

# The Effectiveness of Blended Learning Approach with Student's Perceptions in Control Systems Engineering Course

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**Abstract**—This paper presents student's perception and the effectiveness of blended learning in the control system engineering course. A sample size of 64 engineering students was selected to participate in this research works as a part of the third year engineering programme. Instead of a common face-to-face learning delivery approach, a blended learning approach is used in the evaluation process. Students responded to Likert-type surveys using the research instrument where the questionnaire that utilized to collect the research data contained three sections. Section one is conducted to identify general student's demographic such as age, highest academic qualification and gender while section two consists of evaluation of the experiential data such internet experience, student technology access and proficiency status as factors that may influence student's behavior. Finally, section three in the instrument is performed to evaluate the student's perception with blended learning that measured using the questionnaire item. Students expressed their response regarding the instrument item on a five-point scale from "Strongly Disagree" to "Strongly Agree". Then, the effectiveness of blended learning in the engineering course in

comparison with the traditional teaching approach is assessed with the ultimate goal of this approach is to develop and promote critical thinking where students will be able to learn through meaningful activities. The results of this research works support the expectation that blended learning approach offers meaningful learning and effective towards improving the student's performance. As conclusion, the study showed that blended learning might potentially increase student's motivation leading to better performance in the engineering education.

**Keywords**—Blended Learning Approach; Student's Perceptions; Control Systems Engineering Course

## I. INTRODUCTION

IN the recent decades, the advancement of new technology has bringing significant changes to the progress of current education environment. E-learning is evolving as the new paradigm in the 21st century education where the rapid growth of various e-learning platforms and approaches have taken place especially in the higher education institutions. The e-learning platforms are mainly used to support the delivery of both traditional and online learning, considering the time spent

and the distant constraints [1]. These platforms also arise as a result of intensive competition between the higher education provider in the manners of offering the prospect to the student and fulfill their educational need [2].

In the past years, a learning approach so called a blended mode of learning or known as blended learning also has greatly evolved with the spreads of the information and communication technologies (ICT). The rapid growth of ICT has significantly transformed the way the educator delivers the teaching materials and offers through various communication online platform in order to enhance the student learning environments [3]. This innovative teaching and learning approach which is blended learning is also rapidly evolving in education for engineering field. Furthermore, this innovative approach of teaching delivery is utilized and implemented in engineering curriculum design. This learning approach has effectively combines the traditional face-to-face learning with online learning and has been widely incorporated in the curriculum design. This learning approach changes how the students gain knowledge throughout of their study by using interactive references such digital books, mobile computing devices, global online classroom due to the rise of the World Wide Web.

Blended learning has been introduced in the late 1990's by various higher institutions as a new practice of online learning in the education process [4]. This delivery approach is known as hybrid approach where the learning process is conducted through conventional method through face-to-face and online learning. It is different from the complete face-to-face contact as this innovative approach possess some advantages of fully online courses [5]. Blended learning is thus an innovative delivery technique to the designated courses which will benefits the students and offering flexibility of fully online courses in which the students can learn in different times and places. Blended learning approach is also known as innovative delivery method and it is distinct from the traditional classroom. Through this method, with several guided instructions and the flexibility to control over time, place and path through the student's own pace, the online learning is partially delivered to student.

With the tremendous increment in the number of students particularly for distance learning in higher education, blended learning is commencing to become a viable means of delivery approach in higher education institutions in the world. In this approach, the online delivery component becomes supporting learning activities of traditional face-to-face learning in the classroom. Blended learning approach is discovered to be potentially more effective educational experience rather than traditional face-to-face or fully online learning that the higher institution can offer [5]. Apart from that, a stronger sense of community is generated among learners through blended learning approach. It is identified that the six reasons which are cost effectiveness, access to knowledge, pedagogical richness, personal agency, ease of revision and social interaction become why an educator and learner pick the blended learning approach over other learning techniques.

One of the promising innovative learning technique and simplest way to get involved with blended learning approach is incorporated a "flipped" instructional design method. The idea of flipped classroom is transformed the traditional delivery of the lecture in classroom can be done at home before the class session and all the activities is normally being done at home such assignments can be conducted in classroom. For the higher institution to utilize the advantages of blended learning through flipped classroom, there must be an intensive idea to engage the students to obtain the benefits of face-to-face delivery and online learning [6]. The flipped classroom as part of e-learning is a learning process and the crucial point for implementing the essential idea of making learning personalized and time utilization. However, the lecturer should consider different ideas of blended learning by identifying each student's needs to avoid misperception and degrades the effectiveness of flipped classroom. Blended learning approach through flipped classroom approach aims to encourage students to become more enthusiastically engaged in a topic learning that is sufficiently proximal to their experiences and understanding to facilitate more rapid conceptualization of the problem.

In today educational institution, student's perception regarding the effectiveness of the

blended learning is one of the crucial research studies in higher education. It is an important indicator in the assessment of this learning approach. There are different factors such being connected with technology or interaction among the students that influencing the effectiveness of the e-learning. A comprehensive program content is essential as a criterion in a successful e-learning system, which is well designed and can be accessed easily in order to allow massive students involvement in the online learning environment [7]. The benefits of the e-learning cannot be fully exploited if the students are denied to use this program [8]. Furthermore, although the development of ICT can be considered as a global technology, the efficiency of e-learning tools should be measured locally as users generally work in local contexts. When the students are offered with the same e-learning platform, not every student has a same perception in the specific aspect of work in the teaching delivery and a general impression regarding the blended learning. Thus, it is crucial to observe the effect on the variations between academic background, ICT competencies and genders. These factors should not be neglected when implementing the blended learning approach.

One of the crucial aspect is that some of educator does not felt the blended learning approach is functional enough and stable for engineering course, particularly for the content and the project completion. Another point of view is the act of teaching and learning in engineering is required more than online assessment and individual study. Engineering course consists of lecture delivery, project development, hands-on activities, simulation and experimental works. As an alternative medium and opportunity to reconstruct and studying how the courses are scheduled, developed and delivered via the combination of virtual and physical instruction, it is suggested that the blended learning should be taking into consideration [9].

Besides that, there are lack study about the on effectiveness and perception of blended learning particularly in the engineering curriculum [10]. The evolution

of the engineering field and technology also constitutes it imperative to investigate blended learning with the current technology. One of the first studies in the engineering field regarding blended learning showed that the majority of the learners accepted the online component of the course as a valuable resource [11].

Thus, this paper aims to obtain the perception of the engineering students regarding blended learning in the third year electrical engineering curriculum after experience the online activities and face-to-face delivery. Then, the effectiveness of blended learning in the third year engineering curriculum in comparison with the traditional teaching approach will be assessed with the ultimate goal of this approach is to develop and promote critical thinking and students able to learn through meaningful activities.

## II. METHODOLOGY

In this research study, the targeted populations are mainly classified on the undergraduate learners from Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka in the sixth semester of the academic year 2018/2019 who are enrolled for a compulsory engineering course. The control systems engineering course is one of Bachelor in Electrical Engineering compulsory courses in the academic curriculum. Fig. 1 shows the learning management system using Moodle platform that utilized to conduct the blended learning approach in this research works.

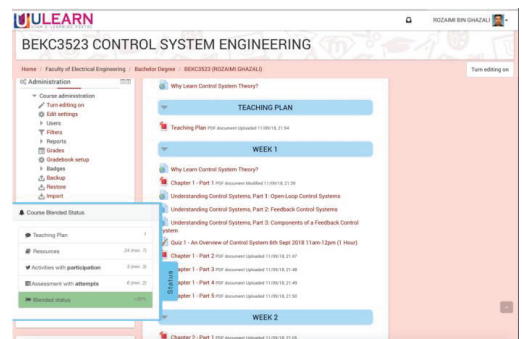


Fig. 1. Learning Management System for Blended Learning Approach

The data of the research will be collected using questionnaire. The questionnaire will be started with simple instruction that summarized with the interpretation of the study and the direction of how it can be done. The instrument contained three sections where section one will be used to identify general student’s demographic such as age, highest academic qualification and gender. Section two consists of evaluation of the experiential data such internet experience, student technology access and proficiency status that may be the factors which influencing learner’s perception. Finally, the measurement using the satisfaction questionnaire will be used to evaluate the student’s satisfaction with the blended learning. Students expressed their opinions regarding the statements on a five-point scale from “totally disagree” (value 1) to “totally agree” (value 5) [12]. The summary of the section, description and items in the questionnaire is tabulated in Table I.

TABLE I. SUMMARY OF THE DESCRIPTION AND ITEM IN THE QUESTIONNAIRE

Section	Description	Items
1	Identify general student’s demographic	Age, highest academic qualification and gender
2	Evaluation of the experiential data	Internet experience, student technology access and proficiency
3	Measurement using the satisfaction questionnaire	Opinions regarding the statements with a five-point scale

The questionnaire was intended to gain evidence of their perceptions about blended learning, particularly factors related to flipped classroom approach such as online materials before class and in-class critical reflective discussion. The students generally will have at least almost a week before the face-to-face class to access through the online materials at their own pace at anytime and anywhere. These students experienced a blended learning approach on the university’s learning management system platform that containing on-line learning activities on several topics.

### III. RESULTS AND DISCUSSION

A sample size of 64 engineering students was selected to participate in this research works to evaluate the blended learning approach in comparison conventional approach of face-to-face content delivery. Students who selected are responded to Likert-type surveys and completed content assessments. In the conducted survey, none of the students were absent or unavailable which smoothing the surveying process. As a consequence, the number of subjects that were planned to participate in the study were fully involved. Due to that reasons, the response rate was 100%. Tables II and III describe all the demographic factors that have been used in the survey.

TABLE II. SURVEY RESPONDENTS DEMOGRAPHIC ON GENDER, AGE AND HIGHEST ACADEMIC QUALIFICATION

Factors	Item	No. of Respondents	Percentage
Gender	Male	38	59.38%
	Female	26	40.63%
Age	21	29	45.31%
	22	28	43.75%
	23	6	9.38%
	24	1	1.56%
Highest Academic Qualification	Diploma	22	34.38%
	Matriculation/ Foundation	37	57.81%
	STPM	5	7.81%

TABLE III. SURVEY RESPONDENTS DEMOGRAPHIC ON INTERNET EXPERIENCE, STUDENT TECHNOLOGY ACCESS AND PROFICIENCY STATUS

Factors	Item	No. of Respondents	Percentage
Electronic Devices	1	1	1.56%
	2	51	79.69%
	3	11	17.19%
	More than 3	1	1.56%
Social Media Account	1	6	9.38%
	2	12	18.75%
	3	18	28.13%
	More than 3	28	43.75%
Messaging Apps	1	17	26.56%
	2	37	57.81%
	3	7	10.94%
	More than 3	3	4.69%

In second section, the satisfaction and perception of the participants to the blended learning, the readiness of flipped classroom

activities designed for blended learning will be evaluated. These criteria are implemented for the evaluation of the engagement and the learning of the course for third year undergraduate student. The result shows that most of the students own at least two electronics devices that able to connect to the online learning materials. Most of students also is observed will have at least three social media accounts such Facebook, Instagram and Twitter to be connected with their friend and social experiences while at least two Messaging Apps will be actively used by the students such WhatsApp and Telegram. These finding shows that the internet experience, student technology access and proficiency status may be the main factors that may influence learners' perception in blended learning activities.

In section three of the instrument, the perception survey is prepared that consists of ten statements as tabulated in Table IV describing the blended learning classroom of the corresponding course. The statements were divided into two parts, which are the designed learning activities from the educators to the students regarding the use of collaborative learning applications in blended course, and also the assessment to the students either they are perceived or not the value of these digital tools.

Based on Likert survey data and questionnaire responses as shown is Fig. 2, the participants in the blended learning conveyed tends to agree and give very positive opinions including good perceptions of the learning process, support of active learning, self-regulated and potential advantages of learning environment to use in engineering education. For the control system engineering course that consist of 64 engineering students, mean and standard deviation for the Likert general items that related to the blended learning are tabulated in Table IV.

Based on the findings, the students tend to agree with the benefits of blended learning approach in the curriculum design. Combining the flipped classroom environment that implemented in this study is considered as a self-directed learning where the students able to

view the teaching materials before the face-to-face class discussions. This approach also shows it may increase the intrinsic motivation for a particular topic or task by trying to make it more interesting. This social enhancement aspect highlighted the positive role of collaborative methods in learning.

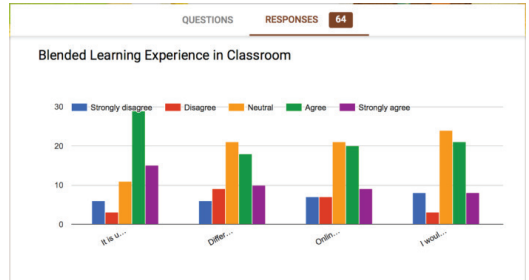


Fig. 2. Survey on Blended Learning Experience in Classroom

TABLE IV. STUDENT PERCEPTION ITEM SURVEY SUMMARY

No.	Item	Mean	SD
1.	It is useful to have online access to the lecture materials (such presentation slide, handout, work instruction, lab sheet) before the class.	3.70	1.16
2.	Different types of interaction in learning such as face-to-face learning with online teaching materials increase student's motivation.	3.28	1.17
3.	Online instructional videos (such solution to the problems/examples, theoretical explanation) help the students to better understand the teaching content.	3.26	1.17
4.	I would like to have more opportunity to choose a specific part of the topic delivered and to access more information while learning through online platform.	3.28	1.14
5.	Face-to-face sessions are more meaningful if the lecturer include discussion following with online learning experiences.	3.57	1.30
6.	Blended learning through flipped classroom enables a student to become more involved and increase participation in the learning process.	3.25	1.16
7.	Information from the classroom through documents in the web, e.g. video and simulation will result in a good understanding of the teaching material.	3.37	1.16
8.	I prefer asking questions I have about the topic being taught in classroom using an online platform (such Social Media or Social Messaging Apps, LMS) rather than in face-to-face classroom discussion.	2.84	1.27
9.	The lecturer created a successful environment that was conducive to learning.	3.28	1.14
10.	The lecturer effectively presented tools such as teaching materials, technical skills, and teaching delivery techniques needed.	3.42	1.17

#### IV. CONCLUSION

The purpose of this study was to evaluate the effectiveness and the benefits of a blended learning approach applied in engineering education. By using a “Flipped classroom” format, the content was delivered and presented online. Even though this is not the only way to organize a flipped classroom, and various prior online learning experiences have been used, including various online experiences on top of instructional on-line video in the learning management system. This “Flipped classroom” format allow the in-person class session to be dedicated for the elaboration of the course’s content, which is also utilized for the student’s reflection and discussion.

Some additional insights on the blended learning in the field of engineering education were included in the study. By incorporating a personalized, a mastery-based, and a meaningful learning, the students will be more engaged that consequently lead to more effective and longer lasting learning experiences in the professional content. As conclusion, the study showed that blended learning might potentially increase student’s motivation that leading to a better performance in the engineering education and the sciences more broadly.

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