DESIGN OF THE BLENDED LEARNING COURSE IN ENGINEERING EDUCATION

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Abstract - Blended Learning is a flexible learning model that combines the creative advances and technology of online learning with the interaction and engagement of face-to-face learning. One of the best ways to deal with the need for "learning anywhere, learning anytime, learning everything, learning flexibly, learning openly and learning for the whole life", which becomes an inevitable trend currently. This requires teachers to design a course and organize the teaching process to assure the formation and development of learners' self-learning ability as well as the cultivation of the skills in using and mastering technology. The paper outlines the theoretical model and steps to be taken to design a blended learning course to help teachers in the course design suitable for their teaching process at university meeting the fourth industrial revolution.

Key words - Blended learning model; course design; industrial revolution 4.0; development of students' capacity; online learning

1. Introduction

The 4th industrial revolution with the development of robot technology has had an impact on many areas including education. In the context of this ever-changing world, it is impossible to keep the old way of teaching and learning. However, Vietnam is facing the risk of being left behind if it does not meet the resources to integrate itself into technology rotation. According to the Ministry of Education and Training, the quality of human resources, especially high-quality human resources, has not met the requirements of the country's development. The main reason is that the quality of training is not high, nor career-oriented and internationalized, leading to the lack of working skills, and the partnership between enterprises and training institutions is weak... The draft on stratification by the Ministry Education and training defines: Research – oriented curricula are highly specialized, attaching importance to basic theory and principles of source technologies as a foundation, whereas application – oriented curricula focuses on equipping learners with the ability to develop the achievements of basic science, turn source technologies into technological solutions to create processes of managing and designing complete tools. Education in revolution 4.0 requires a smart education model, primarily interlinking schools - managers - entrepreneurs, enabling innovation, creativity and productivity in knowledge - based society-one of the smart education models helps engineering education in the current period to encourage learners to be able to "study anywhere, anytime, anything flexibly, openly and for a long-life duration". To this end, in an environment of a training institution, applying a model to training flexibly is an urgent issue. This article presents the steps to develop a plan and process of designing a Blended learning course to help teachers to design the course smoothly in the teaching process at the university to meet the fourth industrial revolution. There are many Advantages to the Blended learning model for students:

Increasing student interest: Students also find it difficult to maintain concentration in the traditional lecture context, which focuses primarily on transmission of knowledge with limited student interaction [1].

Keeping students focused for longer: Focusing for a moment on the properties of the Internet, we know that much of the satisfaction and success of blended learning experiences can be attributed to the interactive capabilities of Internet communication technology [2].

Providing student autonomy: Autonomy in learning involves learners taking more control of their learning, in and out of their classrooms [3]. The use of eLearning materials increases a student’s ability to set appropriate learning goals and take charge of his or her own learning, which develops an ability that will be translatable across all subjects.

Instilling a disposition of self-advocacy: For students to become strong self-advocates, they must be able to reflect and self-assess. This self-reflection also encourages students to recognize in which scenarios they will need to stretch their self-advocacy muscle by asking for assistance.

Instilling a disposition of self-advocacy: Students become self-driven and responsible, tracking their individual achievements, which helps develop the ability to find the resources or get the help they need, self-advocating so they can reach their goals.

Allowing instant diagnostic information and student feedback: The ability to rapidly analyze, review and give feedback to student work, gives the teacher the ability to stretch their self-advocacy muscle by asking for assistance.

Enabling students to learn at their own pace: Blended learning is an instructional approach that combines online and face-to-face instructional activities [4], to create more flexible modes of education, and personalized learning trajectories [5].

Preparing students for the future: MOOCs will serve as virtual mentors for every learner, and provide omnipresent support that integrates user modelling, social simulation, and knowledge representation. This will allow them to function as personalised “tutors”. Computer software is already able to provide customised lessons to learners [6].

Blended learning offers a multitude of real-world skills, that directly translate into life skills, from: Research skills, Self-learning, Self-engagement, Developing critical thinking, Better decision making. Offering a larger sense of responsibility, Computer literacy.

2. Contents

2.1. Definitions of Blended learning

In other words, blended learning, if approached, is not only a construction of time, but a fundamental redesign of the learning model with the change from "teacher centered
learning” to “learner-centered learning,” in which learners become active and interact with learners.

This encourages the interactions between students and lecturers, students and students, students and contents, and students and external sources. How this blend has to occur, remains vague. Some authors describe the blend on the basis of percentages [7], [8], [9]. There are different definitions of this model, as follows:

According to Kaye Thorne [10], “Blended learning is the integration of technology advancements into online learning combined with the interactive participation of face-to-face learning”.

According to Graham, C. R. [11], “Blended learning is the integration of the face - to – face learning in the classroom (speech) and the internet”. This is an optimal approach to enhance and expand learning by reviewing and transforming the structure between teaching and learning to create effective blended learning.

According to Littlejohn & Pegler [12], “Blended learning is a combination of face-to-face learning with online learning under the support of the media”.

Definitions might cover any instructional technology at all, or restrict themselves to web-based technology; they might not mention technology specifically, but instead focus on blending different theoretical approaches.

According to Graham, C. R. [13], “Blended learning provided by the effective combination of different distribution modes, teaching models and learning styles are implemented in an interactive learning environment”. Courses combine online learning activities and face-to-face classes flexibly and use resources optimally to improve students' learning outcomes and to solve lesson-related problems.

The research found evidence that teachers delivering Blended Learning courses are not reflecting on the different characteristics of the online delivery, rather they focus on transposing what they teach face-to-face to the institutional Learning Management Systems [14].

According to Mungenyi Justice Kintu, Chang Zhu, Edmond Kagambe [15]. For Staker and Horn, blended learning is “a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home”.

2.2. Designing a blended learning course in engineering education at university

The real importance and significance in blended learning lies in its potential. If we forget the title and focus on the process, blended learning represents a real opportunity to create learning experiences that can provide the right learning at the right time and in the right place for each and every individual, not just at work, but in schools, universities and even at home. Designing blended solutions means much more than just identifying the learning need and commissioning a provider to create a solution. The most meaningful solutions will be created by those who really explore the full potential of how people learn and work with creativity and imagination to provide rich and stimulating learning experiences. One of the key stages in achieving this is to explore the creative process. Research shows that absence of learner interaction causes failure and eventual drop-out in online courses [16], [17], [18], [19], [20] and the lack of learner connectedness was noted as an internal factor leading to learner drop-out in online courses [21]. Tsoulos, Daskalakis, and Papadopoulou [22] investigated learner perceptions after a learning management system use and found out that the actual system use determines the usefulness among users. According to Goyal & Tambe [23] noted that learners showed an appreciation to Moodle’s contribution in their learning. According to the studies by Dziban, Hartman & Moskal [24], Mungenyi Justice Kintu, Chang Zhu & Edmond Kagambe [14]. Blended learning is considered an effective pedagogical approach and the opportunity for socialization of the classroom with the proactive learning capabilities of the online environment.

Making a plan for the design of a blended learning course

If the ultimate goal of teaching is to help learners achieve a higher level of learning and maturity towards training goals, planning in the teaching process involves two main things: Create a comprehensive support plan for learners to achieve the objectives of the course; (2) Assist learners in creating a viable learning plan to achieve their own goals within the framework of the course offered. In general, in order to implement an effective blended learning course, teachers need to develop a detailed plan based on the collection of important information related to the course. The necessary matters are as follows:

![Figure 1. 4-step diagram of planning the design of the blended learning course](image)

Learning objectives: learning objectives (sometimes called outcomes) are specific statements that describe what a student can prove as a result of learning in a lesson or a module. This is often in the form of knowledge, skills or attitudes and abilities. Lecturers can use Bloom's taxonomy to evaluate the achieved objectives.

Learning outcome standard: includes the criteria that a student needs to achieve after studying a subject.

For example, after finishing a subject/module, what students need to achieve: in terms of knowledge, in terms of skills, in terms of attitude or abilities including problem solving, cooperation in groupwork, ICT, creativity …

Determining the evaluation method to measure each goal, each learning outcome standard

In this step, it is necessary to consider how to evaluate
students with the skills, knowledge or attitudes needed to complete the course, which are directly linked to the learning outcomes from step 1. The nature of the assessment depends on the depth of knowledge or skills that each lesson needs to set out. When requirements such as assignments (individual work, groupwork, projects...) are put in place, assessment for measuring each goal can be an effective way for learning measurement. However, students must use higher-order thinking skills to analyze and evaluate, and real-world problems and scenarios are more appropriate for example, the assessment activities include: Tasks and problem solving scenarios, models and diagrams, essays, project research reports, videos,…

**Planning and organizing all learning activities**

Learning activities include any course activities that students must complete to help them achieve the goals and objectives of the course, including: completing individual assignments or groupwork, reading, and attending observing lectures, watching other videos, participating in online discussion forums, joining projects, participating in group activities in class or activities outside class.

**Determining the sequence and environment for each activity**

The final step of the planning process is to put all the parts together and map out what the course will do. To make a completed plan for the blended learning course, take the following steps:

**Step 1:** Group all learning activities and assess them by module or week and determine the sequence of each activity in each module/week.

**Step 2:** Determine the environment for each activity and assessment (ie. online or face-to-face). If any activity is online, make note of the tool that will be used for the activity and develop tools for online teaching or evaluation (eg. recording lectures, entering exercise questions into LMS, create student groups in LMS, etc.).

2.3. **Design Procedure**

The blended learning design incorporating a focus on the knowledge and learning activities was proposed by Huang. J [25], Dhanya Krishnan [26] and has been adapted for this study. It includes 3 stages: (1) preparation, (2) design activities and resources, (3) evaluation.

**Stage 1: Preparation**

A number of observations and analyses have been conducted to determine whether blended learning can be used, to what extent and in which environment its use enables the combination of online learning and face-to-face learning to be suitable. This stage mainly consists of analysis of the curricula, the institution's environmental characteristics, determination of the basic conditions of infrastructure and learners’ characteristics (such as learning preferences and learning styles). The module syllabus (subject) is analyzed to understand the scope of the implementation of a reasonable learning strategy. Students’ characteristics in the class including their views on online learning are collected and analyzed. This aims to determine the students’ learning capacity and learning styles to create favourable conditions for learning organization. An analysis report is made based on the analyses. The preparation stage is divided into 3 contents to be analyzed (see Figure 2):

**Analyzing the objectives and Learning outcome standards needed for the course (knowledge)**

The analysis of objectives and learning outcome standards needed to be achieved after the course helps teachers to mark the process from the starting point to the end point. Based on the objectives, lecturers can choose the proper teaching method and techniques. With the objectives and learning outcome standards, lecturers can encourage students to shape what to do or what actions students are able to do after gaining the knowledge at the end of the course, and lecturers can rely on the objectives to find an appropriate evaluation method or strategy. Analyzing a module syllabus (subject) for a course helps to solve the problems including the design of lesson scripts for E-learning, how many videos and audio scenarios are needed for online learning, the test scripts, how many hours of online interaction in real-time virtual space.

**Analyzing the blended learning environment**

The learning environment is one of the factors constituting the structure of learning activities, directly influencing the quality and effectiveness of teaching and learning. From the approach of interactive teaching, the learning environment includes specific and diverse conditions created and organized by teachers for learners to adapt based on the right and appropriate choices meeting the requirements for learners to achieve the objective of the teaching task. Environmental analysis plays an important role in teaching organization. Lecturers analyze the favorable and difficult conditions of the learning environment such as the inner environment (intellectual potential, emotions, values, experience, learning styles and teaching styles, personality...) and the external environment (teachers, learners, natural environment, society, the space surrounding the classroom...), thereby making improvement and adjustment plans to help students to be interested in learning and develop creativity in different conditions. In the blended learning environment, lecturers need to analyze and select the ratio of the combination of online learning and traditional learning in a way that is proper for the subject/module to be taught.

**Analysis results:** After analyzing the three steps in the preparation stage, lecturers create a profile and consider it a report that is required for the design of the next activities and learning materials.

**The overall design of blended learning**

**Learning syllabus:** a learning syllabus is a detailed description, fully and clearly presenting the subject/module information such as objectives, learning outcome standards, and teaching contents, teaching methods, methods of evaluation, time distribution according to the number of credits / units of study, teaching means and materials, assessment methods, plans for online learning, traditional learning with detailed contents, practice plan with detailed schedules and evaluation criteria as well.
**Learning activities**: It is important and necessary for lecturers to design learning activities which enable students to develop their abilities.

The importance of class activities lies in their effectiveness in achieving learning outcomes, creating a more collaborative environment, and enhancing students’ learning in a more realistic way. Achieving this, students will benefit the most if the online contents they experience previously are clearly planned with activities in face-to-face sessions.

Online contents provide students with self-orientation, which means students can experience the contents themselves. Information is collected by including modules or performing activities through multi-dimensional interaction or assignments. When students come to class, it is the best that they apply the acquired knowledge to learn effectively.

**Teaching strategy**: The teaching plan is managed by semester and academic year through the whole course plan and students’ learning plan by semester. Lecturers make teaching plans, implement positive teaching methods depending on the requirements of the subject and actual conditions, combining theory and practice. The teaching methods are all aimed at activating students’ learning
process. For a subject / module, a lecturer needs to develop a specific teaching plan or strategy for the module that combines traditional learning and online teaching in the most flexible way, and adopts a proper assessment method in traditional learning and online teaching. Besides, it is necessary to organize effective teaching activities and promote students’ active spirit and creativity throughout the teaching process.

**Learning support strategy:** Strategies to support learning in blended learning enables students to answer questions in the course of online or face-to-face learning, and encourages learners to feel confident in using technology and be aware of the "social" aspects of collaboration and communication in the online environment as in a traditional classroom. It is necessary for lecturers and technical support staff or teaching assistants to support students continuously in class and outside class, which strengthens the communication between, lecturers and technical staff. The positive effect of continuous and real-time support can be represented by online chat, phone calls, and face-to-face dialogues, adding an important and essential value for learning experience, results and performance [27].

**Overall design results:** After the overall design is complete, this is enough to prepare for the design of such details: Designing teaching and learning activities, designing and developing learning materials or teaching contents (electronic learning materials, digital materials, printing materials, books, magazines...).

**Designing activities**

Blended learning activities are also designed for traditional learning and online learning with three contents: (1) Learning activities; (2) Teaching activities; (3) Evaluation activities. In blended learning, teaching activities are not only conceived of as a process of transmitting knowledge and social experience as previously but also through the network environment connected by the system of computers and means for individual support. The process of "connecting" subjects and components of the teaching process will be ensured to realize the teaching goals.

**Design and development of learning materials and online learning and content management system**

Designing lectures, developing contents and learning materials: Developing electronic content archives, e-learning lectures: Digital learning material archives including: syllabi, textbooks, references, testing papers, presentations, the digitized data sheets, audio files, images, videos, electronic lectures, virtualization experiments... to serve the learners’ needs for learning and research. E-learning materials must include contents adhering to the training objectives, being highly pedagogical and easy to use, meeting the students’ needs. Course materials must be fully prepared before the course is organized.

Results of designing activities and learning materials: Results of designing activities and learning materials and LMS and LCMS contents. Lecturers make a plan to assess whether the learning process and the design are appropriate, whether the activities designed meet students’ learning styles and LO standards or objectives and assess the whole course to see if it is proper. If any stage is not suitable, it needs adjustment.

**Stage 3: Evaluation and adjustment strategy**

After the design, no matter how good the design is, it is essential to review or re-evaluate the model to see what changes or adjustments need to be made. Thus, in this stage, a lecturer needs to consider solutions and effectiveness to be ready for a blended learning course. If the lecturer is not ready, it is necessary to review stages of “making a plan” and “designing and developing activities and learning materials”. If the lecturer is ready, it is necessary to prepare information for students to participate in the course such as: how to register for the course on the system (instructions for using the system), the teaching plan for the Blended learning model (online learning days, traditional classroom days, online learning days with real time...). In order for learners to be ready for the course and to create motivation for them to take part in the course experiences, the stage includes 2 forms of assessment: (1) - Assessing the learning process, (2) - Assessing the organization of activities.

3. Conclusion

In planning to design and implement blended learning, we are mindful of the implications raised by this study which is a planning evaluation research for the design and eventual implementation of blended learning. Universities should be mindful of the interplay between the learner characteristics, design features and learning outcomes which are indicators of blended learning effectiveness. From this research, learners manifest high potential to take on blended learning more especially in regard to learner self-regulation exhibited. The design of a blended learning course with a specific plan and specific process will enable teachers to organize their teaching process actively in face-to-face learning and online learning. However, even during the course construction and preparation, instant evaluation is also important for course quality management and design revision (initial evaluation). After conducting the first trial course, it is necessary to check the quality and effectiveness of the course (summative assessment). This check should be implemented regularly for additional updates towards the changes depending on conditions (authentic evaluation). The course needs to be evaluated based on information channels: lecturers’self-assessment [28], experts’ assessment and learners’ feedback. On that basis, modifications and supplements are made to have a better course.

However, to be successful, in addition to the careful preparation of lecturers and the readiness of students, it is necessary to take into consideration other elements such as the design of the model suitable for students and the design and content of LMS/LCMS, design of lessons, material sources and effective specific schedule for online learning and face-to-face learning. Last but not least, it is lecturers’ experimentation on research which will be presented in the next article.
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