

Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 116 (2014) 4596 – 4603

Procedia
Social and Behavioral Sciences

5th World Conference on Educational Sciences - WCES 2013

The past, present and future of blended learning: an in depth analysis of literature

Bayram Güzer^{a*}, Hamit Caner^a^aEastern Mediterranean University, Faculty of Education, Department of Educational Sciences, Famagusta, North Cyprus

Abstract

Blended learning emerged as one of the most popular pedagogical concepts at the beginning of 2000. With an increasing tendency, many researches have reported on blended learning since it flourished. The lack of technological availability prevented blending of traditional face-to-face learning with distributed learning environments. However, within the recent 10 years the introduction of the new technological innovations filled the gap between traditional face-to-face learning and distributed learning environments. The main purpose of this study is to review and analyze the studies carried out on blended learning through reflecting on the past, the present and the future. Graham (2006) stated that blended learning would have a great role in the future and it would be dominated by the distributed learning environments. To sum up, recent developments in technology encourage teacher educators to apply blended learning in their classrooms but how it should be implemented will be one of the key questions to be discussed in this research.

© 2013 The Authors. Published by Elsevier Ltd. Open access under [CC BY-NC-ND license](http://creativecommons.org/licenses/by-nc-nd/3.0/).

Selection and/or peer-review under responsibility of Academic World Education and Research Center.

Keywords: Blended learning, hybrid learning, distributed learning environments, face-to-face learning environments;

1. Introduction

Distance education is one of the alternatives against traditional instruction. The cardinal tenant behind the distance education is about being able to teach while students and teachers are not in the same context at all (Moore and Kearsely, 2011). In their book, Moore and Kearsely (2011) clarified starting point of the distance education. They emphasized that people think the internet as the starting point of distance education but the real starting point occurred through letter correspondence between teacher and student. They categorized distance education into five generations which are correspondence, broadcast radio and television, open universities, teleconferencing and the Internet/Web (Moore and Kearsely, 2011). Basic idea behind the distance education is common in all generations that are being able to teach and learn while student and teacher are at different places.

The spread of the Internet increased the popularity of distance education and created new terminologies like online learning, e-learning or web-based learning. *Online learning* is defined as the use of Internet to access learning materials; to interact with the content, instructors and other learners (Ally, 2002 cited in Anderson, 2008). Many researches have been conducted in relation to online learning, their dimensions and variables having impact on the online learning. Furthermore it is compared with traditional face-to-face instruction. One of the most important

* Bayram Güzer. Tel.: +90-533-875-7866

E-mail address: bayram.guzer@emu.edu.tr

debates is about whether students can learn better at the online learning environment compared to traditional classroom environment. Blended learning have been become the center of attention at the beginning of the 2000 as an eclectic approach while scholars are debating on the best environment for students. In blended learning, main idea is to benefit on good sides of both approaches. This paper aims to review blended learning with respect to its past, present, future and provide insight information on it.

2. The article review methodology

Google Scholar is one of the services of Google, which indexes articles published in scholarly journals and provides you opportunity to search within articles. According to Google Scholar search results, *Blended learning* is traced to be used first time at the beginnings of 2000. This led us to a conclusion that idea of blended learning has limited history within the recent twelve years. In classification of articles, *Blended Learning* term is searched in the title of articles at 30th of November 2012. Search results are classified in Table 1 below. In this study, it is aimed to review blended learning studies within this twelve year period by classifying them past and present studies. *Present period* is defined as recent three years from 2010 to 2012. *Past period* is defined as the remaining years from 1999 to 2009. In this study, we aimed to review most frequently cited articles and we selected 28 most frequently cited articles/books from Google Scholar. Average citation of all reviewed articles is 226,29.

Table 1. Classification of articles including “blended learning” in the title at Google Scholar database

Classification	Sub-Classification	Year range	Number of articles
Past	First attempts	1999-2002	125
	Definition period	2003-2006	1200
	Popularity period	2007-2009	1460
Present		2010-2012	1660

3. Past of the blended learning

3.1. First attempts (1999-2002)

First attempts on the idea of blended learning begun at the 2000. Cooney et. al. (2000) carried out one of the first studies that used the term “blended learning”. They aimed to combine elements of play and work in a prekindergarten school in order to acquire blended activities (Cooney et. al.,2000). Although Cooney et. al.(2000)’s study is far from the general use of blended learning, it is still important to apply the idea of blending learning.

Voci and Young (2001) integrated e-learning into their instructor-led six-month leadership development training programme in order to benefit from instructor-led training and e-learning at the same time. Their results revealed increase in sense of teamwork, establishment of common concepts and language and greater efficiency in group learning (Voci and Young, 2001).

Another study is conducted by Bonk et. al. (2002) in a high-stake course at military. They aimed to understand how blended approach affects professional development of students in a military course. They applied asynchronous internet-based learning in first phase, synchronous learning in virtual collaborative chat tool and residential face-to-face learning in the third phase (Bonk et. al, 2002). Moreover they conducted interviews with students, instructors, education advisor and provided perceived advantages and disadvantages of the system (Bonk et. al., 2002). Overall results indicated that although online learning is favored as enjoyable and flexible; however at most learning occurred in the residential face-to-face phase (Bonk et. al., 2002). Bonk et. al. didn’t designed complete blended learning course but it was an attempt to support online learning courses with face-to-face session at different times.

Stewart (2002) advocated mix of self-paced asynchronous work-based learning with synchronous face-to-face instructor-led learning in intercultural trainings. *First attempts period* consisted of studies on blended learning that

appeared as an idea of supporting online learning with face-to-face traditional learning but there were not exact definitions on blended learning.

3.1.1. *Definition period (2003-2006)*

This period (2003-2006) is named as *Definition period* because most frequently cited articles are on defining blended learning. One of the most cited articles is written by Russel T. Osguthorpe and Charles R. Graham in 2003. Osguthorpe and Graham's (2003) definition on blended learning is as follow: "Blended learning combines face-to-face with distance delivery systems... but it's more than showing a page from a website on the classroom screen...those who use blended learning environments are trying to maximize the benefits of both face-to-face and online methods." Furthermore, they suggested three different blending models that are blend of learning activities, blend of students and blend of instructors (Osguthorpe and Graham, 2003). In first model, same students can benefit from both activities in face-to-face classroom and activities in online learning environment; in second model, they suggested that students in the face-to-face classroom can be blended with different students in the online learning environment; in the third model, they suggested that students in the face-to-face classroom can benefit from other instructors through online learning environment (Osguthorpe and Graham, 2003).

Singh (2003) defined dimensions that can be blended as offline and online learning, self-paced and collaborative learning, structured and unstructured learning, custom content with off-the-shelf content, learning, practice and performance support. He indicated that since technology changes, organizations will also support blended learning programs instead of single delivery mode programs (Singh, 2003).

Garrison and Kanuka's (2004) study is the most cited article on blended learning. They discussed the potential of blended learning in higher education by considering problems faced in higher education. Garrison and Kanuka (2004) stated that "blended learning is the thoughtful integration of classroom face-to-face learning experiences with online learning experiences." In addition, they explored benefits of blended learning in higher education with respect to administration and development characteristics that those benefits are policy, planning, resources, scheduling and support. Their results indicated that blended learning can lead the process for redefining higher education institutions as being learner centered and facilitating higher learning experience (Garrison and Kanuka, 2004). Additionally, they advised scholars to research the effectiveness of blended learning in critical and reflective thinking.

Graham (2006) summarized blended learning, its' background, definition, trends, blend categories, challenges faced and future directions in chapter of his book. All of the studies reviewed in put great effort in defining blended learning. As it is illustrated in Table 1 above, articles in popularity period is found as 1460 that shows an increasing trend in comparison to articles in definition period. Next period of articles that is published between 2007 and 2009 is classified as *Popularity period*.

3.1.2. *Popularity period (2007-2009)*

Last period of the articles investigated in *Past period* is named as *Popularity period*. It is observed that increasing trend of the blended learning continued within this period as well. Thirteen articles were reviewed that published in scientific scholarly journals. In *Popularity period*, it is observed that there are two general points that have got attention by scholars. These points are perceptions of participants on blended learning and effectiveness of the blended learning. For that reason, reviewed articles were categorized into two classifications that are perceptions related articles and effectiveness related articles.

3.1.2.1. *Perceptions*

Scholars are curious about perceptions of students and other participants on blended learning. In popularity period, four articles are reviewed that are studying participants' perceptions on blended learning. Chen and Jones (2007) conducted a survey on MBA students in an accounting class. They aimed to assess students' evaluation of

course effectiveness and overall satisfaction of the traditional and blended courses. Students' perceptions indicated that students in traditional setting were more satisfied with the clarity of instruction (Chen and Jones, 2007). On the other hand, students in blended learning class gained an appreciation of the class and indicated more strongly that their analytical skills improved (Chen and Jones, 2007). This study indicated that when students are in traditional setting, instruction becomes clearer but when they are in blended class, learning process may become doubtful for them although they see more improvements in their analytical skills.

Akkoyunlu and Soylu (2008) researched students' views on blended learning with respect to their learning styles. They indicated that students' views on blended learning are positive with a level of 8.44 in a range of 1 to 10, 1 being the lowest and 10 being the highest. Furthermore, Akkoyunlu and Soylu (2008) pointed out that highest grade of students' perceptions is given to face-to-face environment that learning is best linked with classroom teaching. Face-to-face learning environment is favored in both studies (Akkoyunlu and Soylu, 2008; Chen and Jones, 2007).

Chandra and Fisher (2009) have studied high school students' perceptions of a blended web-based learning environment. Their findings revealed that web-based learning environment has been evaluated as convenient, accessible, promoted autonomy of learning, promoted positive interactions between peers during web-based lessons, enhanced enjoyment and regarded as clear, easy to follow and understandable. Moreover, students preferred asking questions to teacher as face to face instead of asking through email (Chandra and Fisher, 2009). All these findings showed that face to face instruction is regarded as one of the very important part of education.

Another study on perception carried out by So and Brush (2008) on 48 graduate students with respect to satisfaction, social presence and collaborative learning in a blended-format course in health education. In their findings, students who collaborated at high level, tend to be more satisfied with the blended course and perceived high levels of social presence (So and Brush, 2008). So and Brush (2008) indicated that psychological distance and social interaction got an important role in online collaborative learning. In general, course structure, emotional support and communication medium identified as most critical factors with respect to students' perceptions. Furthermore, communication medium is perceived as effective in general but absence of immediate feedback and synchronicity is regarded as negative parts of the course (So and Brush, 2008).

As a result, all these four perceptions studies provided insight information on students' perception and the general conclusion in all studies indicated that students favored web-based online learning environment as effective but they did not want to give up from face to face component of the course. This is one of the rationales of blended learning approach that advocates benefiting from advantages of both online and face to face learning environments.

3.1.2.2. Effectiveness

For *Popularity period* of blended learning, significant numbers of studies were dwelled on effectiveness. Among these, six scientific articles published in journals from 2007 to 2009 is reviewed. In two of the nine studies, effectiveness was evaluated in general (Deliagaoglu and Yildirim, 2008; El-Deghaidy and Nouby, 2009). In the remaining four studies, effectiveness was evaluated with respect to some independent variables that are achievement, satisfaction, behavior, critical thinking skills, learner support, participation, interaction, affect and retention (Akyüz and Samsa, 2009; Hughes, 2007; Melton et. al., 2009; Woltering et. al., 2009).

In a study conducted by Hughes (2007), it is aimed to measure effectiveness of blended learning on learner support and retention. She conducted an action research in third year undergraduate module and designed a blended course. In this blended course, she decreased face-to-face contact time and increased tutor support especially for 'at risk' students (Hughes, 2007). She preferred to use blended learning in order to decrease the effort put for teaching and increasing the effort for tutoring 'at-risk' students. Her results indicated that mixture of well-prepared blended learning with proactive help and encouragement for 'at-risk' learners improves coursework submission and module retention without extra effort (Hughes, 2007) that can be regarded as very effective in helping lecturers to manage their time better.

Melton et. al. (2009) studied effectiveness of blended learning undergraduate health course on student satisfaction and student achievement. They applied quasi-experimental research design and measured students' course grades, satisfaction and teacher evaluation. It is found that students in blended class were significantly more

satisfied than students in traditional class (Melton et. al.,2009). Furthermore, there was not any significant difference on students' pre-test and post-test grades (Melton et. al., 2009).

Akyuz and Samsa (2009) were interested in the effectiveness of blended learning on critical thinking skills of students. The study was carried out on 44 students studying in the department of computer and instructional technology education of Ankara University. It was an experimental study which had pre and post test applications (Akyuz and Samsa, 2009). They measured students' critical thinking skills with Watson-Glaser Critical Thinking Appraisal Test once prior to five weeks blended learning course and once after the blended learning course. Their results indicated that there are no significant differences between pre-test and post-test scores. This result indicated that effectiveness of blended learning on critical thinking skills has not been observed in this study (Akyuz and Samsa, 2009).

A study by Deliağaoğlu and Yıldırım (2008) aimed to compare effectiveness of blended learning with traditional learning. They used MOLTA model to design the course and conducted further evaluations on students' achievement, knowledge retention, attitudes and course satisfaction on both traditional and blended learning environments (Deliağaoğlu and Yıldırım, 2008). Their study showed that both groups had similar achievement levels and knowledge retention. Furthermore, high level of positive attitudes and course satisfaction were reported by both groups. In conclusion, their study indicated no significant difference but satisfaction from blended environment was higher.

El-Deghaidy and Nouby (2008) applied blended e-learning cooperative approach (BeLCA) on pre-service teachers achievement, attitudes and cooperativeness. They conducted quasi-experimental study on twenty-six science pre-service teachers in an Egyptian university (El-Deghaidy and Nouby, 2008). Their findings indicated that achievement of students in blended group is significantly higher than students in control group. Besides, they found that students' attitudes towards e-learning are significantly higher in blended group. In students' attitudes towards cooperativeness, no significant difference found between both groups (El-Deghaidy and Nouby, 2008). El-Deghaidy and Nouby regarded blended learning as effective with respect to attitudes and achievement.

Woltering et. al. (2009) aimed to find out whether blended problem-based learning in medical education increases students' motivation and support learning process with respect to student cooperation. They used a survey to compare traditional problem-based learning with blended problem-based learning. This survey consisted of eight categories (Woltering et. al., 2009). Their findings showed that among these categories, there were significant differences between groups in motivation, satisfaction and subjective learning gains (Woltering et. al., 2009). As a result it was found that blended problem-based learning increased the student motivation, student satisfaction and subjective learning outcomes (Woltering et. al., 2009).

In all the studies analyzed at popularity period of blended learning, scholars measured effectiveness of blended learning on different variables such as satisfaction, motivation, achievement, attitude, cooperativeness, knowledge retention, critical thinking skills and drop-out rate for at risk students. The general findings indicated that there is no significant difference on achievements of students between blended learning and traditional learning but on the other variables like satisfaction, motivation, drop-out rate for at-risk students, attitude and knowledge retention blended learning is observed as superior (Deliağaoğlu and Yıldırım, 2008; El-Deghaidy and Nouby, 2009; Hughes, 2007; Melton et. al., 2009; Woltering et. al., 2009). Furthermore, no significant effect has been observed on critical thinking skills of students in a blended learning experiment (Akyüz and Samsa, 2009).

4. Present of the blended learning

As it was reflected in Table-1 above, present of the blended learning has been classified from articles published between 2010 and 2012 which covers the recent three years. In this period totally seven most frequently cited articles were reviewed in order to observe the recent trends in blended learning.

Miyazoe and Anderson (2010) studied effectiveness of forums, blogs and wikis in an English as foreign language (EFL) blended learning course in a university in Tokyo, Japan. They applied the study in three blended classes and got students' perceptions through questionnaire, interview and written assignments (Miyazoe and Anderson, 2010).

In quantitative analysis it is found that wikis preferred as the favorite among forums and blogs by students. In qualitative analysis it is found that students had positive feelings on blended learning such as novel, easy and fun as most frequently occurring words in their perceptions and blended learning is regarded as supportive learning environment for the course (Miyazoe and Anderson, 2010).

Donnelly (2010) conducted a study on *interaction* in blended problem-based learning at a university environment. She studied other side of the blended problem-based learning that is perceptions of academic staff. In this qualitative study, experiences of 17 academic staff participants in a blended problem-based learning (PBL) module were asked and their perceptions provided (Donnelly, 2010). She advocated technology to support interactions. Furthermore, use of harmonization in blended PBL will create perfect blend of online and face to face environments (Donnelly, 2010).

López-Pérez et. al.(2011) reported 1431 students' perceptions that participated in blended learning activities. They indicated that students got positive perceptions on blended learning. It is also observed that blended learning reduced drop-out rates and raised exam pass rates (López-Pérez et. al., 2011).

Yeh et. al. (2011) focused on knowledge management in a blended learning environment. Their aim was to examine blended learning environments' effects on pre-service teachers' professional development in creativity instruction. They used a special model for knowledge management. This model includes four modes in knowledge management that are socialization, externalization, combination and internalization. The name of the model, SECI, comes from the initials of these four modes. An experimental study was conducted with instruments on professional knowledge and teaching efficacy (Yeh et. al., 2011). They measured students' responses with repeated measure analysis of variance and it was found that blended learning environment could improve participants' professional knowledge and personal teaching efficacy related to creativity instruction (Yeh et. al., 2011).

Yen and Lee (2011) blended mobile learning, web-based learning and classroom teaching in their study and aimed to find out problem solving patterns and their impact on learning achievement. They used quasi-experimental method and gathered information on self-assessment by students, weekly interviews, logs and achievement test (Yen and Lee, 2011). Results indicated that gender is an important factor on enjoying using technological tools in learning environments; classroom group discussions encourage students to interact more and achieve high learning outcomes in the problem solving process; students should be encouraged and appropriate learning strategies should be used according to students (Yen and Lee, 2011).

Jia et. al. (2012) conducted their study on 96 middle school students who are taking English course in China. They used moodle as blended learning management system tool and conducted an experimental study (Jia et. al., 2012). They measured students performance on six different tests throughout the semester and compared the results on both control and experiment groups. The results indicated that blended learning with vocabulary assessment system improved both the vocabulary acquisition and exam performance of students. However, only thirty percent of the students wanted to use the system outside the class. The reason of that is predicted as students' heavy workload (Jia et. al., 2012).

Smyth et. al. (2012) conducted a qualitative study on first year postgraduate students in the School of Nursing and Midwifery in Ireland. They aimed to discover benefits and challenges of blended learning (Smyth et. al., 2012). It is indicated that blended learning's accessibility and flexibility is preferred by students which help them on studying and planning their own learning (Smyth et. al., 2012). Furthermore, participants got more response in learning the content and believed that they learnt more on this method of studying (Smyth et. al., 2012). As a challenge, participants reported that social interaction is better in traditional method, late feedbacks were annoyed them and poor internet connection disallowed participants to use the blended learning system. Overall, participants in this study indicated positive feelings on blended learning system (Smyth et. al., 2012).

In summary, present studies on blended learning is examined with respect to recent articles published within the recent three years (2010 – 2012). It is observed that blended learning is getting increasing attention and studied in different areas on different variables. One thing is common in all studies that it is preferred by the participants but it should be studied carefully in order to benefit more from it.

5. Future of the blended learning

In all studies reviewed in this paper, it is observed that “blended learning” is perceived as useful, enjoyable, supportive, flexible and motivator for learners. However, these factors are not sufficient enough to create an atmosphere for successful learning. In other words, in order to create a positive learning environment, teachers using blended learning environments should encourage students for more participation in the environment and should find ways of creating social interaction through more collaboration. Furthermore, blending of face to face and online learning environments should be planned precisely in order to benefit more from this approach.

Besides this, it is also found that blended learning is studied on different variety of schools and participants from postgraduate students to middle school students; from nursing to English courses and from training programs to high level courses at military. Therefore, all these examples indicates that blended learning will got increasing attention from different areas.

In near future, there should be more studies guiding teachers or administrators on how to create a successful blend. Moreover, near future will be dominated by tablets, smart phones and touch screen devices that will be some of the next interests to be studied in blended learning courses. As technological innovations spread, new types of blends will occur and education will be blended with different technologies but the key question to be answered will remain same “How should we organize such learning environments in order to support learning effectively?”. The answer is we should study to integrate constructivist and collaborative models into blended learning environments and aim to educate more creative and curious students who reads, writes and produces for the world.

References

- Akkoyunlu, B., & Soylu, M.Y. (2008). A study of student’s perceptions in a blended learning environment based on different learning styles. *Educational Technology & Society*, 11(1), 183-193.
- Akyüz, H.İ., & Samsa, S. (2009). The effects of blended learning environment on the critical thinking skills of students. *Procedia Social and Behavioral Sciences*, 1(1), 1744-1748.
- Anderson, T. (2008). *The theory and practice of online learning*. (2nd ed.). Athabasca University Press.
- Bonk, C.J., Olson, T.M., Wisher, R.A., & Orvis, K.L. (2002). Learning from focus groups: An examination of blended learning. *Journal of Distance Education*, 17(3), 97-118.
- Chandra, V., & Fisher, D.L. (2009). Students’ perceptions of a blended web-based learning environment. *Learning Environment Research*, 12, 31-44.
- Chen, C.C., & Jones, K.T. (2007). Blended learning vs. traditional classroom settings: Assessing effectiveness and student perceptions in an mba accounting course. *The Journal of Educators Online*, 4(1), 1-15.
- Cooney, M.H., Gupton, P., & O’Laughlin, M. (2000). Blurring the lines of play and work to create blended classroom learning experiences. *Early Childhood Education Journal*, 27(3), 165-171.
- Donnelly, R. (2010). Harmonizing technology with interaction in blended problem-based learning. *Computers & Education*, 54(2), 350-359.
- Deliağaoğlu, Ö., & Yıldırım, Z. (2008). Design and development of a technology enhanced hybrid instruction based on MOLTA model: Its effectiveness in comparison to traditional instruction. *Computers & Education*, 51(1), 474-483.
- El-Deghaidy, H., & Nouby, A. (2008). Effectiveness of a blended e-learning cooperative approach in an Egyptian teacher education programme. *Computers & Education*, 51(3), 988-1006.
- Garrison, D.R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet and Higher Education*, 7(2), 95-105.
- Graham, C. R. (2006). Blended learning systems: Definitions, current trends and future directions. In C. J. Bonk, & C. R. Graham (Eds.), *The Handbook of blended learning: Global perspectives, local designs* (pp. 3-21). San Francisco: Pfeiffer.
- Hughes, G. (2007). Using blended learning to increase learner support and improve retention. *Teaching in Higher Education*, 12(3), 349-363.
- Jia, J., Chen, Y., Ding, Z., & Ruan, M. (2012). Effects of a vocabulary acquisition and assessment system on students’ performance in a blended learning class for English subject. *Computers & Education*, 58(1), 63-76.
- López-Pérez, M., Pérez-López, M. C., & Rodríguez-Ariza, L. (2011). Blended learning in higher education: Students’ perceptions and their relation to outcomes. *Computers & Education*, 56(3), 818-826.
- Melton, B., Graf, J., & Chopak-Foss, J. (2009). Achievement and satisfaction in blended learning versus traditional general health course designs. *International Journal for the Scholarship of Teaching and Learning*, 3(1).
- Miyazoe, T., & Anderson, T. (2010). Learning outcomes and students’ perceptions of online writing: Simultaneous implementation of forum, blog, and wiki in an EFL blended learning setting. *System*, 38(2), 185-199.

- Moore, M., G., & Kearsley, G. (2011). *Distance education: A systems view of online learning*. (3rd ed.). Wadsworth: Cengage Learning, (Chapter 2).
- Osguthorpe, R.E., Graham, C.R. (2003). Blended learning environments. Definitions and directions. *The Quarterly Review of Distance Education*, 4(3), 227-233.
- Singh, H.(2002). Building effective blended learning programs. *Educational Technology*, 43(6), 51-54.
- Smyth, S., Houghton, C., Cooney, A., & Casey, D. (2012). Students' experiences of blended learning across a range of postgraduate programmes. *Nurse education today*, 32(4), 464-468.
- So, H-J., & Brush, T.A. (2008). Students perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education*, 51(1), 318-336.
- Stewart, J.M. (2002). A blended e-learning approach to intercultural training. *Industrial and Commercial Training*, 34(7), 269-271.
- Voci, E., & Young, K. (2001). Blended learning working in a leadership development programme. *Industrial and Commercial Training*, 33(5), 157-160.
- Wang, M., Shen, R., Novak, D., Xioayan P. (2009). The impact of mobile learning on students' learning behaviors and performance: Report from a large blended classroom. *British Journal of Educational Technology*, 40(4), 673-695.
- Woltering, V., Herrler, A., Spitzer, K., Spreckelsen C. (2009). Blended learning positively affects students' satisfaction and the role of the tutor in the problem-based learning process: Results of a mixed-method evaluation. *Advances in Health Sciences Education*, 14(5), 725-738.
- Yeh, Y. C., Huang, L. Y., & Yeh, Y. L. (2011). Knowledge management in blended learning: Effects on professional development in creativity instruction. *Computers & Education*, 56(1), 146-156.
- Yen, J. C., & Lee, C. Y. (2011). Exploring problem solving patterns and their impact on learning achievement in a blended learning environment. *Computers & Education*, 56(1), 138-145.