Role of Internet Self-Efficacy and Interactions on Blended Learning Effectiveness

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Abstract

Blended learning is widely adopted by organizations where a blend of online component complements the traditional face-to-face learning. Despite its popularity, research on developing a model for blended learning effectiveness is limited. This paper develops and validates a research model for blended learning effectiveness by investigating the role of engagement on perceived learning effectiveness. Further, the role of internet self-efficacy (personal factor) and interactions (environmental factors) on various dimensions of engagements are examined through the lens of social cognitive theory. A total of 246 postgraduate Indian students participated in a Management Information Systems course. Structural

equation modelling is used to validate the research model empirically. It is found that the internet self-efficacy and the interaction factors are positively related to the engagement dimensions, which further positively affects the perceived learning effectiveness. Moreover, perceived learning effectiveness is positively related to student scores. Theoretical and practical implications are discussed.

Keywords: Blended learning, Learning effectiveness, Student engagement, Social cognitive theory.

1. Introduction

The technological innovations and the need for accessibility and flexibility in higher education are leading to a paradigm shift from teacher-centered to learner-centered learning. Blended learning is the learning method which combines traditional face-to-face learning with the online instruction method.[1] The traditional classroom centered learning in higher education poses several challenges such as access, affordability, and quality of the learning.[2] Moreover, it becomes difficult for traditional education to teach in global crisis, such as, pandemics, natural calamities, bad weather conditions, disruption created by various protests, etc. In these situations, computer-mediated learning helps the continuity of education where there is a disruption in physical presence. The Covid-19 pandemic has forced government bodies and decision-makers to reassess the role of technology and use them in various fields, including education.[3] It has impacted the social distancing measures and forced schools and universities to switch to online mode. It is found that IT mindfulness has a positive impact on learning effectiveness.[4,5] The disruptions that occurred due to the pandemic can be viewed as an opportunity and has the transformative potential of current practices.[6] Human society has adapted to the new normal through digitization and accelerated implementation of predicted technology trends, enabling firms and educational institutions to shift to work-from-home.[7,8] The adoption of online teaching in covid-19 is determined by facilitative leadership, regulatory support, and project team capability in higher education.[9] Students use social networking sites in the pandemic, and their usage is determined by the cognitive appraisal of voluntary social distancing compliance and psychological impact.[10]

The primary disadvantage of the fully online learning is the social interaction element. According to Graham et al.,[11] the three major advantages of blended learning are improved pedagogy, increased access and flexibility, and increased cost-effectiveness without giving up the social interaction aspect. Many studies have suggested that the pedagogy of blended learning is better in terms of bringing authenticity to the classroom[12], integrating the formal classroom learning with the informal learning[13], introducing collaborative learning and problem solving[14], etc. In addition to this, the blended learning systems help in achieving cost-effectiveness without sacrificing the human touch required in learning. The rapid development in technology has expanded the possibility of learning in computer-mediated learning environments with the advantages of face-to-face components.[15] For instance, the technology is enabling to achieve the synchronicity and levels of interaction in computer-mediated environments to achieve the effect of face-to-face environments. Similarly, in the humanness dimension, there is an

increasing focus on providing human interactions as much as possible through various means such as virtual communities, blogging, instant messaging, etc.[16] Additionally, technology helps to provide a virtual reality environment for the learners to mimic a physical classroom.

A meta-analysis by Means et al.[17] found that blended learning is more effective than face-to-face learning as compared to purely online learning which is found to be equivalent as face-to-face learning effectiveness. There is also evidence that blended learning has certain advantages over fully online learning in terms of increased communication, engagement, sense of community, increased academic performance, collaborative tasks, active participation, etc.[18] Since blended learning is effective as compared to other instruction modalities, several researchers have explored the learning effectiveness of blended learning. But the effectiveness is mostly measured in terms of pre and post-tests.[19] Research in terms of factors affecting blended learning effectiveness is under-studied. The literature also suggests that student engagement in terms of behavioral, emotional, and cognitive aspects is crucial for understanding the learning effectiveness. Although there has been a vast amount of research in the area of blended learning, there is a gap between the theoretical and empirical part of the research and blended learning need to be based on good theoretical foundations.[20] In blended learning, students use the online medium in addition to the face-to-face component. Some students might be distracted by other websites of the online component; thus, student engagement becomes significant in this context. Hence, authors also a call for research on the motivational and engagement aspects of students in blended learning.[21]

The social cognitive theory explains the behavior of an individual based on the individual's personal and environmental factors.[22] Self-efficacy is one of the most researched personal factors that explain the behavior of an individual.[23] In the blended learning platform, the online learning component requires the internet to access the learning material. Hence, the internet self-efficacy is well suited as a personal factor which affects the behavior of students. In addition to this, the blended learning also requires interaction between the learner, instructor, and the interface.[24] Therefore, the environment of a learner consists of his/her interaction with their peers, instructors, and the blended learning interface. Thus, the aim of this paper is to understand the role of various dimensions of engagement on learning effectiveness in a blended learning environment. Further, the paper also aims to investigate the role of personal and environmental factors on the behavior of an individual (student engagement). This paper develops a conceptual model for blended learning effectiveness through the theoretical lenses of social cognitive theory. The conceptual model is validated using structural equation modeling on the collected data.

The organization of this paper is as follows: Section 2 discusses the theoretical foundation; section 3 presents the conceptual model and develops the hypotheses. Section 4 presents the research methodology followed by data analysis and results in section 5. Further, the results are discussed in section 6 followed by theoretical and practical implications in section 7.

2. Theoretical Foundation

2.1. Blended Learning Effectiveness

The blending of the face-to-face and online components can be provided at different levels in an organization. There are four levels of blending – activity level, course level, program level, and institution level.[1] Using both in-class and online methods via a field experiment Hill et al.[25] posited that the mix of both face-to-face and online methods of learning enhanced student performance. The design features of the platform and learner characteristics are significant predictors of satisfaction, knowledge construction, and intrinsic motivation in blended learning environments.[26] Additionally, the continuous use of blended learning is determined by perceived behavioral control, satisfaction, attitude, subjective norm, and perceived usefulness.[27] Pridmore and Godin[28] found that students' perceptions of learning partially increased after the virtual team experience and their intention to use the technology improved.

Blended learning leads to satisfaction in learners in various programs such as using shared online materials, forums, texts, pictures, and video-based learning in a computer course,[29] using interactive audio and video content in a mental health first aid training course[19], etc. Blended learning enhances students' learning experience and outcomes.[30] Additionally, in blended learning, the learning outcomes are better in terms of learners' achievements[29], performance[31], and marks obtained.[32] Further, the information communication technologies alone do not improve blended learning effectiveness, rather, different teaching strategies used in traditional education can improve the learning effectiveness.[33]

2.2. Social Cognitive Theory

Social Cognitive Theory (SCT) states that individuals' cognitive perceptions while interacting with their environment, affect their behavior or learning.[22] SCT is based on social learning theory[34], according to which all learning occurs either by direct or vicarious experience. The vicarious experience is obtained by individuals by observing or imitating others. Thus, both the cognitive and environmental aspects are vital for human behavior.[35] SCT studies individuals' behavior in the learning context.[36] The cognitive, vicarious, self-regulatory, and self-reflective processes are pivotal in SCT.[37] The external environment of an individual does not directly influence their behavior; rather, they influence the behavior through the cognitive process. The cognitive process determines the environmental events, their meaning, emotional impact, effects, and organizes the information for future use. In addition to learning by observation, individuals also learn by observing and imitating others' actions. Hence, the environment of an individual plays an important role in vicarious learning. The interaction between the environment and cognitive or personal factors influences the behavior of an individual. Student learning occurs in a social context. The learning environment affects the behavior of the learner.[38]

SCT is widely used by several researchers in blended learning. Schmidt[39] has used SCT to understand the change in students' perception of time, self-regulation, and motivation in blended learning

environments. Wu et al.[38] have used SCT to develop a model for learning satisfaction by using computer self-efficacy as a personal (or cognitive) factor and technological and social factors as environmental factors. Geng et al.[40] through the integration of social cognitive theory and theory of planned behavior, explores the connection between self-directed learning, technology readiness, and student motivation. Diep et al.[41] posited that social cognitive theory is a useful theoretical lens for instructional design, cognitive, and motivational processes. Arpaci and Basol[42] have used SCT to validate a research model on the relationship between cognitive and technological factors, and continuous intention to use in a flipped classroom.

From the above literature, it is found that SCT is based on social learning theory, and it explains how student learning occurs in a social context. Here, the learning environment affects the learners' behavior; in this case, the student learns in a classroom through various interactions. Additionally, several researchers have used SCT in the blended learning context. Therefore, we propose our research model through the lens of SCT.

3. Conceptual Model and Hypothesis Development

3.1. Effect of Engagement in Blended Learning

Student engagement is positively related to the academic performance in technology-mediated learning.[43] The engagement construct which is multi-dimensional with behavioral, emotional, and cognitive dimensions positively impacts academic outcomes.[44,45] The behavioral engagement which focuses on active attendance, homework completion, following of classroom norms, etc. is pivotal for attaining positive academic outcomes.[46] It is found that the attendance predicts performance in blended learning.[47] The regularity in the classroom positively impacts students' motivation, commitment, and learning strategies.[48] Moreover, the negative behavioral engagement is associated with the lower academic achievement.[49] There is evidence that emotional engagement predicts the academic achievement[50], and not being emotionally engaged in the academic life leads to poor academic outcomes.[51] It is found that enjoyment is positively related to the user engagement in gamified information systems.[52] Positive emotions are also related to organizational commitment and increased job performance.[53] The cognitive engagement focuses on the psychological investment of the students towards achieving desired learning outcomes is pivotal as students go beyond the minimum course requirements, set learning goals, and seek challenges to increase their competence.[45] Thus, the strategies used positively affect the academic outcomes.

Blended learning has the capability to increase student engagement.[54] A study shows how audience response systems improve engagement which in turn affects learning performance in a blended learning environment.[55] Furthermore, learning engagement positively affects perceived learning effectiveness and learning outcome in technology-mediated learning and blended learning, respectively.[56,44] A study

by Lim and Morris[57] in the context of blended learning has found that the learning involvement which is the degree to which learners interact with other learning component and are engaged in the learning process positively impacts the perceived learning. From the above literature, it is observed that there exists research on the effect of engagement on blended learning effectiveness. However, the effect of various dimensions of engagement—behavioral, emotional, and cognitive engagement on blended learning effectiveness is under-researched. Hence, the following hypotheses are proposed. The research model is shown in Figure 1.

H1a, b, c: Behavioral, emotional, and cognitive engagements are positively related to perceived learning effectiveness in a blended learning environment.

3.2. Effect of Personal Factors in Blended Learning

Self-efficacy which is the belief of an individual to organize and execute certain tasks to achieve desired outcome is found to be one of the predominant antecedents of student motivation, learning, and performance.[58,59] Self-efficacy positively affects different dimensions of student engagement.[60,61] Computer self-efficacy has a significant effect the learning engagement.[62] A study by Lim and Morris[57] has found that the self-efficacy which is a learning motivation variable[63], positively affects the perceived learning in a blended learning environment. In a blended learning environment, students access the course materials using the internet. Thus, internet self-efficacy plays a vital role in student engagement. In addition to this, internet self-efficacy determines internet use[64] and internet use is found to be positively related to student engagement.[43] Thus, the following hypotheses are proposed.

H2a, b, c: Internet self-efficacy is positively related to behavioral, emotional, and cognitive engagement in a blended learning environment.

3.3. Effect of Environmental Factors in Blended Learning

The interactivity is critically important in blended education. There are three types of interactions – learner-content, learner-instructor, and learner-learner interactions.[24] The learner-content interaction dimension is where the learners or students interact with the course material. In a blended learning environment where there is a blend of the online component along with the face-to-face instruction, the interaction with the learning interface becomes vital. The leaner-instructor interaction is the quality of the interaction between the learner and the instructor. Lastly, the learner-learner interaction is the interaction and collaboration among the students as the students learn collaboratively in blended learning platforms.[29] The interaction quality is positively related to the satisfaction and continuation to use of e-textbooks by tertiary students.[65] The learner-content, learner-instructor, and learner-learner interactions are found to be positively affecting the student involvement in the classroom, engagement in a course, and overall learning experience.[66,67,68] A study by Kang and Im[69] has found that instructor interaction positively affects perceived learning achievement. In addition to this, the instructor quality

positively impacts the perceived learning in a blended learning environment.[70,57] Angelo and McCarthy[71] have found that the shared leadership affects the performance of virtual groups within students in a classroom setting. Thus, educators should develop pedagogy to support and encourage the interactions. The learner-interface, learner-instructor, and learner-learner interactions are positively related to the flow in an activity.[72] Further, the flow in a course (concentration, interest, and enjoyment dimensions) leads to the engagement in a classroom.[73] The high levels of interactivity lead to better performance in terms of grade and higher levels of satisfaction among e-learning users.[74] Although studies show that all interactions are positively related to student engagement, their effect on the individual dimensions of engagement is limited. Therefore, the following hypotheses are proposed.

H3, b, c: Learner-learner interaction is positively related to behavioral, emotional, and cognitive engagement in a blended learning environment.

H4a, b, c: Learner-content interaction is positively related to behavioral, emotional, and cognitive engagement in a blended learning environment.

H5a, b, c: Learner-instructor interaction is positively related to behavioral, emotional, and cognitive engagement in a blended learning environment.

Studies have discovered that intention for a behavior leads to the actual behavior.[75] Further, there exists a positive relationship between the learning effectiveness and actual grades.[76] Hence, we propose the below hypothesis.

H6: Perceived learning effectiveness is positively related to student scores in a blended learning environment.

<Insert Figure 1 here>

3.4. Mediation

Numerous researchers have posited that students' self-efficacy has a significant effect on achievement and it is a predominant antecedent of academic performance.[58,59,77] The learning engagement mediates the relationship between computer self-efficacy and learning performance.[78] It is also found that the student engagement mediates the positive relationship between technology use and academic performance.[43] Additionally, the employee engagement mediates the relationship between transformational leadership and employee performance.[79] It is also found that all the dimensions of engagement fully mediate the relationship between internet self-efficacy and perceived learning effectiveness in an e-learning environment.[80] It is evident from the literature that the research on the mediating effect of various dimensions of engagement on the positive relationship between internet

self-efficacy and perceived blended learning effectiveness is limited. Thus, we propose the following hypotheses.

H7a, b, c: Behavioral, emotional, and cognitive engagement mediates the positive effect of internet self-efficacy on perceived learning effectiveness in a blended learning environment.

4. Research Method

4.1. Participants and Procedure

A total of 246 postgraduate Indian students participated in the survey. The survey was conducted online in a classroom setting. The instruction followed in the classroom is the course level blending where the instructor designed the blending of the face-to-face component with the online components. The course was provided to the students of postgraduate diploma in management in Management Information Systems (MIS) course with duration of three months starting from October 2020. The duration of the course ensured the adequate exposure of the blending method to the students. The blended learning course was offered through laptops, mobile devices, and other electronic devices connected to the internet using Elixir software (explained in the next section). The participants were asked to fill out the survey questionnaire with the assurance of treating the responses confidentially. The sample contained 50.41% males and 49.59% females. The majority of participants (80.49%) were in the age group of 18-25 years, and the remaining 19.51% of the participants were in the age group of 26-35 years. The demographic characteristics of the sample are presented in Table 1.

<Insert Table 1 here>

4.2. Elixir

Elixir is a Learning Management System (LMS) which is a software application modeled after a physical classroom that creates, manages, and presents learning and training content with an interactive interface for assessments offering an interactive way of learning. The instructors upload their learning content in the elixir both in the form of text and videos along with the features such as uploading time-bound assignments and quizzes. It also provides assessment features for instructors for evaluating objective (quizzes) as well as subjective (assignments) content. The students can view the contents uploaded by the instructors, submit the assignments, attempt the quiz, and check the mark sheet uploaded. The software also helps administrators to generate various kinds of reports.

4.3. Measurement Development

To measure the latent constructs in the conceptual model, scales are adapted from the literature. The measurement sources are presented in Table 2 with the study, item, description, and item codes. All the items are measured by using a 5-point Likert scale (Here, 1 = strongly disagree and 5 = strongly agree). The Internet Self-efficacy (ISE) scale is adapted from Eastin and LaRose[64] which has eight items. Here,

the individual's self-efficacy in using the internet is measured because students use the internet to study online courses. The scale consists of items which focus on whether the individuals are confident in understanding the hardware and software, troubleshooting, gathering the data on the internet, carrying out online discussions, etc.

The learner-learner and learner-instruction interactions scale are adapted from Liao[72] and Sherry et al.[81] While the learner-learner scale focuses on the interaction between students, whether they ask questions, answer the questions by others and provide their opinion, the learner-instructor interaction focuses on the interaction between the students and the instructor such as whether the instructor facilitates the students with his/her opinion, ask the students' opinions, questions, etc. The learner-interface interaction scale is adapted from Liao[72] and focuses on the interaction between the learners and the interface provided for the blended learning. This includes the response of the platform, and the easiness and fastness of the blended learning platform, etc. All the interaction scales have four items each.

To measure various types of engagement, the engagement scale is adapted from Fredricks et al.[82] and Sun and Rueda[83]. The behavioral engagement subscale consists of five items focusing on the engagement of students in terms of behavioral norms such as paying attention, completing homework, following rules, etc. The emotional engagement subscale consists of six items which focus on the affective aspects of the engagement such as whether the student like the online class, feel interested, happy, etc. in the class. The cognitive engagement subscale consists of eight items which focus on the engagement of the students at a cognitive level to achieve the desired outcome. This comprises of revising the course, studying extra materials, engaging in discussion with people about the course, etc. The Perceived Learning Effectiveness (PLE) scale is adapted from Wan et al.[84] which measures the individual learning effectiveness with five items. The items capture the perception of students about learning the factual material, identifying the central issue of the course, ability to communicate about the subject, etc.

<Insert Table 2 here>

5. Data Analysis and Results

The participants were asked to fill out the survey questionnaire. The responses were used for confirmatory factor analysis (CFA) and structural model in AMOS.

5.1. Structural Equation Modelling

The conceptual model presented in Figure 1 is validated through structural equation modeling using IBM SPSS AMOS version 24. The proposed model is a theory testing exercise that confirms the relationship between a set of variables. The Structural Equation Modeling (SEM) is a well-accepted method to analyze relationships in business studies.[85] The prime reason behind the extensive applicability of SEM is its ability to test multiple relationships simultaneously into a single model.[86]

Covariance-based SEM (CB-SEM) is the most popular method to establish the cause-effect relationship in SEM, and is used for theory testing and confirmation.[86,87] AMOS is a software used for CB-SEM to test or confirm the established theory**.** The objective of this research is to fit data to the model (confirming an established model with minor changes). In addition to this, the number of items per construct is more than 3. Structural equation modeling comprises of measurement and structural model.

5.1.1. Measurement Model

After satisfying results from EFA, Confirmatory Factor Analysis (CFA) is performed in AMOS 24. A good model fit (χ^2 = 1559.203, df = 872, χ^2/df = 1.788, RMR = 0.067, TLI = 0.909, CFI = 0.916, RMSEA = 0.051) is obtained after adjusting the modification indices (MIs). Three pairs of error items from the same constructs were allowed to covariate based on high values of MIs.[88]

The validity and reliability measures achieved for the model is shown in Table 3. The factor loadings should be greater than 0.5 and preferably more than 0.7[89] which is satisfied in the measurement model. The convergent validity can be determined by Composite Reliability (CR) and Average Variance Extracted (AVE).[90] The CRs for all the constructs should greater than 0.7, and AVEs should be greater than 0.5.[89] The composite reliabilities for all the constructs are greater than 0.7 in the measurement model. The CRs for CEng is 0.924, ISE is 0.891, LLearn is 0.907, LInstruct is 0.799, LInter is 0.925, BEng is 0.931, EEng is 0.925, and PLE is 0.887. The AVEs for all the constructs are greater than 0.5 in the measurement model shown in Table 3. The square root of AVEs (in the diagonals fields of Table 3) are greater than the correlations between the constructs indicating that the discriminant validity is satisfied.[90]

<Insert Table 3 here>

5.1.2. Common Method Variance

Common Method Bias (CMB) is caused due to the instrument of data collection rather than the appropriate representation of the construct items. Since the data is collected through survey methodology from the respondent one at a time, it is likely to introduce common method bias.[91] The presence of common method bias can inflate or deflate the correlations among variables in the data. Hence, it is crucial to take procedural measures before data collection to minimize the possible CMB in actual data collection.[92] A psychological separation is created by asking response variable immediately and giving time to answer the rest of the variable at a different time. Further, to minimize the common method bias, the respondents' anonymity is protected which reduced the evaluation apprehension. Moreover, the scale items are improved by defining unfamiliar or ambiguous terms and keeping the items simple and concise. Additionally, a statistical test for common method variance is conducted to check whether the majority of variance is explained by a single factor. Harman's single-factor test is conducted in SPSS to detect the presence of common method variance as it is accepted as

good statistical criteria for CMB.[93] The result showed that no single factor accounted for more than 50% (36.846%) of the variance. Thus, no general factor is identified that explains the majority of the variance in data. This implies that common method variance is not likely to influence the results of the study.

5.1.3. Structural Model

Before proceeding with the structural model, the multivariate assumptions are tested for influencers and multicollinearity. The influencer analysis is performed in SPSS with Cook's distance.[94] Cook's distance of less than 0.07 is obtained for all observations which are below the threshold value of 1. The presence of multicollinearity in the dataset is checked in SPSS for identifying the presence of collinearity among predictor variables. The multicollinearity is checked with the Variance Inflation Factor (VIF) and tolerance values. VIF values of less than 3.2 and tolerance values of more than 0.3 are obtained for the constructs (with a required threshold of less than 10 for VIFs and greater than 0.1 for tolerance).[89]

The structural path testing for the hypotheses is performed in AMOS post confirmatory factor analysis. All the proposed hypotheses are supported by the data. The hypothesis test results are presented in Table 4 and Figure 2. The behavioral (BEng), emotional (EEng), and cognitive (CEng) engagements positively impact the perceived learning effectiveness (PLE) with path coefficients 0.216 ($p<.01$), 0.144 ($p<.05$), and 0.477 ($p<.001$) respectively. This supports hypotheses H1a, H1b, and H1c. The result shows that internet self-efficacy (ISE) positively impacts behavioral, emotional, and cognitive engagement with path coefficients 0.219 ($p<.001$), 0.293 ($p<.001$), and 0.242 ($p<.001$) respectively. This supports hypotheses H2a, H2b, and H2c. The learner-learner interaction (LLearn) has a positive impact on behavioral, emotional, and cognitive engagements with path coefficients 0.199 ($p<.01$), 0.226 ($p<.001$), and 0.168 ($p<0.05$) respectively. This supports hypotheses H4a, H4b, and H4c. The learner-instructor interaction (LInstruct) positively impacts behavioral, emotional, and cognitive engagement with path coefficients 0.278 ($p<.001$), 0.181 ($p<.01$), and 0.171 ($p<.05$) respectively. This supports hypotheses H5a, H5b, and H5c. The learner-interface interaction (LInter) has a positive effect on behavioral, emotional and cognitive engagement with path coefficients 0.286 ($p<.001$), 0.331 ($p<.001$), and 0.186 ($p<.01$) respectively. Therefore, hypotheses H6a, H6b, and H6c are supported. Further, the effect of control variables –age and gender on the perceived learning effectiveness is found to be non-significant with path coefficients 0.012 and 0.060 respectively which is supported by Liberatore et al.[95] The variance explained by behavioral engagement is 55%, emotional engagement is 61%, cognitive engagement is 34%, and that of perceived learning effectiveness is 49%. The perceived learning effectiveness positively determines the student score with a path coefficient of 0.963 supporting hypothesis H6.

<Insert Table 4 here>

<Insert Figure 2 here>

Figure 2 represents the research model with Internet Self-efficacy, Learner-Learner Interaction, Learner-Instructor Interaction, Learner-Interface Interaction, Behavioral Engagement, Emotional Engagement, Cognitive Engagement, and Perceived Learning Effectiveness. The standardized estimates or the regression weights are mentioned with significance levels. *** represents a significance level of .001, ** represents a significance level of .01, and * represents the significance level of .05. Here, ns represent non-significant paths.

5.1.4. Mediation

For hypotheses, H7a, H7b, and H7c, the mediation effect of behavioral (BEng), emotional (EEng), and cognitive (CEng) engagements are tested on the positive effect of internet self-efficacy (ISE) on perceived learning effectiveness (PLE) shown in Table 5. The hypotheses are tested using the Baron and Kenny approach.[96] The direct effects are measured without the mediators by removing the mediator variables from the model in AMOS. The standardized regression weights for the direct effect of internet self-efficacy on perceived learning effectiveness was significant and found to be 0.418 with a p-value less than 0.001. Then the direct effect with the mediator was measured. The mediating effect of behavioral engagement on the relationship between internet self-efficacy to perceived learning effectiveness was tested. The relationship was found to be significant with a regression weight of 0.164 ($p< 0.05$). This indicates that BEng partially mediates the positive effect of ISE to PLE. Similarly, the direct effect of ISE to PLE with the mediators EEng and CEng were significant with beta values of 0.192 ($p< 0.05$) and 0.136 ($p< 0.05$) respectively. This indicates that EEng and CEng partially mediate the positive effect of ISE on PLE. Therefore, the hypotheses H3a, H3b, and H3c are supported.

<Insert Table 5 here>

6. Discussion

In this paper, the conceptual model is validated for blended learning effectiveness by using social cognitive theory. The social cognitive theory is an effective framework used to explain the multidimensional engagement construct from personal and environmental factors. The internet self-efficacy and the three types of interaction – learner-learner, learner-instructor, and learner-interface positively impact the behavioral, emotional, and cognitive engagement well. The empirical results validated the importance and significance of the framework to understand the engagement construct.

The findings suggest that the behavioral, emotional, and cognitive engagement dimensions positively impact the perceived learning effectiveness. This confirms and is aligned with the findings of Chen et al.[56] and Hu and Hui[44]. This paper extends both the studies by investigating the role of different dimensions of engagement (behavioral, emotional, and cognitive) on perceived learning effectiveness in blended learning environments. Interestingly, the results show that emotional engagement is the predominant antecedent of perceived learning effectiveness. This can be attributed to the fact that students in blended classroom learning develop emotional affect towards their peers and instructors

which positively affects the perceived learning.[57] The students tend to interact and collaborate with other students and the instructor which leads to positive learning outcomes.

The result shows that the internet self-efficacy positively affects the behavioral, emotional, and cognitive dimensions of engagement. This study confirms the results obtained by Linnenbrink and Pintrich[61] which posits that self-efficacy affects different dimensions of engagement. This paper has extended the findings by investigating the role of internet self-efficacy on various dimensions of engagement in the blended learning context.

The result also shows that all the dimensions of engagement partially mediate the positive relationship between internet self-efficacy and perceived learning effectiveness. This implies that internet self-efficacy affects the perceived learning effectiveness through engagement. This study supports and extends the findings of Chen[62] and Rashid and Asghar[43]. First, this paper has explored the role of various dimensions of engagement as mediators for the relationship between internet self-efficacy and perceived learning effectiveness. Second, internet self-efficacy is considered as the independent variable in the blended learning platform because students learn over the internet.

The learner-learner, learner-instructor, and learner-interface elements of interaction have a significant positive impact on the behavioral, emotional, and cognitive engagement. Interestingly, it is found that the learner-learner interaction has a greater effect on the emotional engagement which suggests that the students are emotionally engaged with their peers. The learner-instructor interaction has a greater effect on the behavioral engagement which implies that the learner-instructor interaction dimension encouraged the students to follow the classroom norms, active attendance, complete their homework, etc. Lastly, the learner-interface interaction has a greater effect on the emotional engagement. This suggests that when the students find the interface easy, fast, etc., they tend to be happy, interested, and excited about the class. Furthermore, the learner-interface interaction has a greater effect on all the dimensions of engagement compared to other interaction variables. This implies that students give more importance to the interface interactions than the peer and instructor interactions.

7. Theoretical and Practical Implications

The study has several theoretical implications. First, this paper has developed and validated a model for learning effectiveness using personal and environmental factors on the theoretical lenses of social cognitive theory. The research on the factors affecting blended learning effectiveness is limited. Hence, the model adds to the extant literature of blended learning. Furthermore, the social cognitive theory used for the study is validated, and it fits well with the proposed research model.

Second, this study has extended the work of Chen et al.[56] and Hu and Hui[44] where they have studied the role of engagement on the learning outcome and perceived learning effectiveness. Although the multidimensional nature of engagement is well studied in the education literature[45,82], the role of

behavioral, emotional, and cognitive engagements on perceived learning effectiveness in the blended learning context is under-researched. It is found that the emotional dimension of engagement is the predominant antecedent of perceived learning effectiveness in blended learning.

Third, although several studied have investigated the role of various dimensions of interactions (learner-learner, learner-instructor, and learner-interface) on engagement[66,67,68], the studies on the effect of interactions on various dimensions of engagement are limited. This study establishes a positive relationship between the interaction dimensions and engagement dimensions in blended learning. It is also observed that the learner-learner interaction and learner-interface interactions explain the emotional engagement more than other dimensions of engagement, and learner-instructor interaction explains the behavioral engagement more than other dimensions of engagement.

Fourth, the mediation effect of various dimensions of engagement is investigated, and it is found that all the dimensions of engagements partially mediate the positive relationship between internet self-efficacy and perceived learning effectiveness. This supports the finding of Wu et al.[78], where they posited that learning engagement mediates the relationship between computer self-efficacy and learning performance. We have extended the literature by establishing a partial mediation of all dimensions of engagements on the relationship between internet self-efficacy and perceived learning effectiveness. This suggests that the students' belief in their ability to organize and execute internet actions required to yield certain outcomes leads to perceived learning effectiveness through various dimensions of engagement in terms of participation, enjoyment, and strategy use.

Based on the empirical findings, the results can have several implications for the instructors, blended learning provider organizations, and the students. Since emotional engagement is the primary antecedent of perceived learning effectiveness, the blended learning organizations should focus on designing the interactions (learner-learner, learner-instructor, and learner-interface) to support students to foster emotional engagement. This can be achieved by creating a collaborative environment with students and faculties to develop an emotional connect and engagement. The instructors should interact with the students to ensure achieving greater behavioral engagement in terms of participation, following classroom norms, etc. Since the learner-interface interaction has a greater effect on all the dimensions of engagement than the other interaction dimensions, it is crucial for the organizations to create a seamless integration of the online course materials with easy accessibility and focus on the other qualities of the learning interface. It is also found that internet self-efficacy is a significant predecessor of all the dimensions of engagement. Since enactive mastery (previous success in a task) is the primary source of self-efficacy[97], students should put effort and focus on the success in using the internet to achieve higher perceived learning effectiveness.

8. Conclusion

This paper develops and validates a research model for blended learning effectiveness using the theoretical lenses of social cognitive theory using structural equation modeling on the survey data. It is found that all the dimensions of engagement –behavioral, emotional, and cognitive engagement have a positive relationship with perceived learning effectiveness. In addition to this, it is also validated from this study that the personal factor –internet self-efficacy, and the environmental factors –learner-learner interaction, learner-instructor interaction, and learner-interface interaction have positive impacts on all the dimensions of engagement. It is further noted that the emotional engagement apart from other dimensions has a greater impact on the perceived learning effectiveness, and the learner-interface interaction dimension is critical in achieving greater student engagement. Moreover, this paper also draws that all the dimensions of engagement fully mediate the positive relationship between internet self-efficacy and perceived learning effectiveness. Lastly, the theoretical and practical implications are discussed.

References

1. Bonk CJ, Graham CR. The handbook of blended learning: Global perspectives, local designs. John Wiley & Sons; 2012.
2. Yeld N. Can UN development goals fix higher education's problems?. 2016 April 08 [accessed 2021 October 21]. https://www.britishcouncil.org/voices-magazine/can-un-development-goals-fix-higher-educations-problems.
3. Dwivedi YK, Hughes DL, Coombs C, Constantiou I, Duan Y, Edwards JS, Gupta B, Lal B, Misra S, Prashant P, et al. Impact of COVID-19 pandemic on information management research and practice: Transforming education, work and life. International journal of information management. 2020;55:102211.
4. Iivari N, Sharma S, Ventä-Olkkonen L. Digital transformation of everyday life–How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care? International Journal of Information Management. 2020;55:102183.
5. Shirish A, Chandra S, Srivastava SC. Switching to online learning during COVID-19: Theorizing the role of IT mindfulness and techno eustress for facilitating productivity and creativity in student learning. International journal of information management. 2021;61:102394.
6. Davison RM. The transformative potential of disruptions: A viewpoint. International journal of information management. 2020;55:102149.
7. Barnes SJ. Information management research and practice in the post-COVID-19 world. International journal of information management. 2020;55:102175.

8. Pandey, N., & Pal, A. (2020). Impact of digital surge during Covid-19 pandemic: A viewpoint on research and practice. International journal of information management, 55, 102171.
9. Mittal A, Mantri A, Tandon U, Dwivedi YK. A unified perspective on the adoption of online teaching in higher education during the COVID-19 pandemic. Information discovery and delivery. 2021;ahead-of-print(ahead-of-print).
10. Chakraborty T, Kumar A, Upadhyay P, Dwivedi YK. Link between social distancing, cognitive dissonance, and social networking site usage intensity: a country-level study during the COVID-19 outbreak. Internet research. 2021;31(2):419–456.
11. Graham CR, Allen S, Ure D. Benefits and challenges of blended learning environments. In: Encyclopedia of Information Science and Technology, First Edition. IGI Global; 2005. p. 253–259.
12. Alayyar GM, Fisser P, Voogt J. Developing technological pedagogical content knowledge in pre-service science teachers: Support from blended learning. Australasian journal of educational technology. 2012;28(8).
13. Khaddage F, Müller W, Flintoff K. Advancing mobile learning in formal and informal settings via mobile app technology: Where to from here, and how? Journal of Educational Technology & Society. 2016;19(3):16–26.
14. Sun Z, Liu R, Luo L, Wu M, Shi C. Exploring collaborative learning effect in blended learning environments: Exploring collaborative learning effect. Journal of computer assisted learning. 2017;33(6):575–587.
15. Broadbent J, Panadero E, Lodge JM, Barba P. Technologies to enhance self-regulated learning in online and computer-mediated learning environments. Cham: Springer; 2020. p. 37–52.
16. Rao KS, Subangi MC, Malhan IV. Social Networks as a Platform for Academic Interaction: Possibilities and Challenges for Indian Academic Libraries. Asian Journal of Information Science & Technology. 2019;9.
17. Means B, Toyama Y, Murphy R, Baki M. The effectiveness of online and blended learning: A meta-analysis of the empirical literature. Teachers College Record. 2013;115(3):1–47.
18. Tayebinik M, Puteh M. Blended learning or E-learning? International Magazine on Advances in Computer Science and Telecommunications. 2013; 3(1),103-110.
19. Reavley NJ, Morgan AJ, Fischer J-A, Kitchener B, Bovopoulos N, Jorm AF. Effectiveness of eLearning and blended modes of delivery of Mental Health First Aid training in the workplace: randomised controlled trial. BMC psychiatry. 2018;18(1):312.
20. Drysdale JS, Graham CR, Spring KJ, Halverson LR. An analysis of research trends in dissertations and theses studying blended learning. The internet and higher education. 2013;17:90–100.
21. Halverson LR, Graham CR. Learner engagement in blended learning environments: A conceptual framework. Online learning. 2019;23(2): 145-178.

22. Bandura A. Social foundations of thought and action. Englewood Cliffs, NJ; 1986.
23. Zhang Y, Fang Y, Wei KK, Wang Z. Promoting the intention of students to continue their participation in e-learning systems: the role of the communication environment. Information Technology & People. 2012;25(4):356–375.
24. Moore MG. Three types of interaction. 1989.
25. Hill T, Chidambaram L, Summers JD. Playing 'catch up'with blended learning: performance impacts of augmenting classroom instruction with online learning. Behaviour & Information Technology. 2017;36(1):54–62.
26. Kintu MJ, Zhu C, Kagambe E. Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. International journal of educational technology in higher education. 2017;14(1):7.
27. Sabah NM. Motivation factors and barriers to the continuous use of blended learning approach using Moodle: students' perceptions and individual differences. Behaviour & information technology. 2020;39(8):875–898.
28. Pridmore J, Godin J. Investigation of virtual teams and serious games. Journal of Computer Information Systems. 2020;60(2):194–200.
29. Eryilmaz M. The effectiveness of blended learning environments. Contemporary issues in education research. 2015;8(4):251–256.
30. Wai CC, Seng ELK. Measuring the effectiveness of blended learning environment: A case study in Malaysia. Education and information technologies. 2015;20(3):429–443.
31. Gambari AI, Shittu AT, Ogunlade OO, Osunlade OR. Effectiveness of blended learning and elearning modes of instruction on the performance of undergraduates in Kwara State, Nigeria. MOJES: Malaysian Online Journal of Educational Sciences. 2018;5(1):25–36.
32. Pereira JA, Pleguezuelos E, Merí A, Molina-Ros A, Molina-Tomás MC, Masdeu C. Effectiveness of using blended learning strategies for teaching and learning human anatomy. Medical education. 2007;41(2):189–195.
33. Sulčič V, Lesjak D. E-learning and study effectiveness. Journal of Computer Information Systems. 2009;49(3):40–47.
34. Bandura A. Social learning theory of aggression. The Journal of communication. 1978;28(3):12–29.
35. Wood R, Bandura A. Social cognitive theory of organizational management. Academy of management review. 1989;14(3):361-384.
36. Zimmerman BJ. A social cognitive view of self-regulated academic learning. Journal of educational psychology. 1989;81(3):329–339.
37. Bandura A. Social cognitive theory of mass communication. Media psychology. 2001;3(3):265–299.

38. Wu JH, Tennyson RD, Hsia TL. A study of student satisfaction in a blended e-learning system environment. Computers & education. 2010;55(1):155–164.
39. Schmidt JT. Preparing students for success in blended learning environments: Future oriented motivation and self-regulation. 2007. (Doctoral dissertation, lmu).
40. Geng S, Law KM, Niu B. Investigating self-directed learning and technology readiness in blending learning environment. International journal of educational technology in higher education. 2019;16(1):17.
41. Diep AN, Zhu C, Cocquyt C, De Greef M, Vo MH, Vanwing T. Adult Learners' Needs in Online and Blended Learning. Australian Journal of Adult Learning. 2019;59(2):223–253.
42. Arpaci I, Basol G. The impact of preservice teachers' cognitive and technological perceptions on their continuous intention to use flipped classroom. Education and information technologies. 2020;1-12.
43. Rashid T, Asghar HM. Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. Computers in human behavior. 2016;63:604–612.
44. Hu PJ-H, Hui W. Examining the role of learning engagement in technology-mediated learning and its effects on learning effectiveness and satisfaction. Decision support systems. 2012;53(4):782–792.
45. Kuh GD. The national survey of student engagement: Conceptual and empirical foundations. New directions for institutional research. 2009;2009(141):5–20.
46. Kuh GD. Excerpt from high-impact educational practices: What they are, who has access to them, and why they matter. Association of American Colleges and Universities. 2008;14(3):28–29.
47. Stewart M, Stott T, Nuttall A-M. Student engagement patterns over the duration of level 1 and level 3 geography modules: Influences on student attendance, performance and use of online resources. Journal of geography in higher education. 2011;35(1):47–65.
48. Boroujeni MS, Sharma K, Kidziński Ł, Lucignano L, Dillenbourg P. How to quantify student's regularity? In: European Conference on Technology Enhanced Learning. Cham: Springer International Publishing; 2016. p. 277–291.
49. Collie RJ, Holliman AJ, Martin AJ. Adaptability, engagement and academic achievement at university. Educational psychology. 2017;37(5):632–647.
50. Gunuc S. The relationships between student engagement and their academic achievement. International Journal on New Trends in Education and their implications. 2014;5(4):216–231.
51. Hirschfield PJ, Gasper J. The relationship between school engagement and delinquency in late childhood and early adolescence. Journal of youth and adolescence. 2011;40(1):3–22.
52. Suh A, Wagner C, Liu L. Enhancing User Engagement through Gamification. Journal of Computer Information Systems. 2018;58(3):204–213.

53. Kock N, Moqbel M. Social networking site use, positive emotions, and job performance. Journal of Computer Information Systems. 2021;61(2):163–173.
54. Dziuban C, Hartman J, Cavanagh TB, Moskal PD. Blended courses as drivers of institutional transformation. In: Blended Learning across Disciplines: Models for implementation. IGI Global; 2011. p. 17–37.
55. Blasco-Arcas L, Buil I, Hernández-Ortega B, Sese FJ. Using clickers in class. The role of interactivity, active collaborative learning and engagement in learning performance. Computers & education. 2013;62:102–110.
56. Chen PSD, Lambert AD, Guidry KR. Engaging online learners: The impact of Web-based learning technology on college student engagement. Computers & education. 2010;54(4):1222–1232.
57. Lim DH, Morris ML. Learner and instructional factors influencing learning outcomes within a blended learning environment. Journal of Educational Technology & Society. 2009;12(4):282.
58. Robbins SB, Lauver K, Le H, Davis D, Langley R, Carlstrom A. Do psychosocial and study skill factors predict college outcomes? A meta-analysis. Psychological bulletin. 2004;130(2):261–288.
59. Zimmerman BJ. Self-efficacy: An essential motive to learn. Contemporary educational psychology. 2000;25(1):82–91.
60. Ouweneel E, Schaufeli WB, Le Blanc PM. Believe, and you will achieve: changes over time in self-efficacy, engagement, and performance: Self-efficacy, engagement, and performance. Applied psychology. Health and well-being. 2013;5(2):225–247.
61. Linnenbrink EA, Pintrich PR. The Role of Self-Efficacy Beliefs In student Engagement and Learning In the classroom. Reading &Writing Quarterly. 2003;19(2):119–137.
62. Chen I-S. Computer self-efficacy, learning performance, and the mediating role of learning engagement. Computers in human behavior. 2017;72:362–370.
63. Lim DH, Kim H. Motivation and learner characteristics affecting online learning and learning application. Journal of educational technology systems. 2003;31(4):423–439.
64. Eastin MS, LaRose R. Internet self-efficacy and the psychology of the digital divide. Journal of computer-mediated communication: JCMC. 2000;6(1):0–0.
65. D'Ambra J, Wilson CS, Akter S. Continuance of E-textbook use by tertiary students: A qualitative approach. Journal of Computer Information Systems. 2020;60(3):223–232.
66. McBrien JL, Cheng R, Jones P. Virtual spaces: Employing a synchronous online classroom to facilitate student engagement in online learning. The International Review of Research in Open and Distributed Learning. 2009;10(3).
67. Sims R, Dobbs G, Hand T. Enhancing quality in online learning: Scaffolding planning and design through proactive evaluation. Distance education. 2002;23(2):135–148.

68. Sims R. Promises of interactivity: Aligning learner perceptions and expectations with strategies for flexible and online learning. Distance education. 2003;24(1):87–103.
69. Kang M, Im T. Factors of learner-instructor interaction which predict perceived learning outcomes in online learning environment: Factors of learner-instructor interaction. Journal of computer assisted learning. 2013;29(3):292–301.
70. Cheng YM. Extending the expectation-confirmation model with quality and flow to explore nurses' continued blended e-learning intention. Information technology & people. 2014;27(3):230–258.
71. Angelo R, McCarthy R. A pedagogy to develop effective virtual teams. Journal of Computer Information Systems. 2021;61(5):450–457.
72. Liao LF. A flow theory perspective on learner motivation and behavior in distance education. Distance education. 2006;27(1):45–62.
73. Shernoff DJ, Csikszentmihalyi M, Schneider B, Shernoff ES. Student engagement in high school classrooms from the perspective of flow theory. In: Applications of Flow in Human Development and Education. Dordrecht: Springer Netherlands; 2014. p. 475–494.
74. Zhang D. Interactive multimedia-based E-learning: A study of effectiveness. The American journal of distance education. 2005;19(3):149–162.
75. Renaud K, Van Biljon J. Predicting technology acceptance and adoption by the elderly: a qualitative study. In: Proceedings of the 2008 annual research conference of the South African Institute of Computer Scientists and Information Technologists on IT research in developing countries: riding the wave of technology. ACM, 2008. p. 210–219.
76. Kankanhalli A, Pee LG, Tan GW, Chhatwal S. Interaction of individual and social antecedents of learning effectiveness: A study in the IT research context. IEEE Transactions on Engineering Management. 2011;59(1):115–128.
77. Hong E, Mason E, Peng Y, Lee N. Effects of homework motivation and worry anxiety on homework achievement in mathematics and English. Educational research and evaluation: an international journal on theory and practice. 2015;21(7–8):491–514.
78. Wu H, Li S, Zheng J, Guo J. Medical students' motivation and academic performance: the mediating roles of self-efficacy and learning engagement. Medical education online. 2020;25(1):1742964.
79. Hee OC, Ibrahim R, Kowang TO, Fei GC. Employee engagement as a mediator between transformational leadership and employee performance. Asian Journal of Scientific Research. 2018;11(3):441–448.
80. Panigrahi R, Srivastava PR, Panigrahi PK. Effectiveness of e-learning: the mediating role of student engagement on perceived learning effectiveness. Information technology & people. 2020;ahead-of-print(ahead-of-print).

81. Sherry AC, Fulford CP, Zhang S. Assessing distance learners' satisfaction with instruction: A quantitative and a qualitative measure. The American journal of distance education. 1998;12(3):4–28.
82. Fredricks JA, Blumenfeld PC, Paris AH. School engagement: Potential of the concept, state of the evidence. Review of educational research. 2004;74(1):59–109.
83. Sun JCY, Rueda R. Situational interest, computer self-efficacy and self-regulation: Their impact on student engagement in distance education". British Journal of Educational Technology. 2012;43(2):191–204.
84. Wan Z, Wang Y, Haggerty N. Why people benefit from e-learning differently: The effects of psychological processes on e-learning outcomes. Information & management. 2008;45(8):513–521.
85. Babin BJ, Hair JF, Boles JS. Publishing research in marketing journals using structural equation modeling. The Journal of Marketing Theory and Practice. 2008;16(4):279–286.
86. Sarstedt M, Ringle CM, Smith D, Reams R, Hair JF Jr. Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers. Journal of family business strategy. 2014;5(1):105–115.
87. Hair JF, Ringle CM, Sarstedt M. PLS-SEM: Indeed a silver bullet. The Journal of Marketing Theory and Practice. 2011;19(2):139–152.
88. Byrne BM. Structural equation modeling with AMOS: Basic concepts, applications, and programming. Routledge; 2016.
89. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL. Multivariate Data Analysis: International Edition. 5th ed. Upper Saddle River, NJ: Pearson; 1998;5(3):207–219.
90. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. JMR, Journal of marketing research. 1981;18(1):39–50.
91. Batista-Foguet JM, Revilla M, Saris WE, Boyatzis R, Serlavós R. Reassessing the effect of survey characteristics on common method bias in emotional and social intelligence competencies assessment. Structural equation modeling: a multidisciplinary journal. 2014;21(4):596–607.
92. Podsakoff PM, MacKenzie SB, Lee J-Y, Podsakoff NP. Common method biases in behavioral research: a critical review of the literature and recommended remedies. The Journal of applied psychology. 2003;88(5):879–903.
93. Harman HH. Modern factor analysis. University of Chicago press;1976.
94. Cook RD. Detection of influential observation in linear regression. Technometrics. 1977;19(1):15–18.
95. Liberatore MJ, Wagner WP. Gender, Performance, and Self-Efficacy: A Quasi-Experimental Field Study. Journal of Computer Information Systems. 2021:1–9.

96. Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of personality and social psychology. 1986;51(6):1173.
97. Van Dinther M, Dochy F, Segers M. Factors affecting students' self-efficacy in higher education. Educational research review. 2011;6(2):95–108.

Appendix

Constructs

Internet self-efficacy
I feel confident in:
1. understanding terms/words relating to Internet hardware.
2. understanding terms/words relating to Internet software.
3. describing functions of Internet hardware.
4. trouble shooting Internet hardware.
5. explaining why a task will not run on the Internet.
6. using the Internet to gather data.
7. learning advanced skills within a specific Internet program.
8. turning to an on-line discussion group when help is needed.

Learner–instructor interaction
1. The instructor frequently offers opinions to students.
2. Students often state their opinions to the instructor.
3. The instructor frequently asks the students questions.
4. Interaction between the instructor and the class is high.

Learner–learner interaction
1. The students seldom ask each other questions.
2. There is little interaction between students.
3. In class, students seldom state their opinions to each other.
4. Students seldom answer each other's questions.

Learner–interface interaction
1. When I use the distance learning system there is very little waiting time between my action and response from the computer.
2. Interacting with the system is slow and tedious.
3. Navigation of the system is natural.
4. Interacting with the system is intuitive.

Engagement scale
Behavioral
1. I follow the rules of the online class.
2. I have trouble using the online class.
3. When I am in the online class, I just 'act' as if I am learning.
4. I am able to consistently pay attention when I am taking the online class.
5. I complete my homework on time.

Emotional

1. I like taking the online class.
2. I feel excited by my work at the online class.
3. The online classroom is a fun place to be.
4. I am interested in the work at the online class.
5. I feel happy when taking online class.
6. I feel bored by the online class.

Cognitive

1. I check my schoolwork for mistakes.
2. I study at home even when I do not have a test.
3. I try to look for some course-related information on other resources such as television, journal papers, magazines, etc.
4. When I read the course materials, I ask myself questions to make sure I understand what it is about.
5. I read extra materials to learn more about things we do in the online class.
6. If I do not know about a concept when I am learning in the online class, I do something to figure it out.
7. If I do not understand what I learn online, I go back to watch the recorded session and learn again.
8. I talk with people outside of school about what I am learning in the online class.

Perceived learning effectiveness

1. I learned factual material
2. I learned to identify central issues of the course
3. I learned to interrelate important issues of the course
4. I developed the ability to communicate clearly about the subject
5. I improved my ability to integrate facts and develop generalizations from the course material

Tables

Table 1: Demographic characteristics

		Number of Participants	Percentage of Participants
Gender	**Male**	124	50.41%
	Female	122	49.59%
Age	**18-25**	198	80.49%
	26-35	48	19.51%

Table 2: Measurement Sources for Blended Learning Effectiveness

Study	Item	Description	Item code
Eastin and LaRose (2000)	Internet Self-efficacy	It focuses on whether the individuals are confident in understanding the hardware and software, troubleshooting, gathering the data on the internet, carrying out online discussions, etc.	ISE
Liao (2006)	Learner-Learner Interaction	It is defined as the interaction between the students to understand whether they actively ask questions, and provides answers and opinions.	LLearn
	Learner-Instructor Interaction	It is defined as the interaction between the students and the instructor to understand whether the instructor provides and ask opinions, and questions and answers to the students.	LInstruct
Sherry, Fulford, and Zhand (1998)	Learner-Interface Interaction	It is defined as the interaction between the students and the blended learning platform interface to understand whether the students find it easy, fast, quick, etc.	LInter
Sun and Rueda (2012)	Behavioral Engagement	It is the student engagement in terms of participation and behavioral norms such as paying attention, completing homework, following rules, etc.	BEng
	Emotional Engagement	It is defined as the student engagement in terms of affective reactions such as whether the student like the online class, feel interested, happy, etc.	EEng
	Cognitive Engagement	It is the student engagement at a cognitive level to achieve the desired outcome. This comprises of revising the course, studying extra materials, engaging in discussion with people about the course, etc.	CEng
Wan et al. (2008)	Perceived Learning Effectiveness	It is the perception of students about learning the factual material, identifying the central issue of the course, ability to communicate about the subject, etc.	PLE

Table 3: Test for Validity and Reliability

	CR	AVE	MSV	MaxR(H)	CEng	ISE	LLearn	LInstruct	LInter	BEng	EEng	PLE
CEng	0.924	0.606	0.482	0.929	**0.778**							
ISE	0.891	0.547	0.378	0.909	0.468	**0.739**						
LLearn	0.907	0.71	0.346	0.91	0.436	0.51	**0.843**					
LInstruct	0.799	0.504	0.382	0.824	0.455	0.402	0.47	**0.71**				
LInter	0.925	0.754	0.388	0.932	0.419	0.395	0.415	0.505	**0.868**			
BEng	0.931	0.729	0.382	0.932	0.57	0.553	0.547	0.618	0.599	**0.854**		
EEng	0.925	0.673	0.388	0.931	0.465	0.615	0.588	0.588	0.623	0.525	**0.82**	
PLE	0.887	0.611	0.482	0.889	0.694	0.45	0.383	0.489	0.485	0.594	0.509	**0.782**

Table 4: Hypothesis testing

	Path Coefficient	Standard Error	Critical Ratio	P Value	Hypothesis
H1a: BEng -> PLE	0.216	0.061	3.205	0.001	Supported
H1b: EEng -> PLE	0.144	0.049	2.128	0.033	Supported
H1c: CEng -> PLE	0.477	0.068	6.819	0.000	Supported
H2a: ISE -> BEng	0.219	0.047	3.541	0.000	Supported
H2b: ISE -> EEng	0.293	0.058	4.83	0.000	Supported
H2c: ISE -> CEng	0.242	0.052	3.331	0.000	Supported
H3a: LLearn -> BEng	0.199	0.052	3.114	0.002	Supported
H3b: LLearn -> EEng	0.226	0.063	3.673	0.000	Supported
H3c: LLearn -> CEng	0.168	0.056	2.241	0.025	Supported
H4a: LInstruct -> BEng	0.278	0.058	4.189	0.000	Supported
H4b: LInstruct -> EEng	0.181	0.068	2.939	0.003	Supported
H4c: LInstruct -> CEng	0.171	0.062	2.251	0.024	Supported
H5a: LInter -> BEng	0.286	0.057	4.656	0.000	Supported
H5b: LInter -> EEng	0.331	0.07	5.501	0.000	Supported
H5c: LInter -> CEng	0.186	0.061	2.619	0.009	Supported
H6: PLE -> Student Score	0.963	1.46	15.157	0.000	Supported

Table 5: Mediation Results

Relationship	Direct without Mediator	Direct with Mediator	Comments
H7a: ISE -> BEng -> PLE	0.418 (.001)	0.164(0.02)	Partial Mediation
H7b: ISE -> EEng -> PLE	0.418 (.001)	0.192(0.015)	Partial Mediation
H7c: ISE -> CEng -> PLE	0.418 (.001)	0.136(0.026)	Partial Mediation

Figures

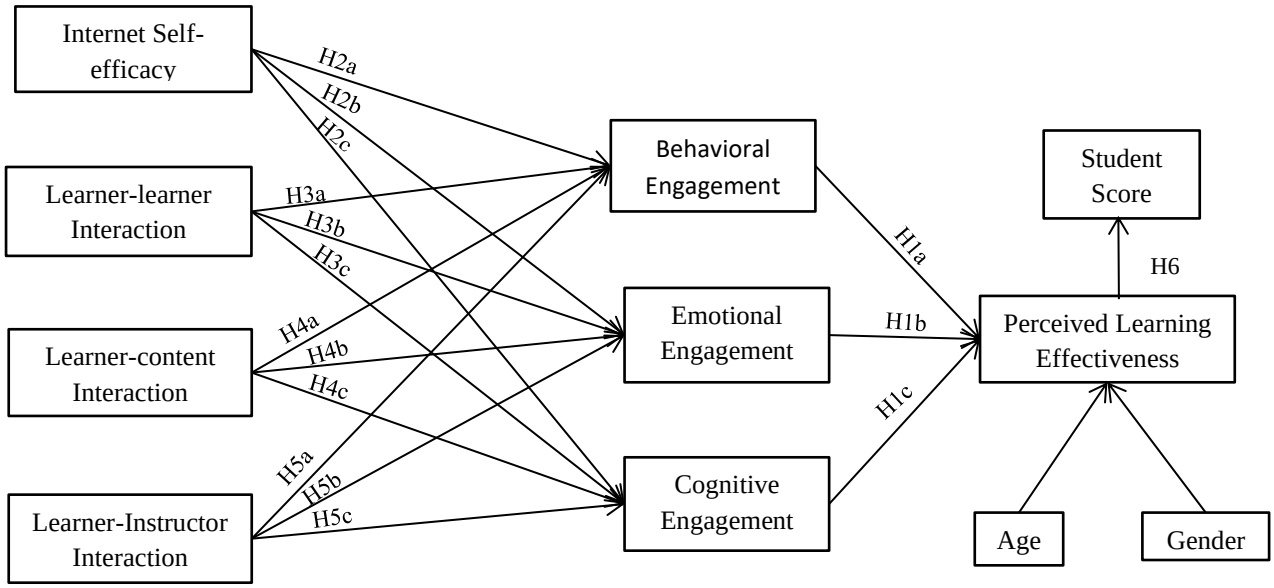

Figure 1: Conceptual Model for Blended Learning Effectiveness

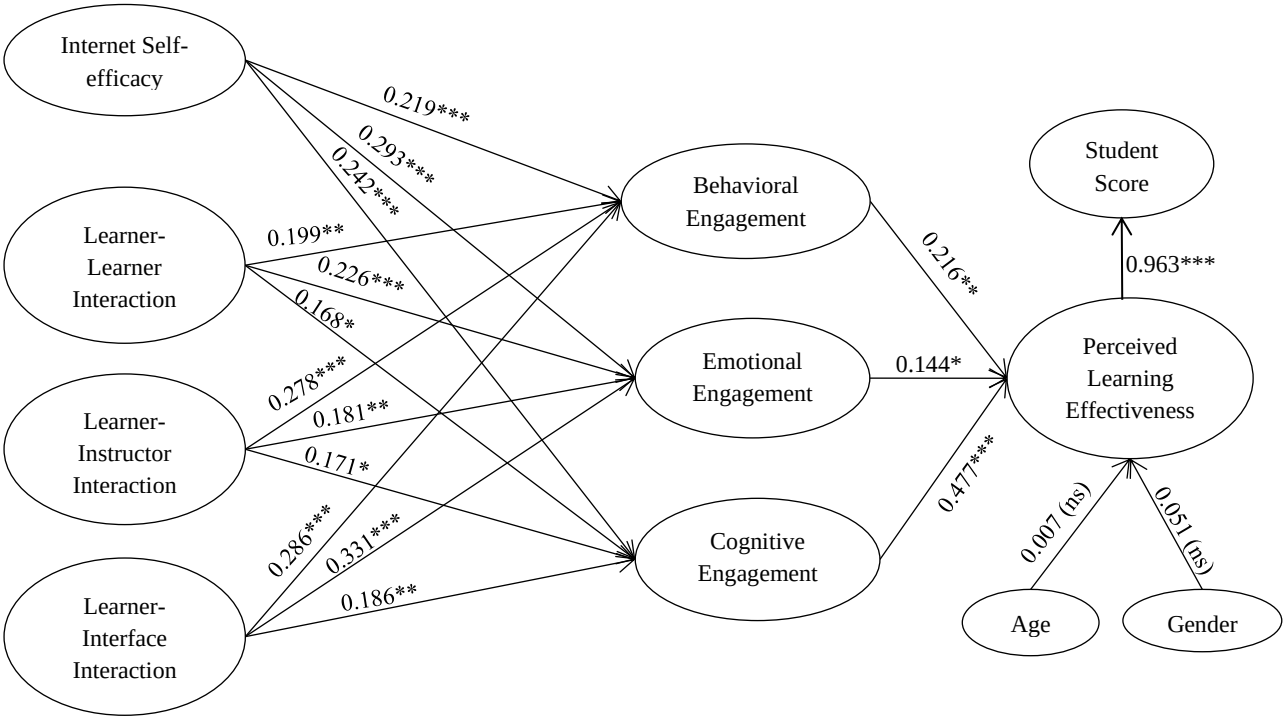

Figure 2: Path analysis with standardized estimates. *** p<.001, ** p< .01, and * p<.05