An effective way of designing blended learning: A three phase design-based research approach

Ahmet Berk Ustun[1] · Monica Walch Tracey[2]

Abstract

Online learning is common in higher education, but has its drawbacks. As a result, blended learning (BL) has emerged as an alternative to alleviate the challenges of online learning. The purpose of this design-based research study was to determine what elements were needed to assist a higher education instructor inexperienced in designing and teaching a BL course to successfully create and implement it, and to document the instructor's perceptions about the first experience of teaching a BL course. The BL course was designed, implemented and redesigned to make the BL course an effective and efficient learning environment through the three phases of this design-based research. Qualitative and quantitative research methods including instructor interviews, learning environment observations and student surveys were employed to collect data. Results indicated that iterative analysis, design and evaluation of the created BL course provided an opportunity for the researchers to find applicable solutions to any real-world problems that the instructor faced in the course. Besides, the design and implementation of BL led the instructor to shift from a passive teaching approach to an active teaching approach and allowed the students to become active and interactive learners through the process of three iterative design cycles. Although challenges were identified, she had an overall positive perception toward teaching the BL course.

✉ Ahmet Berk Ustun
   ustun.ab@gmail.com; abustun@bartin.edu.tr

   Monica Walch Tracey
   monicatracey@wayne.edu

[1] Bartin University, Bartın, Turkey

[2] Wayne State University, Detroit, MI, USA

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1 Introduction

Online courses are being extensively practiced in higher education with the fast and exponentially expanding growth of online learning environments. Zhang and Bonk (2008) state that one of the significant reasons why online education has incrementally been embraced is that it has shifted where, when, and how learning occurs. It not only removes the boundaries of traditional learning but also has the potential to provide flexible, open, and ubiquitous applications for instructors to utilize active and collaborative learning activities. However, even though there are many benefits of online learning, it has its limitations (Chou and Chou 2011) such as difficulties for students in managing their time, fulfilling their commitments, and keeping their self-motivation. Because of such drawbacks of online learning, blended learning (BL) has emerged to alleviate the weaknesses of online learning. This approach has commonly been cited as an effective alternative learning approach (Chou and Chou 2011; Garrison and Kanuka 2004; Graham 2006; Wu et al. 2010).

Learning outcomes, learner satisfaction, faculty satisfaction, and cost benefits are significant considerations while implementing a BL course (Graham 2013). In parallel with that, Porter and Graham (2016) state that the accessibility and convenience of appropriate and adequate infrastructure, technological support, pedagogical support and the agreement between instructors and institutional administrators about the goal of BL are taken into account when instructors made a decision about BL implementations in higher education.

Some studies focus on student outcomes and satisfaction. Willging and Johnson (2009) point out that student satisfaction is an influential determinant for the effectiveness of BL courses. McCutcheon et al. (2015) indicate the effectiveness of BL as a positively influential learning approach for student outcomes by capitalizing on the strengths of online and face-to-face learning after conducting a comprehensive systematic review. For instance, Jesus et al. (2017) examined the student performance in teaching therapeutics by comparing students ($n = 54$) taught in a face-to-face course and students ($n = 56$) taught in a BL course. They found statistically significant differences between the students' final exam scores with the comparison of two groups and the students who were taught in the BL course achieved higher scores. A quasi-experimental study was conducted by Ho et al. (2016) who explored the effectiveness of a BL course and students satisfaction level in a BL course by comparing control group ($n = 60$) thought in a traditional face-to-face course and experimental group ($n = 117$) taught in a BL course revealed that knowledge acquisition and satisfaction with the course were significantly higher in the BL course than the face-to-face course. An experimental study was conducted by Al-Qahtani and Higgins (2013) who evaluated students' achievement by comparing three groups involving a control group ($n = 50$) taught by a traditional course, an experimental group taught by ($n = 43$) e-learning approach and another experimental group ($n = 55$) taught by the BL approach. According to the results of pre- and post-achievement tests, students' achievement in BL group was significantly higher than in other groups. However, Yen et al. (2018) who measured learner academic outcomes by making three examinations, giving one research paper assignment and the course total grade, and student satisfaction by administering the Student Opinion Questionnaire and the Constructivist On-Line Learning Environment Survey in three teaching approaches including face-to-face,

online, and BL in order to investigate the impact of these teaching approaches on learner academic outcomes and satisfaction found that there were no statistically significant differences between students' academic achievement and satisfaction across the three teaching approaches. Other studies focus particularly on institutional adoption and implementation of BL in terms of aligning the BL strategy with the institutional strategy (Galvis 2018; Graham et al. 2013).

While experimental studies have examined student outcomes and satisfaction in BL courses, few studies have explored the design and implementation of BL (Porter and Graham 2016). Because of this fact, Porter and Graham (2016) suggest that "future research could include interviews with faculty regarding their rationales for indicating particular decisions as facilitating or impeding their BL adoption" (p. 759). In this sense, there is still an insufficient number of studies that explore the design and implementation of a BL course in terms of investigating the instructor satisfaction and specifically there is a gap in the literature exploring an inexperienced instructor in designing, implementing and teaching a BL course in higher education. This study conducted design-based research that explores the varied range of designed innovations to help an inexperienced instructor in designing and implementing a BL course to create an effective and efficient BL course in iterative design cycles and reveal her experience in teaching the designed BL course as a real-life practice.

1.1 Blended learning

Three widely cited definitions of BL are categorized in the literature by Graham (2006). These are (1) a combination of instructional methods (Singh & Reed, 2001 as in cited Graham et al. 2005), (2) a combination of instructional modalities or delivery media (Driscoll 2002 and Rossett et al. 2002 as in cited Graham et al. 2005) and (3) a combination of online and face-to-face instruction (Reay 2001; Rooney 2003 & Sands 2002). The third perspective is the most common point of view in the literature, which identifies BL as rigorously and thoughtfully combining the best features of face-to-face learning with the best features of online learning (Bonk and Graham 2006; Garrison and Kanuka 2004; Graham 2013; Graham et al. 2005; Osguthorpe and Graham 2003). In this sense, in order to take full advantage of the best features of face-to-face instruction and online instruction, the strengths and weaknesses of both face-to-face and online learning should accurately be recognized before creating a BL environment.

1.2 Benefits of blended learning

How student learning outcomes are influenced in BL is underscored by the literature (Halverson et al. 2012) because BL can be used as a remarkably versatile learning practice to enhance effectiveness and efficiency of learning experiences and promote meaningful learning outcomes (Garrison and Kanuka 2004). Graham et al. (2005) classify the versatility of BL in three groups as improved pedagogy, increased access and flexibility, and increased cost-effectiveness. First, utilizing suitable resources, tools, and learning materials in an online learning environment can be blended with a face-to-face learning environment in order to design active, interactive and collaborative learning environments. Rovai and Jordan (2004) state that BL provides powerful learning tools that can be utilized to construct student-centered classrooms by

encouraging a sense of community among students and eliciting student engagement in group activities. According to the comprehensive systematic literature review conducted by Van Laer and Elen (2017), teaching in a BL environment facilitates and promotes social interactions between student-content, student-student and/or student-instructor that positively effect on student cognition, metacognition and motivation. Second, increased access and flexibility are key factors that enable instructors to design a flexible learning environment where students have increased chances to have access to knowledge, social interaction, and the human touch. According to Graham (2006), providing flexible learning alternatives and interactive learning activities are unique opportunities offered by BL. Yen et al. (2018) prove the importance of flexibility in a BL environment in their study, which shows that student academic achievement and course satisfaction are increased when students have opportunities to access to the course materials and communicate with their instructor online. Finally, reducing cost is possible through cutting funding for physical infrastructure such as decreasing face-to-face class time and through modifying a schedule to enhance its efficiency by lessening full-time instructor responsibilities owing to the possibility of replacing them with a part-time instructor (Osguthorpe and Graham 2003). However, even though BL can be considered as an innovative approach to a learning environment, O'Connor et al. (2011) point out that it is not a straightforward approach. As such, there may be new challenges while designing a BL environment.

1.3 Challenges of blended learning

Eliciting the potential benefits of BL may cause challenges because it requires the mindful design of BL, which comprises the strengths of face-to-face and online learning and none of the weaknesses of each. Jokinen and Mikkonen (2013) indicate that determining online resources, preparing appropriate content and motivating students are some challenges of BL and those who teach their course in a BL environment should be aware of these daunting challenges. Ocak (2011) categorizes the three groups of challenges: "instructional processes, community concerns and technical issues" that instructors might encounter while designing a BL environment. First, according to the study conducted by Tang (2013), it is difficult to alleviate students' reluctance to learn and motivate them to spend their time to be active knowledge seekers in the BL environment. Second, limited institutional support can be a major deterrent for instructors to teach a BL course. Graham et al. (2013) identify institutional support as institutional policies, structures, and lack of support. Last, at least moderate technology literacy and skills are expected for those who are interested in teaching a BL course, otherwise instructors will eventually face problems when they need to have access to course materials, engage with course content, or encourage student involvement in an online environment (Toth et al. 2008). Additionally, according to Bazelais and Doleck (2018), if it the detailed and comprehensive plan is made to create a well-designed BL environment, the learning environment will be a very effective and positive learning atmosphere in which students have the high quality of learning opportunities that help improve their learning outcomes. However, detailed and comprehensive plans for how to access, use and manage technology should be made in advance; if not, it may result in undesirable technology integration (Ocak 2011).

1.4 Purpose

BL is potentially an effective learning approach if the design of BL is thoughtfully carried out before implementing it (Spanjers et al. 2015). Although it may sound easy to combine the components of the best practices of face-to-face and online learning, Hew and Cheung (2014) indicate that the design process of a BL course intrinsically requires problem-solving skills. Garrison and Kanuka (2004) point out that "daunting challenges" might emerge in the design process of BL due to its "implementation with challenge of virtually limitless design possibilities and applicability to so many contexts" (p. 96). Even though there is no recipe for determining an accurate design process and choosing the right combination of the components of best practices of face-to-face and online learning, Osguthorpe and Graham (2003) identify the degree to which face-to-face and online components are employed depends on taking into account the nature of the instructional goals, student characteristics, instructor background, and online resources. This study aimed to determine what elements were needed to assist a higher education instructor inexperienced in designing and teaching a BL course to successfully design and implement a course. In accordance with the purpose of this study, these research questions guided the study:

1. What practices are associated with making a blended learning course effective and efficient?
2. What are the instructors' perceptions about their first experience of teaching a blended learning course?
3. Does the iterative process of this design-based research study improve the effectiveness and efficiency of a blended learning course throughout the semester?

2 Method

This study employed a design-based method. Wang and Hannafin (2005) define design-based research as "a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (p. 6). Figure 1. illustrates the research model of the present study.

Mixed methods were used to answer research questions. While the mixed methods aided to ensure the objectivity, validity, and applicability of this research (Wang and Hannafin 2005), these methods enabled the first author to probe the instructor's perceptions and feelings towards designing, implementing and teaching a BL course through revealing in-depth and comprehensive understanding of how and why she held these perceptions and feelings.

2.1 Participants

In order to recruit participants, a purposeful selection method was chosen for this study. It was a convenient method for the study because the intention of the study sought an
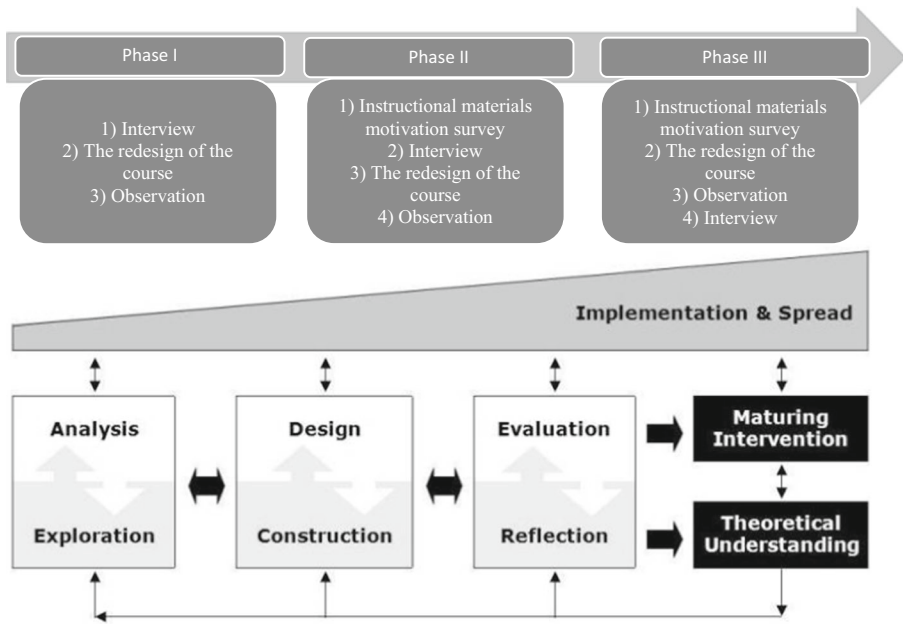
Fig. 1 Research Model. Adapted from "Conducting educational design research," by S. McKenney and Reeves 2012, London: Routledge

individual who frankly shares the experiences while closely working with the first author to design an effective BL course in accordance with design-based research. Patton (1990) states that data sources meet the specific participation requirements when choosing a purposeful selection method. Therefore, the following set of criteria was identified to select an instructor to participate in this study:

- Having a moderate level of competency at least using and managing online components, triggering questions, monitoring the students, and leading discussion to the right track in the online learning environment,
- Open to enhance IT capabilities,
- Being not biased towards the use of technology inside or outside of classroom settings,
- The necessary physical and technological infrastructure to deliver online instruction provided by the institution of higher education.

A Psychology instructor was predetermined because she was both willing to work with the first author and met a brief list of requirements to be an appropriate participant for the study. She is an associate professor and full-time faculty in Psychology and has been teaching face-to-face graduate and undergraduate psychology courses in one of the largest universities in North America. However, she had never taught a BL course. After the first author explained the purpose of the study and asked whether she would like to participate, she realized the impressions and potential benefits of the study and accepted to closely work with the first author to convert a face-to-face graduate level

course into a BL course in the Fall 2016 semester. The selected course was 3 semester credit hours and offered for only graduate students. This traditional course was heavily based on lectures and reading assignments.

The second participant group was students enrolled in the instructor's graduate level course in the Fall 2016 semester. There were twenty-three students consisting of two male and twenty-one female participants in the class. They were expected to have a moderate level of competency to attend online instruction such as sending e-mails, posting threads, conducting video conferences, and so on. There was a preliminary meeting to determine their level of competency. They weren't tech-savvy, but twenty-two students met the participant requirement. The first author helped the remained student being prepared by introducing the course Blackboard site and other technological recourses for this BL course. Also, the first author was always ready to help any students when they had a technological problem. Lastly, instructional design experts were recruited as a second pair of eyes to look into the created BL course and to provide feedback. They were recruited from The Office for Teaching & Learning at Wayne State University.

2.2 Data collection

Qualitative and quantitative collection methods were employed in this design-based research study. Qualitative data collection method was used to gather data at different times throughout the study. These different times of data collection were referred to as:

- Phase 1: From August 19, 2016 to October 7, 2016
- Phase 2: From October 7, 2016 to November 11, 2016
- Phase 3: From November 11, 2016 to December 16, 2016

During Phase 1, the first author interviewed the instructor and instructional design experts. The purpose of the instructor interview was to explore her strengths and weaknesses in using technological tools and the goals of the course, and to discuss the design and implementation of the BL course. Based on the instructor's interview, the learning environment was redesigned. Then, the instructional design experts were requested to judge the learning environment and the necessary adjustments were done according to their suggestions. After discussing the last prototype of the learning environment with the instructor, the final version of the learning environment was designed and implemented. Finally, she was observed while teaching the BL course.

During Phase 2, the first author interviewed the instructor and instructional design experts. The purpose of the instructor interview was to investigate the strengths and weaknesses of her online capabilities, and determine what practices were associated with making the BL environment effective and efficient. Based on the instructor's interview, the learning environment was redesigned. Then, the instructional design experts were requested to appraise the learning environment and the necessary adjustments were done according to their advice. After showing the last prototype of the learning environment to the students and discussing with the instructor, the final version of the learning environment was designed and implemented. Finally, she was once again observed while teaching the BL course.

During Phase 3, the first author interviewed the instructor to learn the instructor's perception of the first experience in teaching a BL course. Her thoughts about what, why, and how to select, use, and manage appropriate technological processes and resources throughout the semester were discussed. Her opinions on designing and implementing the effective and efficient BL course throughout the semester were uncovered.

A quantitative data collection method was used to gather data at different times throughout the study. A validated Likert material motivation survey was used to collect data at two times throughout the study. The collected data were measured for the improvement of using instructional activities and tools.

Quantitative data collection schedule was as follows:

- First material evaluation survey: Fifth week of the term (October 5, 2016)
- Second material evaluation survey: Tenth week of the term (November 9, 2016)

2.3 Data collection instrumentation

The Instructional Materials Motivation Survey (IMMS) developed and validated by Keller (2010, 1987) has been used in several research studies to determine if students are satisfied with the use of instructional activities and tools. Based on the results, the instructional activities and technological tools used in the designed BL course could be changed.

Three comprehensive and thorough Semi-Structured Interviews were conducted with the instructor. The questions of each interview were validated by experienced faculty who have worked in Learning Design and Technology program and taught online and hybrid courses for several years.

The observation tool the researchers used was derived from "Seven Principles for Good Practice in Undergraduate Education" published by Chickering and Gamson (1987). This instrument provided a beneficial framework to appraise the effectiveness and efficiency of online teaching. Specifically, observing the learning environment helped the researchers unfold what remained hidden in the interviews.

2.4 Data analysis

The data collection techniques, interviews and observations were also utilized in data analysis to discern the contradictions between the data gathered by the two methods (Gay et al. 2011). Thus, data analysis began concurrently with the data collection, and new questions and issues led to further data collection and analysis (Gay et al. 2011; Ruona 2005). Three iterative stages of analyses were conducted following "(1) becoming familiar with the data and identifying potential themes; (2) examining the data in depth to provide detailed descriptions of the setting, participants, and activity; and (3) categorizing and coding pieces of data and grouping them into themes" (Gay et al. 2011, p. 467). In addition, a validated survey instrument using a Likert type Scale with 5 choices and consisting of 36 items was employed to gather the quantitative data in this study. The mean score of the survey was calculated to determine whether or not the group of students were satisfied. The survey was administered to assist the first author to analyze qualitative data.

3 Results

3.1 Phase one

Phase One began 3 weeks prior to the start of the Fall 2016 semester and ended the 4th week of the semester. Phase One consisted of: 1) An instructor interview, 2) The redesign of the course, and 3) Observation of the learning environment.

Interview The aim of the instructor initial interview was to acquire the instructor's needs, demands and competence for constructing a BL course. The constant comparative analysis method was utilized to analyze data collected from the interview. In order to ensure coding reliability and unearth all explicit and implicit themes from the raw data, two doctoral students in the Learning Design and Technology program and the first author analyzed the data by using open coding. Five themes represented in Table 1 emerged from the initial interview analyses: prior experience, motivation to change, expectation, concern/ambiguity and resistance. Respectively, the first theme refers to the instructor's previous experience using learning technological tools, resources or activities. The second theme refers to her desire to convert a face-to-face course into a BL course. The third theme refers to her expectations while teaching a BL course. The fourth theme refers to the perceived challenges she believed she would face while teaching a BL course. The last theme refers to the reasons she was reluctant to teach a BL course.

Redesign of the course The goal of redesigning the course was to turn the traditional face-to-face course into a desired BL course. The process of redesigning the learning environment included transforming the syllabus, designing a course Blackboard site and creating instructional activities.

Syllabus The instructor and the first author smoothly integrated the online learning environment into the face-to-face learning environment, and had it reflected in the syllabus. We set up face-to-face meetings along with a total

Table 1 Summary of themes from initial interview

Emerging Themes	Sample interview comments
Prior experience	"I'm aware of some of the technological tools (using Blackboard)"
Motivation to change	"I'm not interested in people memorizing and regurgitating information, but I'm interested in people internalizing and knowing how to use material and resources and where to find information."
Expectation	"I would like to present it (information) in an engaging, innovative way." "I want to use them (technological tools) to make my work more efficient to reach more people and to accommodate people's lives in various ways." "I want it (BL) to be engaging something people look forward to doing."
Ambiguity / Concern	"My weaknesses include organizing material in an efficient manner."
Resistance	"I don't want to create another burden."

of 15 email correspondences to cooperatively update the conventional course syllabus. The updated syllabus included (1) revising the requirements, attendance policy, office hours, course schedule, grading policy, and (2) adding new learning activities and online communication guidelines. It was a comprehensive layout that had the instructor organized in the online and face-to-face teaching and allowed the students to be prepared for the BL course by reviewing the course components, expectations and requirements of the course. Explicitly stated in the updated syllabus that what, why and how to do the assignments along with giving the due date of assignments was vital to guide the students in this new learning environment.

The course blackboard site The instructor and the first author jointly designed and implemented the course Blackboard site in order to make the educational materials available online, traditionally delivered during face-to-face meetings and to supply a variety of supplemental tools for the enhancement of the face-to-face teaching and the facilitation of learning. The design of the site was deliberately kept simple and organized to help the instructor easily navigate the site, provide content, and edit items and to allow the students to effortlessly access and use the content, tools, information, and course materials. Basic tools utilized in the course Blackboard site included a syllabus, discussions, course content, announcements, grade book, assignments, and a calendar.

Weekly content folders, the course textbooks and a discussion forum were three major examples implemented in the course Blackboard site. First, weekly content folders were created to hold readings assignments such as articles, reports, case scenarios, etc. and all learning materials such as PowerPoint presentation, video lecture, visual aids, website links, etc. available on the site. This content page was designed to automatically show each week folder according to the course schedule. Second, the course textbooks were provided in the course Blackboard site through the university library. Therefore, the students had a chance to have access to the electronic version of all course materials anywhere anytime without necessarily purchasing a textbook. This also allowed students the opportunity to increase their familiarity with using the university library and expand their interactions with librarians, which assisted them to do their research assignments. Third, a discussion forum for general questions about the class was implemented to enable the students to use this forum to ask questions about assignments, deadlines, class procedures or concerns. The questions and answers were available to everyone through this forum and the students were encouraged to participate. Therefore, the students who had the same question had a chance to find a response, which promoted their engagement and interaction. When an issue was not resolved by peer interactions, the instructor responded to the question in the forum.

Instructional activities Online discussions and collaborative Google Document writing were two instructional activities created in an effort to enhance interactions between instructor-student and student-student; engage the students in online knowledge construction and promote self-paced learning. Discussion

boards were set up for small group discussions using the Blackboard Groups feature. Students played an active role in the discussion assignments through interacting and collaborating among themselves. The instructor benefitted from these assignments by monitoring the students to discern whether students reflected upon their assigned readings and peers' thoughts, and/or participated in a critical and thoughtful manner. She also provided an opportunity for any students who were not confident enough to participate in-class discussions or who didn't have time to speak up in face-to-face classes and gave the students chances to bring any unsolved issues in group discussions to the face-to-face class for further discussions or vice versa.

Collaborative Google Document writing was prepared as a class summary document that was intended to compile a weekly summary of in-class discussions, lectures and readings into one document from the voluntary participation of the students. Only nine students out of twenty-three subscribed to this collaborative Google Document in the first 2 weeks of the semester. However, a dramatic increase in subscription of the document occurred in the third week after the benefits of it were realized by the students.

Observation of the learning environment An observation tool was used to observe the learning environment by the first author. It was a beneficial framework to assess the effectiveness of the BL course. According to the observation findings, the instructor displayed some key competencies in teaching the BL course while displaying a lack of some key competencies to make the learning environment effective and efficient. The observation data represented in Table 2 were used to make improvements in the learning environment for the next phase of the study.

3.2 Phase two

Phase Two took place between the 4th week and the 9th week, for a total of a 5-week time frame during the semester. Phase Two consisted of: 1) The first student instructional materials motivation survey (Keller 2010), 2) An instructor interview, 3) The redesign of the course and 4) Observation of the learning environment.

Instructional materials motivation survey The first author administered the first student IMMS (Keller 2010) in the fifth week of the semester in order to estimate students' motivational attitude toward the use of instructional activities and tools. The results of the survey were used to determine the need for altering the use of instructional activities and tools in the learning environment. Twenty-three students completed the survey.

Reliability is the "degree to which evidence and theory support the interpretation of test scores entailed by proposed uses of tests" (Gall et al. 1996, p. 191) and according to George and Mallery (2003), "_ > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, _ > .5 – Poor, and _ < .5 – Unacceptable" (p. 231) are rules of thumb to determine the level of internal

Table 2 Summary of Observation of Learning Environment for Phase One

Phase One of Case	
Feedback for the Instructor	The Instructor
Strengths	-The syllabus was converted to Blended course syllabus including • Requirements and expectation for due dates of exams, assignments, and papers, course interactions • Course learning goals, assessments and learning activities • Netiquette expectations regarding online communication • Clear assignment grading criteria • Detailed and clear course schedule -Making the class atmosphere conducive to student learning -Providing student interaction spaces for study groups -Engaging students in collaborative learning activities, and active use of writing and speaking activities -Providing a well-organized course Blackboard site including organized content, free of errors and dead links, easy navigation, and easily accessible and usable learning materials -Providing assignment feedback that was clear, positive, specific, and focused on observable behavior -Responding to students' emails and promoting peer-to-peer collaboration -Utilizing a variety of assessment tools -Providing supplemental online materials -Making explicit statements drawing student attention to key ideas -Assigning students to think, talk, and write about their learning -Encouraging and fostering a healthy exchange of ideas and sharing of experiences among course participants in the online learning environment -Providing an open discussion forum where students could ask questions, and receive instructor feedback, about course content and activities -Guiding and eliciting student participation -Using a prominent announcement area to communicate important up-to-date course information to students -Providing alternative assignment options - Using positive reinforcement to encourage student participation
Weaknesses	-Being present, proactive and engaged in the course Blackboard site -Demonstrating modeling of good discussion participation practices - Providing opportunities for students to "customize" their learning, and information gathering, synthesis, and analysis in solving problems -Giving information on where to focus their studies when students digress from the main topic -Providing frequent and detailed feedback -Providing meaningful feedback on student assignments in a reasonable time frame -Responding to student inquiries in a timely manner -Assigning students to organize, apply, synthesize, or evaluate information -Promptly responding to students' emails and other inquiries -Preventing specific students from dominating a discussion

reliability. Based on the results of the SPSS analysis of the first IMMS, a measure of internal consistency reliability (Cronbach Alpha) for pretest was .941. The value for Cronbach's alpha indicated good internal consistency of the items of the first IMMS.

The students had a mean score of 138 (3.86 out of 5). Based on (5–1)/3 evaluation interval, when the arithmetic average is between "1,00 – 2,33", "2,34 – 3,67" and "3,68 – 5,00" score range, the evaluation criterion is determined to respectively indicate low, moderate and high level for IMMS scale in the interpretation of the findings after data analysis (Yurdakul 2011). According to the interpretation of the score, students' attitude toward the use of instructional activities and tools was high level and this score suggested that the students' reactions to the use of instructional materials were positive at the learning environment at the fifth week of the semester.

Interview The aim of the instructor design improvement interview was to reveal the instructor's strengths and weaknesses while teaching the BL course and to determine what instructional activities were effective and efficient or ineffective and inefficient in the implemented BL course. The same method of phase one was used in the analyses of the interview. Six themes, illustrated in Table 3 emerged from the analyses of the design improvement interview: motivation to change, benefit, expectation, ambiguity/concern, limitation and resistance. Respectively, the first theme refers to the instructor's desire to transform the traditional learning environment into the BL environment. The second

Table 3 Summary of Design Improvement Interview Result for Phase Two

Emerging Themes	Sample interview comments
Motivation to change	"The reading alone is difficult so if they (students) were reading and discussing and reading and discussing maybe it would be more interactive." "They highlight and talk about what they don't know (online discussion) but they don't have time to talk about it in class"
Benefit	"One thing that I've noticed coming out of this is the Google Docs has been a very value-added experience for this class." "I think the Google Doc is one element that has given them a different way to engage" "That (design of the course Blackboard site) seems to be a very well-organized way of keeping everything together. If I make it as easy as possible for them to organize material, then they're happy. They don't have to work at finding like they used to." "I read the Google Doc. and what I found is that has allowed me to figure out what students pay attention to what they find interesting and what they take away from each class."
Expectation	"There's an expectation if students don't know how to do it you've been available to provide supplemental instruction."
Ambiguity/Concern	"There's something about the discussion board that is not appealing to this group of students because it couldn't get full participation." "I think they feel overwhelmed with additional outside work" "Somebody who braves enough to put it out there and then everybody sort of jumps in and there might be a difference when you do it online that nobody's going to be the first one"
Limitation	"I don't have as much time available to spend on discussion board" "I just haven't put the energy or the time"
Resistance	"I have not been a good online instructor actually because of the way this class is structured and the nature of this content and the type of people they are, they prefer in-person interaction and so the discussion is happening on the blackboard, but they would actually prefer it in person."

theme refers to her perceptions of teaching the BL course in terms of taking advantage of BL. The third theme refers to her expectation of teaching a BL course. The fourth theme refers to any challenges she faced while teaching the BL course. The fifth theme refers to her limitations which constrained her while teaching the BL course in the best way. The last theme refers to her reluctance to teach the BL course.

Redesign of the Course The aim of redesigning the course was to improve the effectiveness and efficiency of the initial implemented BL course. The process of redesigning the learning environment included modifying the course Blackboard site and enhancing instructional activities.

The course blackboard site The same layout of the course Blackboard site was maintained in this phase. It was a straightforward and well-organized design that maximized the effectiveness of delivering the course content and reduced impediments by capitalizing on the content. A major example task was that the instructor easily collected assignments and gave feedback on them through "Grade Center" features of the course Blackboard site. It also enabled the students to comfortably access their graded assignments with instructor feedback.

Instructional activities The multiple-choice quizzes were created to make a comprehensive evaluation of student knowledge in this phase. The "Assessment" feature of the course Blackboard site with modification to the test duration, test due date and various forms of feedback on students' test results was used. The instructor found it appropriate to assess students' comprehension of details and specific knowledge from multiple chapters. She began devoting more time to keep track of student performance, giving prompt feedback and leading students to be active learners in the online discussion assignments and the collaborative Google Document in this phase. Student engagement, activities, interactions and collaborations were increased after she spent more time. She realized these increases and praised the Google collaborative activity by exclaiming in the document:

"I must admit… I love reading through this document! At first, I was a bit unsure if it… But I am so proud to be working with such an intelligent, curious and insightful group of people. It makes me excited to read, learn, and question with you.
Thank you for posting such wonderful take always… it really helps me to understand what we focus on in class- what stands out and how you integrate new knowledge with existing sources. Keep it up! This is an amazing document."

Observation of the learning environment The same observation tool used in phase one was employed to observe the learning environment. The instructor's strengths in teaching BL were increased according to the first author's observation. The observation

data illustrated in Table 4 indicates what changed in the instructor's competency. The data was used to make improvements in the learning environment for the next phase of the study.

3.3 Phase three

Phase Three took place between the 9th week and at the end of the 14th week, a 5-week time frame in the Fall 2016 semester. Phase Three consisted of: 1) The second student Instructional Materials Motivation Survey (Keller 2010), 2) The redesign of the course, 3) Observation of the learning environment and 4) An instructor interview.

Instructional materials motivation survey The first author administered the second student IMMS (Keller 2010) in the tenth week of the semester in order to assess students' motivational attitude toward the use of instructional activities and tools. The results of the survey helped determine the need for altering the use of instructional activities and tools in the learning environment. Twenty-three students completed the survey.

Based on the results of the SPSS analysis of the first IMMS, a measure of internal consistency reliability (Cronbach Alpha) for pretest was .943. The value for Cronbach's alpha indicated good internal consistency of the items of the second IMMS. The students had a mean score of 141.9 (3.94 out of 5). Based on (5–1)/3 evaluation

Table 4 Summary of Observation of Learning Environment for Phase Two

Phase Two of the Case	
Feedback for the Instructor	The Instructor
Strengths	-Preventing specific students from dominating a discussion
	-Striving to improve the navigational skills for itself and the students to be able to give easily understandable navigational instructions
	-Asking challenging questions that prompt students to think more deeply
	-Providing a prominent announcement area to communicate important up-to-date course information to students
	-Conveying the purpose of each assignment
	-Providing assignment feedback with information on where students focus on their studies when they digress the main topic
	-Providing more informative and constructive feedback to students such as making distinctions between fact and opinion and presented divergent viewpoints
	-Asking critical questions when communicating with students about course assignments and activities
	-Providing meaningful feedback on student assignments in a reasonable time frame
	-Providing opportunities for students to "customize" their learning, and information gathering, synthesis, and analysis in solving problems
Weaknesses	-Being present and engaged in the course Blackboard site
	-Demonstrating modeling of good discussion participation practices
	-Responding to student inquiries in a timely manner
	-Providing frequent and detailed feedback

interval, when the arithmetic average is between "1,00 – 2,33", "2,34 – 3,67" and "3,68 – 5,00" score range, the evaluation criterion is determined to respectively indicate low, moderate and high level for IMMS scale in the interpretation of the findings after data analysis (Yurdakul 2011). According to the interpretation of the score, students' attitude toward the use of instructional activities and tools was high level. This score suggested that the students' reactions to the use of instructional materials were positive in the learning environment at the tenth week of the semester.

Redesign of the course The aim of redesigning the course was to make improvements in the BL course. The process of redesigning the learning environment included developing the course Blackboard site and enhancing instructional activities.

The course blackboard site The straightforward and well-organized design of the course Blackboard site was maintained in this phase. Also, Graham (2006) states that one of the key factors is the flexibility that BL promises. The instructor benefitted from the flexibility and convenience of the blended teaching method by switching an in-class week with an online week because of her sickness, unplanned travel, or extreme weather conditions, etc. The United States presidential election of 2016 was one instance because it was held on the same date of the tenth week face-to-face class. She considered student convenience and switched the tenth week in class session with the eleventh week online class. This switch provided an opportunity for the students not to miss class on the election day.

Instructional activities The instructor continued to use the online discussions, a collaborative Google Document and multiple-choice quizzes created in the previous Phases. In this phase, the instructor and the first author jointly redesigned her PowerPoint presentations to make them effective and engaging. The first author assisted the instructor in the redesign of the presentations by drawing upon Mayer's Multimedia Learning principles (2009).

Observation of the learning environment The same observation tool used in the previous phases was employed to observe the learning environment. The results of the observation were used to help determine appropriate practices for the instructor inexperienced in teaching a BL course to successfully design and implement a BL course. The result of the observation showed that she began providing more frequent and detailed feedback and maintained the same key competencies of teaching the BL course mentioned in the previous observation. Although she strived to be more present in the online learning environment in order to demonstrate modeling of good discussion participation practices and respond to student inquiries in a timely manner, her presence wasn't sufficient to be counted as the strengths of teaching the BL course.

Interview The aim of the instructor experience evaluation interview was to unveil the instructor 's reflections on teaching an effective and efficient BL course and the use of technological resources, and to uncover her reactions to the first experience of teaching a BL course. The same method of previous phases was used in the analyses of the interview. Five themes illustrated in Table 5 emerged from the analyses of the instructor experience evaluation interview: motivation to change, benefit, ambiguity/concern, limitation and

Table 5 Summary of Instructor Experience Evaluation Interview Result for Phase Three

E m e r g i n g Themes	Sample interview comments
Motivation to change	"I was hesitant at first, but I think it (teaching BL course) went well. I was pleased." "I think it (BL) taught me because I copied the course again for next semester and then using the same layout." "I think having you work with me taught me to stay more consistent. I think it is the importance of consistency because I like to do something new every semester." "I think we have to have online materials to engage students"
Benefit	"The takeaway that we implemented with the Google Docs was a strength that I didn't really see ahead. I think that produced the greatest benefit for the class." "I was pleased. Actually, I was coming in class and they were really excited about having materials ahead of time which I was never successful to do it." "It was more structured, and it was actually productive." "when sat at night and I went to the Google doc, I saw deeper learning happening there. That's where I saw people expressed themselves, but they didn't say anything in the class. They express themselves there. It really hits me." "I think they had actually more interactions than any other semesters I've had with the students using both online and in-class materials."
Ambiguity/ Concern	"I think my weakness is maintaining consistency on the online discussion boards that I was very weak."
Limitation	"My own time challenges were not being able to spend a lot of time online for online discussions."
Resistance	"I think for that particular course because it's so clinical in nature students like to gather in groups and discuss things in person." I was a poor instructor because I also didn't want to leave class and go online so that was me. That was my fault." "It worked better than my expectations. I think I was skeptical like it won't work for the psychological class."

resistance. Respectively, the first theme refers to the instructor's desire to transform the traditional face-to-face learning environment into the BL environment. The second theme refers to her perception on the advantages of the BL course that she availed while teaching. The third theme refers to any challenges she faced while teaching the BL course. The fourth theme refers to her limitations which constrained her from teaching the BL course in the best way. The fifth theme refers to her reluctance to teach the BL course.

4 Discussion

We begin by addressing the first research question: What practices are associated with making a blended learning course effective and efficient?

Redesigning the course syllabus was the first and significant step to theoretically combine the best practices of online learning with the best practices of face-to-face learning. The optimal balance between face-to-face and online learning activities with teaching strategies and techniques was constituted by taking particular goals, the audience, and the context into account and considering the instructor's prior

experiences, motivation, expectations, and concerns of using technological resources. For instance, the instructor was uncertain about how to teach a BL course although having enough prior knowledge of using technological resources implied by "my weaknesses include organizing material in an efficient manner" and "I don't want to create another burden." Knowing her prior experiences and expectations helped make the decision while designing the BL course.

The course Blackboard site was designed to immerse the students in critical thinking, problem solving, and collaborative activities, to increase communication between the instructor and students and to deliver all learning materials online. She stated that "I have always learned some different ways to use technology, but I was skeptical like it (BL) won't work for my class…. It worked better than my expectations…I will copy the course for the next semester and then using the same layout." Also, the design of the site was straightforward and well-organized, which facilitated navigating on the Blackboard site, managing course content, editing course items for the instructor and made easier to have access and use the course content, tools, information, and materials for the students. She indicated the usefulness of the design by stating that "That [design of the course blackboard site] seems to be a very well-organized way of keeping everything together…" "I think what's improved for me was to have my class organized and release the material in a timely manner, so it gave the students predictability in consistency and they knew exactly what they were coming into." The simple and well-organized design was vital to overcome her prejudiced toward the potential and promising benefits of blended learning such as enhanced pedagogy, and increased access and flexibility (Graham et al. 2005; Graham 2006; Osguthorpe and Graham 2003).

Blended learning has great potential to improve student learning through collaborative learning strategies and active student engagement (Garrison and Kanuka 2004; Hoic-Bozic et al. 2009; Twigg 2003; Yang 2012). The integration of collaborative learning into a BL environment helps students improve their problem-solving skills and promote their performance (Kuo et al. 2012). In parallel with their findings, the use of the collaborative Google Document promoted the interactive and collaborative learning assignments in this study. It immersed the students in critical thinking and helped them increase communication and collaboration skills. The contribution of using Google documents to effective, meaningful and deep learning was explicitly declared by the instructor "the Google Docs I think was a strength that I didn't really see ahead. I think that produced the greatest benefit for the class… I think initially with the takeaway Google Docs being able to just write out some thoughts about what was interesting but what was something to think about made each class more in-depth and they were able to think more deeply about it…when I went home after class and sat at night and I went to the Google Doc, I saw deeper learning happening there. That's where I saw people expressed themselves but they didn't say anything in the class. They expressed themselves there. It really hits me. I didn't even think about it like this."

Now we address the second research question: What are the instructor's perceptions about the first experience of teaching a blended learning course?

Teaching a BL course can be a challenge for instructors who even have some experience in using learning technology (Jokinen and Mikkonen 2013). In this sense, the instructor was initially doubtful whether BL would be an obstacle for teaching and learning or would it facilitate learning and promote a better teaching experience. Her

perceptions about the first experience of teaching a BL course was very positive and she found it a beneficial learning environment overall. She stated that "I was a little hesitant at first, but I think it worked well. I was very pleased."

Advantages of blended learning include pedagogic richness, convenience of access and flexibility (Graham 2006) by using online tools to engage students in learning group activities and by creating collaborative learning opportunities (Picciano 2013). This coincides with the instructor's documented four benefits of teaching the BL course: (1) to design and implement a desired learning environment for the students, "It was more structured, and it was actually productive… You (the first author) helped me organize the class in a great way;" (2) to enable the students to learn deeper "they had to work a little bit harder… I went to the Google Doc, I saw deeper learning happening there;" (3) to enable the instructor to use strategies to heighten interactions and engagement, "I think they had actually more interactions than any other semesters I've had with students using online and in-class materials…I think we had online materials to engage students;" (4) to lead students to their learning, "we organize and release the material in a timely manner so it gave the students predictability in consistency and they know exactly what they were coming into…they were really excited about having materials ahead of time."

Yilmaz et al. (2017) find that the use of interactive platforms such as wiki, blogs, Facebook, etc. has a significant impact on students' social presence perceptions in a positive way in their experimental study. In this sense, the instructor was very satisfied with the use of the Google Document. She perceived the use of Google Docs as the most beneficial collaborative tool to provide an online platform for sharing knowledge and ideas under her guidance and for receiving supportive feedback between students and from her in the learning environment. Overall, she emphasized this tool as an efficient means of synchronous and asynchronous communication to improve the quality of teaching and learning by implying that "One thing that I've noticed coming out of this is the Google Docs has been a very value-added experience for this class… I think the Google Doc is one element that has given them a different way to engage…I think that produced the greatest benefit for the class." This result aligns with the findings of the systematic review conducted by Atmacasoy and Aksu (2018) who indicate that BL enhances student-student/teacher-student interaction.

However, as Ocak (2011) asserts that BL requires instructors to invest more time to design and deliver an effective BL course, the instructor emphatically pointed out an impediment of efficiently teaching a BL course was the time limitation. Interacting with the students, giving extra feedback on student assignments and necessarily being motivating and engaging in the online learning environment demanded extra time allocation for her. "I just haven't put the energy or the time," "My own time challenges were not being able to spend a lot of time online for the online discussions."

We now address the third question: Does the iterative process of this design-based research study improve the effectiveness and efficiency of a blended learning course throughout the semester?

The first author closely collaborated with the instructor to improve the quality of the BL course through the process of three iterative design cycles as Wang and Hannafin (2005) state that design-based research study requires a researcher to collaborate with a practitioner(s) in order to enhance an educational practice in a real-world setting through iterative analysis, design, development and implementation in a systematic

but flexible way. For this study, iterative exploration, construction and reflection on the created BL course provided an opportunity for the researchers to find applicable solutions to any real-world problems that the instructor faced in the course.

The first, even though the instructor was not actively present, proactive and engaging in online activities at the beginning of the semester, she increased her effort to guide and elicit student participation and to make further clarifications on what remained an unresolved issue in either online or face-to-face learning in successive cycles. The second, Graham (2006) indicates that BL has commonly been cited as practicing better pedagogical approaches that particularly means shifting from a passive teacher-approach to an active/collaborative approach. This shift was achieved through promoting active learning strategies and peer-to-peer learning strategies within the iterative process of analysis, design, development and implementation of the learning environment such as modifying or adding interactive learning activities over each phase. The third, providing a high-quality learning experience in BL depends on the instructor's roles in planning, enacting and delivering (Wenger and Ferguson 2006, p.79). These roles can be varied but coaching, mentoring and counseling are considered as significant roles (Bonk et al. 2006, p.564). Each subsequent design cycle helped the instructor play these critical roles better. For instance, she realized the importance of spending more time for support and guidance, and the beneficial effect of using technological tools to promote engaging students in collaborative and personalized tasks. These results align with the findings of design-based research conducted by Jepchumba and Gaceri (2013) who find teachers who take a part in designing and implementing a BL environment in a systematic manner gain technical knowledge and skills that significantly contribute to their professional development and also improve their teaching practices. Overall, she made many major and/or minor amendments to maximize the effectiveness and efficiency of the BL course through the iterative process of this design-based research method.

5 Limitations and suggestions for further research

A limitation could be the absence of follow-up interviews with the instructor to obtain further information about whether she keeps teaching BL courses after the study. Asking the follow-up questions to her can be very useful to see the impact of the study in the long run. Another limitation could be the generalizability of this research because of the chosen research approach. Designing, implementing and redesigning a BL course through the three phases depended mainly on the instructor's prior experiences, motivation, expectations, and concerns of using technological resources and so the findings could vary from learning context to learning context. Therefore, it will be beneficial to explore the impact of further similar studies in different contexts. Also, the situation discussed in this study can be planned as an experimental study such as a traditional face-to-face learning course as a control group and a BL course created by design-based research as an experimental group and the results in terms of the effectiveness of course design, the student outcomes and satisfaction can be compared.

6 Implications for practice

This study can offer various implications that instructional designers and instructors, who have never experienced teaching a BL course specifically, may take advantage of creating a BL course. Extensive qualitative data collection demonstrated many practical and beneficial design factors that addressed the issue of integrating the best features of online learning into the best features of face-to-face learning.

In this study, the potential benefits of BL such as enhanced pedagogy, and increased access and flexibility (Graham et al. 2005; Graham 2006 & Osguthorpe and Graham 2003) were achieved through using the course Blackboard site and providing a variety of instructional activities. Providing active learning and collaborative learning activities were vital to convert the traditional course into the BL course in terms of the transition from an instructor-centered approach to a student-centered approach. This transition and the improvement of the BL course were put into practice through the process of three iterative design cycles. Therefore, instructional designers might consider the importance of obtaining feedback from instructors, students and other instructional designer about the design of the BL environment as well as monitoring it. According to the findings, the instructional designers may have the opportunity to systematically redesign the BL environment in order to optimize it.

Although an instructor knew the potential benefits of BL, it was an intimidating experience for the instructor to design, implement and finally teach a BL course. Due to her/his initial perception regarding the complexity of designing a BL course, s/he was skeptical to play an active role in the process of creating a BL course and to teach it. In order to surpass this initial feeling, it was not enough to show the benefits of BL to her/him. It was necessary for her/him to perceive that his/her ability to apply technological processes and tools was perfectly adequate and to realize the benefits of BL for himself/herself, students and the course itself. The importance of a straightforward and well-organized design became evident in this study and it also presented a neat way for the instructor to easily select, utilize and manage the adopted technologies. The instructional designer might consider designing a straightforward and well-organized site and providing easy-to-handle learning activities for those who are inexperienced or with limited experience in designing and teaching a BL course.

7 Conclusion

The purpose of this design-based research study was to determine what elements were needed to assist a higher education instructor inexperienced in designing and teaching a BL course to successfully create and implement it and to document the instructor's perceptions about her first experience of teaching a BL course. The results of this study demonstrated that it was significant to alleviate the instructor's prejudice against BL in terms of designing, implementing and finally teaching a BL course. In this sense, the design of the BL course was kept simple and well-organized. Also, her prior experiences and expectations should be taken into consideration while making

decisions on designing a BL course. Spanjers et al. (2015) indicate that the potential of BL can become apparent in the implementation of a BL course if it has thoughtfully designed. Inal and Korkmaz (2019) find a significant effect of BL to the academic achievement of students compared to the traditional method in their experimental study after the design of BL was rigorously carried out.

Blackboard Learn (Learning Management System) and Google Documents were two beneficial learning resources to create the desired BL environment. The design and implementation of these learning resources enabled the instructor to shift from a traditional teacher-centered teaching model to a student-centered teaching model. The learning environment that was improved in terms of the quality of teaching and learning encouraged students to be productive and engaging. Students became active and interactive learners through the adoption of active learning approaches and transactional collaborative learning approaches in the designed blended learning course. In order to enhance the efficiency and effectiveness of learning activities, increase the quality learning and teaching experiences and maximize the productivity of the BL course, the learning environment was rigorously and thoughtfully modified through the process of three iterative design cycles. Finally, the instructor's overall perception was positive toward taking the role in designing and implementing an optimized BL course and she was very satisfied with teaching a blended learning course.

Compliance with ethical standards

Conflict of interest   Author Ahmet Berk Ustun declares that he has no conflict of interest. Author Monica W. Tracey declares that she has no conflict of interest.

Ethical approval   All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent   Informed consent was obtained from all individual participants included in the study.

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