The results of the model are shown in Fig. 5 and Table 3. As the respective models' main statistics were consistent, this indicates that the validity and results of the hypotheses were confirmed.

D. HYPOTHESES OF TTF THEORY

The first six hypotheses relate to TTF theory. As noted in Table 3 and Fig. 5, there is a significant positive correlation between TEC and TTF ($\beta = 0.148$, t = 1.922, p < 0.001), thus indicating the positive and significant relationship of the first hypothesis (H1). TAC was positively

and significantly correlated with TTF as well ($\beta = 0.186$, t = 2.856, p < 0.001), thereby indicating the positive and significant relationship represented by the second hypothesis (H2). In addition, the third hypothesis (H3) that suggested the relationship between SOC and TTF would be positive and significant ($\beta = 0.426$, t = 5.651, p < 0.001) was supported. Moreover, TTF was significantly and positively correlated with behavioral intention ($\beta = 0.160$, t = 2.525, P<0.001), thus indicating that relationships suggested by the seventh hypothesis (H7) were also significant and positive. Similarly, the TTF and students' satisfaction correlation ($\beta = 0.363$, t = 6.004, P <0.001) indicated that the eighth hypothesis (H8) confirmed significant and positive relationships. Finally, we described the relationship between TTF and students' AP as significant and positive, ($\beta =.195$, t = 2.791, P <0.001), thus indicating that our ninth hypothesis(H9) confirmed a significant and positive relationship. This is consistent with previous studies [34], [35], [43], [49], [53].

E. TECHNOLOGY ACCEPTANCE MODEL HYPOTHESES

The second set featuring seven direct hypotheses related to the TAM model. According to Table 3 and Fig. 5, there was
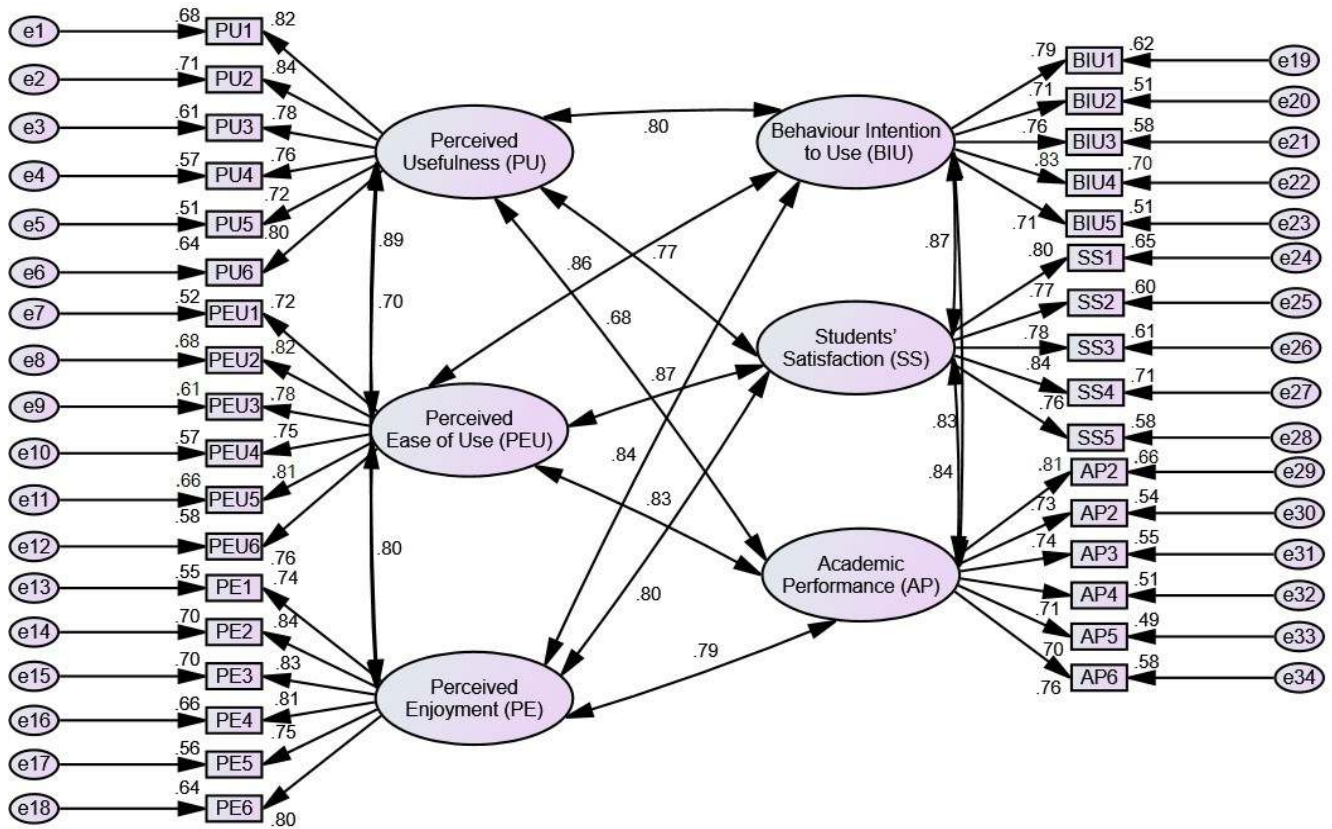
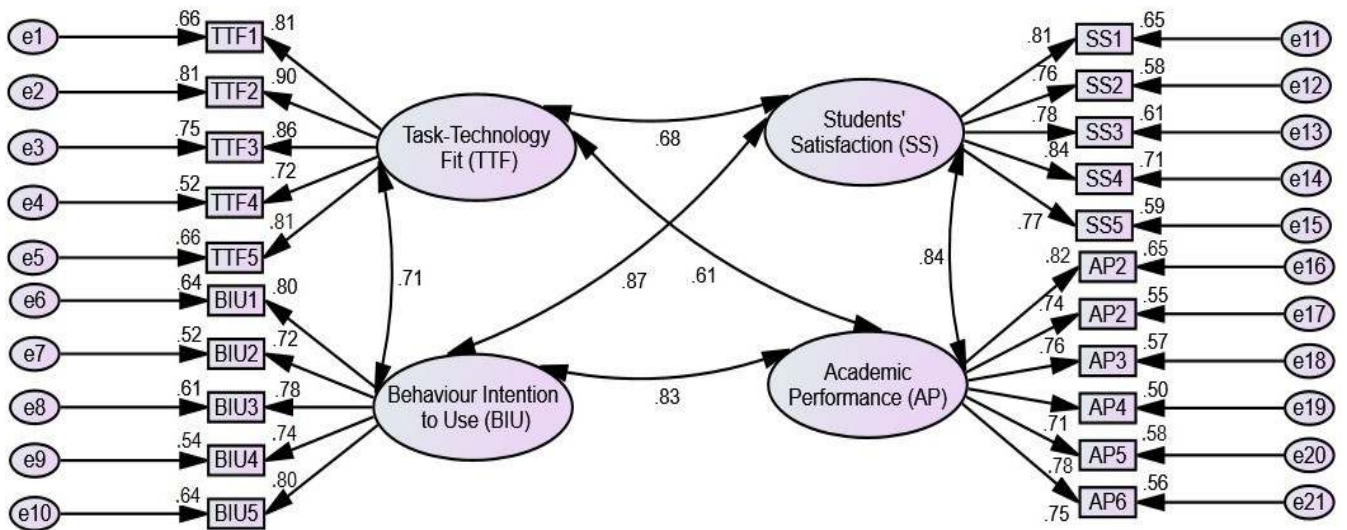**FIGURE 3.** Measurement model (TAM theory).

FIGURE 4. Measurement model of mediator and dependent factors.

a significant positive correlation between behavioral intent to use social media and perceived usefulness (β =.241, t = 3.974, p <0.001), thereby indicating the positive and significant relationship of the fourth hypothesis (H4). In addition, the PEU was positively and significantly correlated with behavioral intent to use social media (β =.282, t = 4.287,

p < 0.001), thus indicating the positive and significant relationship represented by the fifth hypothesis (H5). Additional to the above results, the sixth hypothesis (H6) that assumed the relationship between PE and behavioral intent to use social media would be positive and significant (β =.238, t = 3.341, p < 0.001) was supported. Similarly, the behavioral

TABLE 2. Validity and reliability.

|	TTF	TEC	TAC	SOC	PU	PEU	PE	BIU	SS	AP	CA	CR	AVE	R. S
TTF	.910										.921	.907	.618	.592
TEC	.325	.832									.893	.932	.623	.000
TAC	.324	.428	.888								.832	.837	.649	.000
SOC	.431	.538	.439	.835							.934	.943	.593	.000
PU	.321	.401	.541	.435	.901						.888	.954	.633	.000
PEU	.542	.444	.342	.449	.438	.889					.887	.923	.648	.000
PE	.348	.390	.438	.461	.551	.452	.894				.891	.889	.681	.000
BIU	.340	.351	.435	.366	.539	.449	.448	.886			.932	.845	.598	.562
SS	.348	.429	.452	.439	.538	.351	.537	.535	.931		.930	.905	.621	.518
AP	.432	.464	.428	.363	.520	.462	.509	.500	.430	.917	.911	.909	.648	.565
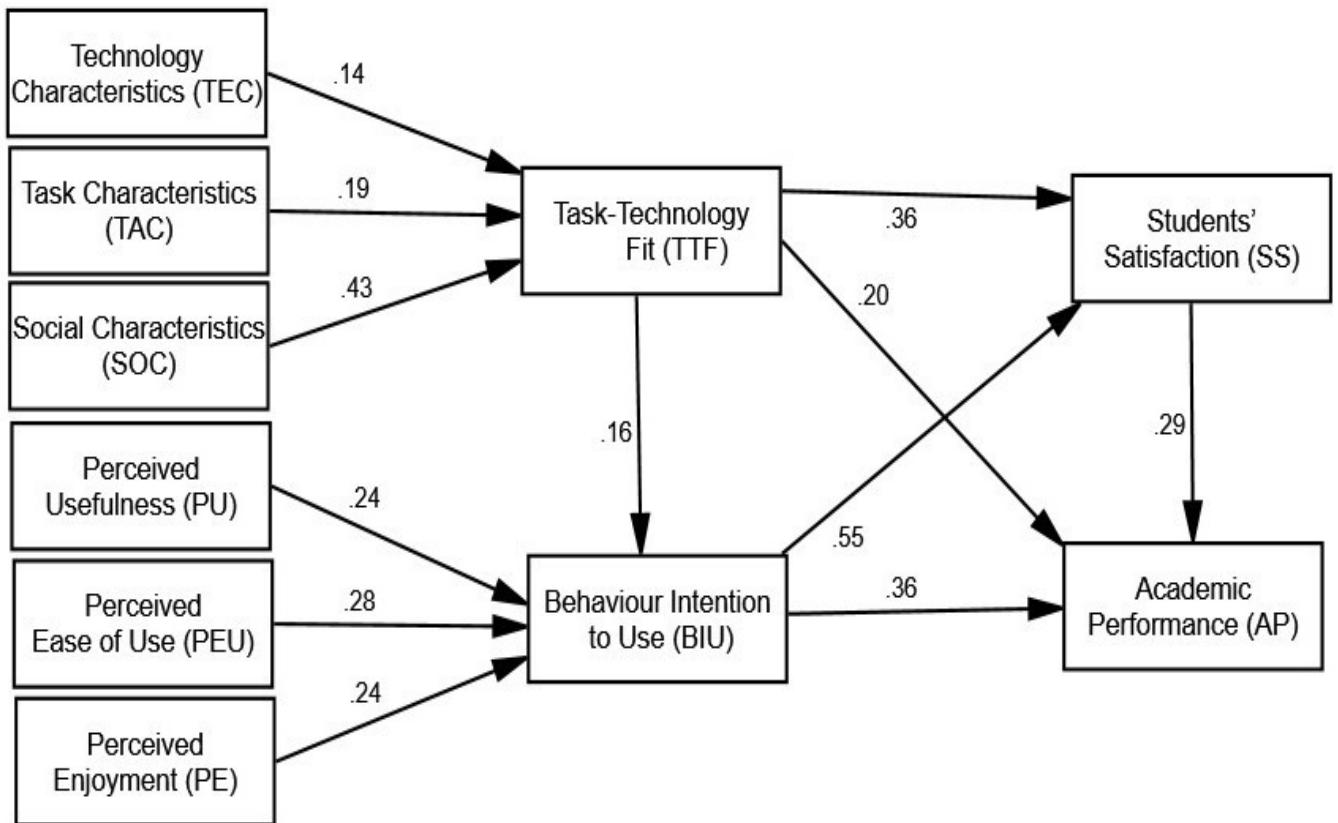
FIGURE 5. Research model with structural model testing of hypotheses results.

intention to use social media was significantly and positively correlated with students' satisfaction (β =.549, t = 8.893, p < 0.001), thereby indicating that relations suggested by the tenth hypothesis (H10) were significant and positive. Moreover, the relationship between behavioral intention to use social media and AP (β =.361, t = 4.585, p < 0.001) were both positive and significant, thus supporting the 11th hypothesis (H11). Finally, the twelfth hypothesis (H12) that suggested a positive and significant relationship between students' satisfaction and AP (β =.290, t = 3.522, p < 0.001) was supported as the result of significant and

positive relations shown in the data. In general, all TAM hypotheses were consistent with our study data, thus confirming most previous studies in which PE, perceived ease of social media use, and PU enhanced the behavioral intent to use social media, thereby fostering students' satisfaction and AP in turn [14], [59], [62], [72], [83].

VI. DISCUSSION AND IMPLICATIONS

The results of our study broaden the understanding of AP and its relations to their TEC, TAC, PU, SOC, PE, as well as the perceived ease of using social media. The background

TABLE 3. Structural model hypothesis testing results.

H	Independent	Relationship	Dependent	Estimate	S.E.	C.R.	P	Result
H1	TEC	⟶	TTF	.148	.078	1.922	.048	Supported
H2	TAC	⟶	TTF	.186	.065	2.856	.004	Supported
H3	SOC	⟶	TTF	.426	.075	5.651	.000	Supported
H4	PU	⟶	BIU	.241	.061	3.974	.000	Supported
H5	PEU	⟶	BIU	.282	.066	4.287	.000	Supported
H6	PE	⟶	BIU	.238	.071	3.341	.000	Supported
H7	TTF	⟶	BIU	.160	.063	2.525	.012	Supported
H8	TTF	⟶	SS	.363	.060	6.004	.000	Supported
H9	TTF	⟶	AP	.195	.070	2.791	.005	Supported
H10	BIU	⟶	SS	.549	.062	8.893	.000	Supported
H11	BIU	⟶	AP	.361	.079	4.585	.000	Supported
H12	SS	⟶	AP	.290	.082	3.522	.000	Supported

Note: P: P-value, SE: Standard Error, and CR: Critical Ratio or t-value

created by TTF and the behavioral intentions to use social media are facilitated by social media that is capable of augmenting students' satisfaction and AP. On the basis of this study's findings, the use of social media provides positive improvements that are useful for technology and task characteristics, SOC, and its TTF, all of which can enhance students' satisfaction and AP as identified in previous and current studies [16], [34], [35], [41]. Likewise, the findings of this study show that using social media can lead to positive perceptions of enjoyment, usefulness, and ease of use. It also improves the behavioral intention to use social media, thereby enhancing students' satisfaction and AP as demonstrated by this study and previous research [14], [57]. Therefore, the behavioral intentions to utilize social media relate to the perceptions of enjoyment, usefulness, and ease of use, all of which improve student academic activities by obtaining important resources from their peers, including their instructors' guidelines. Experimental evidence suggests that on-campus students need additional support beyond short face-to-face talks when using social media to collaborate. In addition, based on progress related to research skills development by educators and the concept of exchanges between students, it has been found that for the purposes of learning, the behavioral intent to use social media is comparatively more beneficial with face-to-face sessions [1], [84]. Therefore, this research contributes to the literature by presenting a model that reconciles TTF theory with the TAM model that is useful for interpretation. In addition, this study helps to integrate the TTF theory and the TAM model. This also aids social media and it's improving computer systems that foster greater interest in future use. Therefore, the most important practical conclusions and contributions of this research were obtained by meeting the research questions. In addition, human computer interaction (HCI) has recently attempted to analyze user behavior in order to improve the design of social technologies [76], [94]. The present study offered an extensive collection of human-produced tools that reinforce the design of advanced social technologies. In particular, the inherent features of Web 2.0 combined with Internet-based websites and applications support greater social engagement. Therefore, scholars are attempting to refine theories that are capable of guiding these practices [94]. This study recommends the TTF and TAM theories as contributors to a further understanding of the behavioral intentions of students and task-technology fit to utilize social media in order to enhance university-level students' academic performance. In addition, new assessment criteria and measures are essential factors in practice and research. It is argued in Davis [57] that TAM provides criteria for evaluating the planned system. Therefore, the accepted model of social media utilized in this research can be used to evaluate the practical usage of social media in relation to TTF as well as technology, task, and SOC to enhance the educational performance of both university students and those in other institutions. Meanwhile, although all the hypotheses are supported by the current study, other measures have also been confirmed and are likely to be used to measure various aspects of computer and educational interaction related to "human-computer interaction." One additional theoretical aspect of our study that we found to be remarkable was the dissemination of knowledge regarding the use of social media for the behavioral intent of using social media for learning through TTF that is likely to increase academic progress in higher education. Three sets of empirical evidence were developed in this study: First, TTF via TEC, TAC, and SOC were all analyzed. Second, the behavioral intention to use social media as a tool to understand the usefulness, ease, and enjoyment of social media use was found to improve student progress in higher education. Finally, TTF and the behavioral intentions of students to utilize social media for learning purposes enriched the academic activity of higher education students. These provide an important theoretical contribution to prior TAM research in which the impact of using social media for learning had not been taken fully into account [4], [8], [24], [30], [57], [77], [96]. The following conclusions are based on the results of this research: Using social media (e.g. Facebook, blogs, and YouTube)

for technology-based tasks combined with its inherent SOC that improve collaborative learning can significantly improve students' academic performance in higher education. In addition, students are supported by faculty members and lecturers via question and answer sessions, they share knowledge and information, and the relative ease in which knowledge can be acquired has improved exponentially. All of these have the potential to improve learning outcomes and research experiences.

VII. CONCLUSION AND FUTURE WORK

Supported by the results of this research, three types of characteristics technology, task, and social will influence academic achievement via TTF for learning. Similarly, the outcomes also indicated that AP is affected by increasing the behavioral intent to use social media for learning purposes, as well as the PU, ease of use, and enjoyment of social media. In addition, the results showed that the behavioral intentions of students to use social media had a positive impact on TTF and their educational outcomes. Moreover, findings supported the TAM with TTF theory that was used to examine the behavioral intentions of students to utilize social media for learning as a method to enhance their AP in higher education. In sum, TTF and the behavioral intentions to use social media can improve the learning activities of students, their sharing of knowledge, information exchange, and greatly simplifies discussions among peers. This research yielded new results albeit with the following limitations: The sample size was limited to one university in Malaysia; therefore, the outcomes may not reflect the behavior of other institutions, such as secondary school teachers, private colleges, or military facilities. The level of understanding and the perceptions of other students may differ from a lecturer's observation or what students actually do in practice. In addition, the dissimilarities between research areas were not considered. Therefore, future studies are proposed to replicate the research in other environments and under distinct circumstances.

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