

Towards a Design Theory of Blended Learning Curriculum

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Abstract. The purpose of this article is to develop a design theory of blended learning curriculum in ways of establishing a model for designing such a curriculum and a model for designing an activity in a blended learning curriculum as well as demonstrating how these models can be utilized in a curriculum design. It first attempts to define what the essence of blended learning is by drawing on definitions of previous studies. Then, it goes on to identify the characteristics and rationales of blended learning. Finally, it exemplifies the devised BLC activity model, which is supported by the BLC design model and the BLC process model.

Keywords: Blended Learning, Blended Learning Curriculum (BLC), BLC Design Model, BLC Activity Model, BLC Process Model.

1 Introduction

Blended learning is not a new concept [6, 13]. It originates from corporate training and development in the U.S.A. and is believed to have made its first appearance in the late 1990s [3]. Blended learning has become a buzzword and has grown increasingly in demand and popularity in both corporate and academic settings. It has been broadly researched across the globe in the educational circle over the past couples of years. However, the term of blended learning has been defined differently since its birth and its meaning has been changing with time [12]. Many define it as a combination of two pedagogical approaches [3, 5, 6, 16], in our view, with their focus merely on the superficial level while few have had it defined like Singh & Reed [14] do as “optimizing achievement of learning objectives by applying the [‘right’] learning technologies to match the [‘right’] personal learning style to transfer the [‘right’] skills to the [‘right’] person at the [‘right’] time” (p. 2), which we believe goes beyond the superficial form and penetrates the essence of blended learning.

In blended learning design, “five key ingredients” are known to be involved in a

blended learning process [2]. However, when we design a blended learning curriculum, we still have no clue to the way how such design can be produced. As blended learning has been practiced across various disciplines at various levels of educational institutions and in various part of the globe, little has been done in establishing a theoretical framework which is used to guide blended learning curriculum design and believed to be highly desirable to ensure effective blended learning. This paper attempts to make just such an endeavor, with the hope of laying a theoretical foundation for blended learning curriculum design.

2 Characteristics of Blended Learning

Blended learning takes many forms. In general, it has three characteristics. The first one is flexibility of providing learning resources. Blended learning is treated as an instructional strategy, which is developed in a networked environment. Such a strategy is usually supported by virtual learning environments (VLEs), which are a computer-based standardized learning system and are used to sustain content delivery of online learning as well as to promote online communication between an instructor and learners [7]. Studies [1, 8, 15] show that, with the medium of VLEs, the three most common uses in blended learning are providing course information, supplementing on-campus studies as well as accessing Internet resources. It can help diversify the provision of learning resources through BBS, E-mail, and other functions.

The second is support of learning diversity. As learners are diverse in terms of learning styles, learning proficiency, as well as learning ability, blended learning can come to the rescue by making it possible for individualized learning and self-regulated learning to happen. Teachers can use combined approaches to cater for the needs of the diverse student body and to create an opportunity to make everyone's learning an equally successful experience.

The third is enrichment of e-learning experience on campus. From the faculty's perspective, blended learning can enable them to improve their existing teaching practices. For example, we used to ask students to submit their weekly assignments by the paper, but now we ask them to submit their work by email and then we evaluate their performance by e-Portfolios. One more specific example, we used to teach students with the typically teacher-centered approach, but now individualized learning is no longer a rarely seen phenomenon. Learning systems also help teachers to reduce the burden of calculating the marks of the papers, for the systems can do the whole trick automatically. From the learners' perspective, learning has become rights of their own, which they can make own decisions on what they do each day and what they are going to achieve by certain deadlines for the same goal and how they are going to achieve them. Moreover, learning anytime and anywhere has become a reality. From the administrators' perspective, tons of paper work has been replaced by limited e-work. Educational administration brought about by blended learning has become as easy as mouse-clicking.

3 Rationales of Blended Learning

3.1 Theoretical Rationales of Blended Learning

Blended learning does not come out of nothing but has a solid theoretical foundation. In addition to the theoretical bases of constructivism and other learning theories, the first principles of instruction, which are advocated by Merrill [9], also give rise to blended learning. According to him, “[l]earning is promoted when learners are engaged in solving real-world problems[,] ... when existing knowledge is activated as a foundation for new knowledge[,] ... demonstrated to the learner[,] ... applied by the learner[,] ... [and] integrated into the learner’s world” (pp. 44-45).

Briefly speaking, effective learning can happen when the learner is given the right task (problem-centered tasks) to accomplish by informing them of the right method (such as activation, demonstration, application, and integration) to use. As the goal of blended learning is to optimize learning outcomes and cost of program delivery, which is indicated by Singh & Reed [14], effective learning can be undoubtedly achieved because blended learning enables effective instruction to come into play as learners are not only presented with real-world problems to solve but also provided with how to solve the problems.

3.1 Educational Rationales of Blended Learning

Blended learning is intended to promote learning in the best manner possible. Before we find out the rationales for blended learning, let’s first take a look at what learning is. Learning has two kinds [17]: One is regarded as “shallow learning,” which is characterized with memorizing while the other, “deep learning,” which is featured with “taking [new] knowledge, understanding it and checking that it fits in with one’s existing knowledge, and incorporating it into one’s present framework of knowledge” (p. XXII). The former simply involves “recall of information”, which is a less effective way of learning. In contrast, the latter involves a process of “digestion” and is therefore referred to as problem-solving learning. Obviously, blended learning is encouraged for the promotion of “deep learning.”

Furthermore, blended learning is embraced for promoting situated learning, which refers to learning in terms of activity and participation in a community of practice. As students observe their peers, reflect what they do, and practice apprenticeship, they develop habits, beliefs, identities, and skills that are shared by the community through interaction. Blended learning enables learners to learn in various ways possible, including problem-based and activity-based learning, such as those mentioned above.

4 Rationales of Blended Learning Design

There are three other fundamental reasons why blended learning design is created.

First, large group teaching requires blended curriculum designs. For example, in China, as larger enrollments were allowed in colleges and universities by China's Ministry of Education, both class sizes and group sizes grew significantly. In order not to sacrifice instructional effectiveness and efficiency, as well as to ensure instructional quality, both higher education administrative staff and faculty had to face the challenging problem and to come up with something that was different from what they did in the past in terms of curriculum design.

Blended learning could be an effective means of enhancing learning by blending traditional classroom learning and online learning. Then, a blended curriculum design is desirable to respond to the situation, which may include designing tasks for dealing with difficult topics, creating extension activities for some learners of the entire learner population; providing additional feedback opportunities, helping students with practical work, encouraging dialog opportunities within small groups, and promoting interactivity in class [11].

Second, blended learning design is needed to engage learners outside of class. Traditionally, learner can only have access to direct teacher support during face-to-face class sessions. Because learners remain little contact with their instructors outside of class, they may find it hard to gain an easy access to faculty for support when they have problems with their academic work. This situation requires that a novel curriculum design be produced to support learners during periods of little faculty and learner contact. For example, Clarke, Lindsay, McKenna, & New [4] provided student support during the period of absence of learner faculty contact by creating sets of multiple choice questions to complement an introductory series of first-year undergraduate management lectures. All these blended course designs can effectively make learners' learning a pleasant experience when making them feel at "home" while away from "home." According to Sharpe [11], these curriculum designs may comprise the following: discussions which are used to guide study, between face-to-face sessions, discussion boards for sharing ideas about course topics of common interest, multiple choice questions to check progress in preparation for exams, and interactive tasks that students can deal with outside of class sessions.

Last, blended learning design is sought after for developing professional skills. Corporate adoption of blended learning design mainly derives from enhancing employees' professional skills and eventually their work efficiency. Likewise, institutions of higher learning are also following that path, namely, to develop professional skills of future professionals, which are needed in the current fiercely competitive job market.

Research [10] shows that the driving force of course redesigning stems from the requirements for use of IT as a competency in some disciplines while Sharpe, Benfield, & Francis (as cited in [12]) reveal that course redesigning is initiated by enhancing learners' skills which are required in the modern business world. Obviously, the latter case is also true in China. For a little while, most Chinese universities are making great efforts to distinguish themselves from their counterparts by gaining an edge over others. These endeavors are made not only by raising higher academic research standards for faculty but also by offering learner unique professional programs with cutting-edge curriculum designs through integrating technology into curriculum. Take a course of international trade practice in a Chinese university for instance. Originally, this course was designed for traditional face-to-face settings.

Students were presented with some fundamental theories and practice. For giving students a better idea about how international trade was performed, and, more importantly, in order to enhance students' practical skills in international trade, the course was redesigned after an online platform for international trade practice and trade processes was brought forth in 2001. Students took the course in two separate locations: classroom and laboratory. The lab instruction engaged students in trade simulations covering wide range of issues, such as product promotion, quotation, offer, counter-offer, negotiation, signing contract, delivery, and so on, and so forth. Apparently, this new design is intended to familiarize learners with business knowledge and practical skills.

5 The Blended Learning Curriculum (BLC) Design

5.1 The BLC Models

Blended learning is now promoted in educational circles worldwide. It is ubiquitous in both corporate and academic settings. However, how to design such a curriculum still remains tricky because there are few models that can be applied to the guidance of such curriculum design.

The following model depicts the design procedures that can be followed when designing a blended learning curriculum (see Fig. 1). The ultimate goal of this model is for instructional implementation. The procedures are made up of three main components: (1) pre-analysis; (2) activity and resource design; and (3) instructional assessment.

Pre-analysis. In order to ascertain whether blended learning could be used, several observations and analyses need to be conducted. These analyses chiefly are composed of three factors: (1) analysis of learner characteristics, in terms of regular assessment of learners' prior knowledge, learning styles, learning preferences, etc.; (2) analysis of learning objects (knowledge taxonomy), in terms of defining what should be taught based on knowledge taxonomy; and (3) analysis of blended learning environments, in terms of finding out the environmental features. The purpose of this component is to identify learners' proficiency level and spell out learning tasks so as to lay a sound foundation for organization of learning activities. The result of this pre-analysis is represented by an analysis report, which is a brief summary of the starting point of instruction based on these analyses.

Design of Activities and Resources. This component consists of three subcomponents, that is, overall design of blended learning, unit (activity) design, as well as resources design and development. The overall design of blended learning predetermines the other two subcomponents in terms of the fact that it sets the tone for what can be done in the other two designs by laying out the general objectives and making appropriate arrangements for specific activities. The byproduct of this overall design is a detailed design report, which can be regarded as a roadmap for the other two designs. It is the basic document for blended learning and focuses teachers' instructional methods for organizing course events and activities and also the basic

principles for curriculum assessment. The most important feature of the design that differs from the usual instructional design is that it focuses on which activities and resources fit in the learning context and which fit in the typical classroom instruction context.

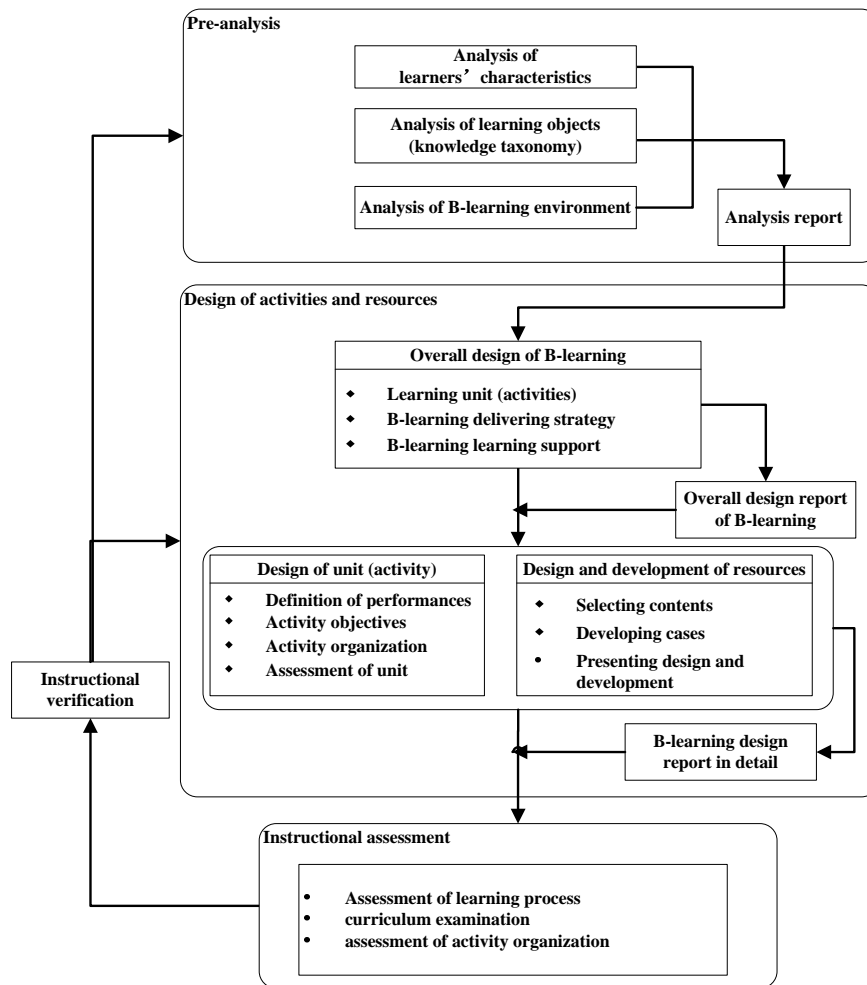


Fig. 1. The BLC design model

Instructional Assessment Design. The assessment design depends on the activity objectives, performance definition, and the general environment of blended learning. It mainly uses the assessment of the learning process (for example, using e-portfolios), the examination of curriculum knowledge (for example, online tests), and the organization of learning activities.

To clarify what is to be done in teaching a unit, which is, in essence, the overall design of blended learning encompassed in the middle component of the BLC design

model, let's take a look at the BLC process model (See Fig. 2). This model is a detailed illustration of this subcomponent, which elaborates the processes where instructional activities are performed. The whole process can be broken down into three modules. Module one is curriculum lead-in and Module three is Review and Assessment. In between the two modules is Module two, which is where actual instructional and learning activities are going on.

Module one goes beyond a warming-up activity by familiarizing learner with learning objectives, tasks to be completed, learning materials to be studied, and channels of communication to be used.

Module two bears upon a complex series of instructional and learning activities. Based on specific learning objectives, learning tasks, and learner characteristics, an instructor may choose to offer face-to-face (f2f) instruction in a traditional classroom setting and then ask learner to complete the assigned task, either individually or in groups, in a self-regulated manner in an online learning environment. Next, the instructor may ask students to come back to the physical classroom again, aiming at helping to solve their problems and undertaking learning activities so as to consolidate what they have learned and to promote transfer of learning. Alternatively, the class may also be conducted the other way round or in some other combined ways, which involve both instructor-guided learning and learners' self-regulated learning in both physical and online learning contexts, until the task has been completed.

Module three mainly pertains to assessment of learning outcomes through tests or exams and oral presentations, in which the formative assessment instead of the summative one is stressed in order to engage students in actively participating in various class activities

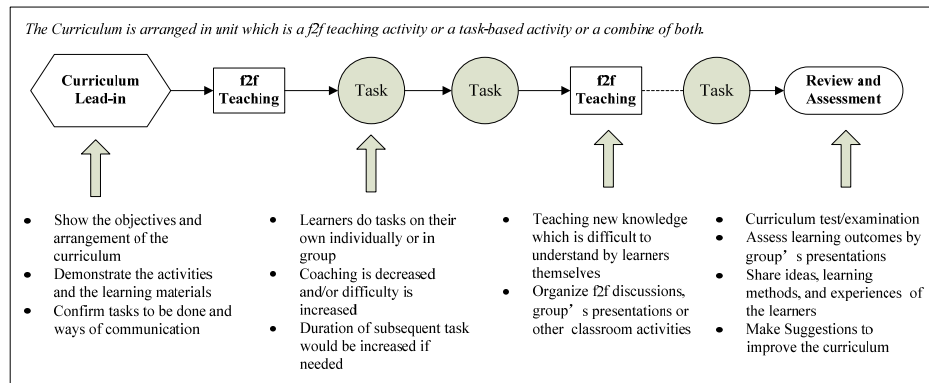


Fig. 2. The BLC process model

In order to better understand how the design of a unit (activity) works in the BLC design model, an activity-based blended learning model is set up for that purpose (See Fig. 3). Having been built upon the first principles of instruction and above-mentioned learning theories, this model demonstrates what methods we may use to design a problem-based and "learning-centered" blended learning activity. There are four main components in the whole procedure: (1) Lead-in; (2) Planning; (3) Acting; and (4) Reviewing.

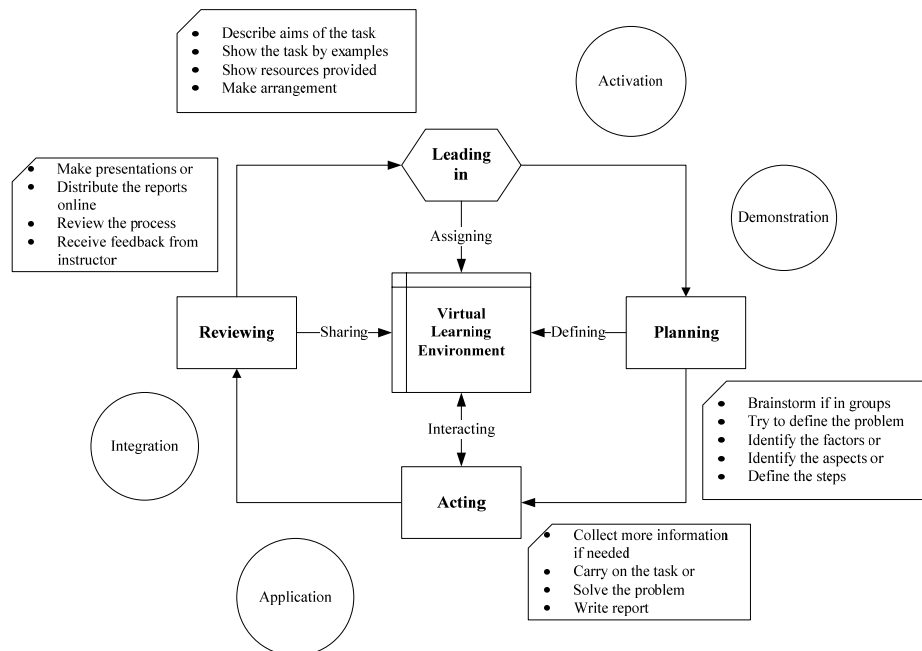


Fig. 3. The BLC activity model

Lead-in. It is the starting point of the activity. The main objective is to demonstrate the task to learners. In this component, there are four subcomponents, which are: (1) describe aims of the task; (2) show the task by examples; (3) show resources provided; and (4) make arrangements. The first one is intended for students to have an idea what they are expected to achieve after completion of the task. The second is meant to let students have a better understanding of the task. The third is set to provide students with resources that they can use to complete the task. The last is to make instructional arrangements, which are mainly referred to as the general planning for how this course will be carried on through the whole semester.

Planning. The objective of this component is to define the task by learners themselves through using their knowledge. There are three subcomponents, which are: (1) brainstorm if in groups; (2) define the problem; and (3) identify the factors or aspects or define the steps. If learners work in groups, they may be required to work out various issues related to the given problem and to define the steps that you can follow to deal with the problem.

Acting. The objective is to deal with an actual task or problem by completing task-related requirements. This component distinguishes itself from other components by interacting with VLEs. It has three subcomponents: (1) collect more information if needed; (2) carry on the task or solve the problem; and (3) write reports. Through interacting with VLEs, learners are able to acquire needed information and support from both their peers and their instructor.

Reviewing. The objective is to have newly constructed knowledge transferred to learners' future learning through sharing their work with their peers and the instructor. This component encompasses the following three subcomponents: (1) make

presentations or distribute the reports online; (2) review the process; and (3) receive feedback from instructor. The first one is a kind of “show and tell”. Students may be expected to make presentations or display their work online in VLEs. The second is a kind of self-reflection process, where they can compare their own work with their peers’ and review their own work to see how well they have done their job. The third is how their work is evaluated by their peers and the instructor so that they are informed of how well they have done their work and where they are expected to improve in terms of knowledge construction and learning strategies.

This model is in a cyclical form, with VLEs in the center and all of the four stages surrounding the center in a cyclical sequence. VLEs could be referred to as learning support systems, which perform the functions of content delivery and promotion of online communication. In all of the stages except the third stage, learners interact with the center in the form of giving, which is represented by a unidirectional arrow.

Moreover, each of the four components is related to the first principles of instruction [9]. For example, the first component is based on Principle 3 (Demonstration), where what is to be learned is demonstrated; the second, on Principle 4 (Application), where learners are required to use their new knowledge to define the problem; the third, on Principle 2 (Activation), where learners’ prior knowledge is activated to complete actual tasks; and the fourth, on Principle 5 (Integration), where learners are encouraged to integrate their new knowledge into their future learning.

5.2 Case Study

To shed light on how the BLC activity model works, we could use as an example a hands-on design of the “Career Development Planning” activity in an introductory course titled “An Introduction to Educational Technology.” This course has been offered to freshmen of the educational technology major in every first semester since 1985, which is intended to open the window for the learners to have a general idea about what educational technology is all about, to arouse their interest, and to enhance their motivation to probe more into this field so that they can improve their learning strategies and abilities in their future exploration of the field of educational technology throughout the rest of the academic years.

In the course of their study, the learners work as a group and, based on their group’s interest, choose one of the five career orientations in the field of educational technology, namely, instructional design and curriculum development; information technology education; distance education; educational software development as well as educational media development. After the completion of this introductory course, they are expected to know what they might need to learn for a particular career in their four-year undergraduate studies of educational technology. At the end of the semester, the groups are required to bring their completed written reports to the classroom and to give an oral presentation. Over the past two decades, this course has been developed into one of the key courses in the field of educational technology in China and it has also been rewarded as an excellent course in the educational quality initiative launched by China’s Ministry of Education. The curricular activity design presented here is chosen for the course instruction in the first semester of the 2006-

2007 academic year. The design has been proven to be effective and it still provides guidance for instructors to teach this course. A brief description of the course schedule goes as follows (Fig. 4):

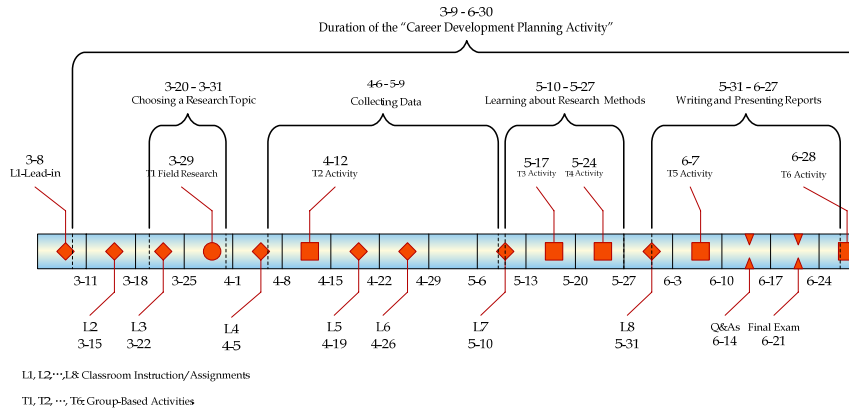


Fig. 4. A course schedule for the “An Introduction to Educational Technology” course

In Fig. 4, the timeline indicates weeks of the whole semester. Bigger square symbols represent activities while smaller square symbols refer to face-to-face instructions, with the only circle symbol on the timeline signifying field research, which is a field study of the applications of educational technology at a Chinese distance learning company in Beijing. From this figure, we could see that the activity lasted almost throughout the whole semester, which was composed of 17 weeks from March 8 to June 28, 2007.

The activity design followed the four design stages of lead-in, planning, acting, and reviewing. The lead-in was instruction-intensive, which was intended for the learners to know about the goal of this course and basic information about future career paths and prospects in the field of educational technology. The activity as a group assignment was also made available to the learners so that they could know where they would be going right from the start. Supplementary learning resources and communication support channels were demonstrated so that they could be better informed of where to find support from.

Then, planning would be the next stage of the activity design. Planning, which was known as planning of the activity by the learners themselves, mainly involved choosing a research topic through the application of their prior knowledge and of what they learned in the classroom. In order for the learners to choose a topic appropriately, classroom instruction was brought into the classroom in Weeks 2 and 3, which covered an introduction to the brief history of educational technology development and the disciplinary system of educational technology. With a fundamental understanding of what educational technology was, the learners were made to have a field trip to a Chinese distance learning services business in Week 4, which was intended to give the learners an opportunity of experiencing what was covered in the lectures was actually referred to in the real world. In the meantime, this field research could also give rise to a better understanding of their career orientations

and ultimately help them to have a better idea about their own research topics.

Next, collecting data and learning about research methods are combined to constitute the stage of implementation. The learners went through 8 weeks, with the exception of a one-week-long “May Day” holiday, to do real jobs in terms of the activation of their knowledge. In the data collection period, data collection methods were discussed in Week 5 to help the learners to have a foundation on the right method to be used in the process. In Week 6, conducted was an on-campus survey of sophomore, junior and senior learners of educational technology while in Weeks 7, 8, and 10 conducted was the survey of the graduates who majored in educational technology and worked in the educational technology-related businesses. Meanwhile, basic theoretical foundations of educational technology were presented in classroom instruction in Weeks 7 and 8 in order for the learners to utilize the theories in their research. While the learners were preparing for data processing and analysis, their research methods, including introduction to qualitative and quantitative research methods, were developed in classroom instruction in Week 10. This week was followed by a one-week research method seminar in Week 11 and a one-week group presentation on research methods that the learners could adopt in their research in Week 12.

Starting from Week 13, the learners came to the stage of presenting their “products”, which was the last stage of the activity design. This stage was manifested by integrating what they learned throughout the semester into the problem-solving reports of their group’s career development planning. Report writing was taught in a lecture form in Week 13 and learners started to discuss the outline of their reports and research methods with which the available data could be presented in Week 14. In Week 15, a Q&A session was held to help solve the learners’ problems in the process of report writing. Finally, the learners made oral presentations on their findings coupled with the instructor’s comments and their peer’s critical review of each individual group’s completed project. Then, each group gave a response to how their reports needed to be improved.

To summarize, this curriculum design starts with a curriculum lead-in, which is mainly intended to familiarize learners with the goal of this course and tasks to be completed. Then, it moves on to a blended approach which is aimed at helping learners to achieve effective learning in the best way possible. Finally, the design winds up with revision and assessment. For the BLC activity design, the four stages of activity lead-in, planning, acting, and reviewing are inseparable from the backbones of the first principles of instruction as advocated by Merrill [9].

6 Conclusions

The BLC Design Model is developed on the basis of the first principles of instruction and constructivism as well as a renewed view of behaviorism. It is intended to provide instructors with a conceptual framework and practical design guidance before blended learning is implemented. When BLC is designed, the following two aspects in activity design may deserve full attention:

The first is concerned about the sequential features of activity design. In

curriculum lead-in, instructors should make it clear about learning objectives and overall instructional arrangements. Also, learning activities and resources should be demonstrated with examples so that learners could have the right target to shoot. Moreover, tasks should be clearly identified and modes of interaction should be put in place right from the start. In classroom instruction, the emphasis should be laid on the learning content that is hard to comprehend for an individual learner's self-regulated learning. Face-to-face discussions and group-based presentations could be effective inside-of-class activities. In non-instructional activities, instructors' guidance should be gradually decreased while the difficulty level of given tasks could be increased little by little. In the process of evaluation, course exams could be a form of evaluation. However, having learners' share their learning experiences through presentations and critical reviews might be also a good form of evaluation.

The second involves how a BLC activity can be better designed to help learners perform an activity effectively. In general, the following four steps are crucial: activity lead-in, in which the goal of an activity is presented, a specific task to be completed is exemplified, and the supplementary learning resources that are accessible to learners are demonstrated; planning, in which possible ways to accomplish the task are brainstormed, the research problem is defined, and concrete steps to resolve the problem are identified; implementation of the plan, in which the task is completed by collecting required data and working on the task collaboratively, as well as reviewing and sharing, in which research findings are presented and shared among fellow learners and the instructor with critical comments from the both.

Blended learning is transforming education in every corner of the world. Its unique characteristics go beyond those of any of its counterparts. With the changing of educators' traditional concepts and deepening of their theoretical explorations in blended learning curriculum design and practical applications of the theoretical findings, it will benefit not merely the learners in one region but all the learners on the entire globe.

Reference

1. Bricheno, P., Higgison, C., & Weedon, E.: The Impact of Networked Learning on Education Institutions. Bradford: UHI Millenium Institute & Bradford University—INLEI, (2004) <http://www.sfeuprojects.org.uk/inlei/>
2. Carman, J. M.: Blended Learning Design: Five Key Ingredients, (2005) <http://www.agilantlearning.com/pdf/Blended%20Learning%20Design.pdf>
3. Clark, D. R.: Blended Learning (2007), <http://www.nwlink.com/~Donclark/hrd/elearning/blended.html>.
4. Clarke, S., Lindsay, K., McKenna C., & New, S.: INQUIRE: a case study in evaluating the potential of online MCQ tests in a discursive subject. *ALT-J, Research in Learning Technology* 12(3), 249-260 (2004)
5. Garrison, D. R., & Kanuka, H.: Blended learning: Uncovering Its Transformative Potential in Higher Education. *Internet and Higher Education*. 7, 95–105 (2004)
6. He, K. K.: The New Developments in the Theory of Educational Technology from the Perspective of Blended Learning (I). *E-Education Research*. 2004(3), 1-6 (2004)
7. Huang, R. H., Zhou, Y. L., & Wang, Y. (2006). *Blended Learning: Theory into Practice*. Beijing: Higher Education Press.

8. JISC.: Study of Environments to Support E-learning in UK Further and Higher Education: A Supporting Study for the Joint Information Systems Committee. Joint Information Systems Committee (JISC): Bristol, (2005) http://www.jisc.ac.uk/uploaded_documents/e-learning_survey_2005.pdf
9. Merrill, M. D.: First Principles of Instruction. *ETR & D.* 50(3), 43-59 (2002)
10. Molesworth, M.: Collaboration, Reflection and Selective Neglect: Campus-Based Marketing Students' Experiences of Using a Virtual Learning Environment. *Innovations in Education and Teaching International.* 41(1), 79-92 (2004)
11. Sharpe, R. (n.d.). Why blend? Rationales for blended e-learning in undergraduate education. The Higher Education Academy, http://www.heacademy.ac.uk/assets/York/documents/ourwork/research/literature_reviews/blended_elearning_why_blend.pdf.
12. Sharpe, R., Benfield, G., Roberts, G., & Francis, R.: The Undergraduate Experience of Blended E-Learning: A Review of UK Literature and Practice. The Higher Education Academy, (2006) http://www.heacademy.ac.uk/assets/York/documents/ourwork/research/literature_reviews/blended_elearning_full_review.pdf
13. Shaw, S. & Ignieri, N.: Effectively implementing a blended learning approach: maximizing advantages and eliminating disadvantages (2006), http://adlcommunity.net/file.php/11/Documents/Eedo_Knowledgeware_whitepaper_Blended_Learning_AMA.pdf.
14. Singh, H. & Reed, C.: A White Paper: Achieving Success with Blended Learning. Centra Software, (2001) <http://www.centra.com/download/whitepapers/blendedlearning.pdf>
15. Ward, G.: Flexible delivery: A report on an evaluation of the use of the virtual learning environment in higher education across Scotland. The Quality Assurance Agency for Higher Education, (2006) from http://www.enhancementthemes.ac.uk/documents/flexibleDelivery/Flexible_delivery_QAA_128.pdf
16. Whitelock, D. & Jelfs, A.: Editorial. *Journal of Educational Media.* 28(2-3), 99-100 (2003)
17. Wood, E. J.: Review: Problem-based learning. *Acta Biochimica Polonica Quarterly,* 51(2), XXI-XXVI, (2004) http://www.actabp.pl/pdf/2_2004/XXI.pdf