

Review on Blended Learning: Identifying the Key Themes and Categories

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Abstract—Blended learning is getting popular nowadays. Even though many studies have been conducted on online learning, studies specifically on blended learning are still scarce. This paper reports on a systematic literature review about blended learning of 103 journal research articles. The purpose of the review is to explore the status of blended learning research, and identify their themes and categories according to their contents. Twelve themes are identified of the articles examined in this paper. Findings showed that these researches mainly belong to six categories: design, strategy, factors, evaluation, methodology and review. Researches in each category are discussed in this paper. Future directions for research are discussed.

Index Terms—Blended learning, review, themes, categories.

I. INTRODUCTION

The term “blended learning” is being used with increased frequency in both academic and corporate circles [1]. Blended learning, combining the best elements of online and face-to-face education, is likely to emerge as the predominant teaching model of the future [2]. Blended Learning could become one of the most significant developments of the 21st century” [3]. Although blended learning or blended e-learning sounds like a confusing term at first since it is relatively a new term for today’s instructors [4], it is an inevitable trend because traditional face-to-face learning environment is indispensable for social aspect of teaching and learning however Internet based asynchronous technologies such as e-mail, forum, listserv, blog, e-portfolio, webfolio.etc. can provide learners more flexible and interactive learning environments independent from time and space [5]. This new approach to learning incorporates and integrates the strengths of face-to-face and online learning in a synergistic manner to create a “unique learning experience congruent with the context and intended educational purpose” [6]. Today’s framework of blended learning is filled with various blends and models that makes it difficult for educators to agree in opinion with a single definition of blended learning. In this paper, the authors agree with the definition of Colis and Moonen [7] who defined blended learning as a hybrid of traditional face-to-face and online learning so that instruction

occurs both in the classroom and online, and where the online component becomes a natural extension of traditional classroom learning. In recent years, research and implementation of blended learning is getting popular. Even though many studies have been conducted on online learning, studies specifically on blended learning are still scarce. Therefore, it is needed to look into the literatures to investigate the various opinions for blended learning available. This paper aims to explore the status of blended learning research, and identify their themes and categories according to their contents.

II. METHODS

The paper follows a theoretical procedure of literature review by Hemingway and Brereton [8]. According to their theory, high quality systematic reviews seek to:

- Identify all relevant published and unpublished evidence
- Select studies or reports for inclusion
- Assess the quality of each study or report
- Synthesise the findings from individual studies or reports in an unbiased way
- Interpret the findings and present a balanced and impartial summary of the findings with due consideration of any flaws in the evidence.

TABLE I: KEY THEMES AND CATEGORIES IDENTIFIED

	Key Themes	Categories
103 Articles	Blended learning design	Design
	Blended learning as a strategy	Strategy
	Learners factors influencing BL	Factors
	Institutional factors influencing BL	
	Teachers' factors influencing BL	
	Evaluation	Evaluation
	Implementation	
	Benefits and barriers	
	Comparative study	Methodology
	Case study	
	Literature Review	Review
	Overall introduction	

After identifying all relevant published and unpublished evidence by searching from google, the author selected 103 articles from Science Direct by searching titles with “blended learning” in the Social Sciences Area. Science Direct is a website which provides subscription-based access to a large database of scientific research. The articles were downloaded with full text and were listed in a table with the following items: article title; authors name; year publication; type; journal name; level of education; country of the study; full or not; download; source; key themes. At last, 12 key themes are identified, as is shown in Table I, then they are developed and

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integrated into six general categories: Design; Strategy; Factors; Evaluation; Methodology; Review. The article will be analyzed under these six categories in the following part.

III. FINDINGS

A. Blended Learning Design

There are 29 research articles which are about blended learning design. Among which 7 research articles emphasize online component, especially for online tools used. 22 articles propose blended learning models, programmes, etc.

For the 7 research articles which emphasize online component, 3 of them are about the use of Moodle as the online tool for blended learning [9]-[11]. Muscarà and Beercock [9] utilized the wiki tool in the Moodle open source learning management system (LMS) as both the group database management and project presentation tool. Jia, *et al.* [10] customized the open source course management system Moodle to build the individualized vocabulary review and assessment functions for English instruction. Hertsch [11] focused on the Moodle testing system, which offers an alternative to classical testing, to enrich its course system successfully. 4 of them emphasize online components [12]-[15]. Derntl and Motschnig-Pitrik [12] proposed a layered framework for deriving Web-based support from these educational principles. Méndez and González [13] proposed a Fuzzy Logic based controller for a blended learning approach in an introductory control engineering course, which is based on a web tool called ControlWeb. Hubackova, *et al.* [14] prepared on-line courses which are based on tutors' and students' needs, students' knowledge, on teachers' long term experience, and of course on the positive attitude of ICT students (and not only of them) to modern technologies. Miyazoe and Anderson [15] reported on empirical research investigating the qualitative changes in writing proficiencies in response to using three online writing tools, i.e., discussion forums, blogs, and wikis, in an EFL blended-format course.

For the 22 articles which propose blended learning models or programmes, each article has created its own model or program. For example, Köse [16] described a blended learning model which consists of face to face environment and online learning process formed with Web 2.0 technologies. Yeh *et al.* [17] developed a teacher training program that integrates knowledge management (KM) and blended learning.

B. Blended Learning as a Strategy

There are 21 research articles which utilize blended learning as a strategy, among which 6 of them utilize blended learning in medical sciences, in which 2 of them are about radiology [18], [19]. Bleiker, *et al.* [18] undertook a small scale research project to develop blended learning resources for the teaching of patient care to radiography students. Mahnken, *et al.* [19] investigated whether there are differences in learning outcomes after the application of self-determined (intrinsic motivation) or mandatory (extrinsic motivation) use of e-learning units in an undergraduate radiology internship. 1 article is about nurse education [20].

Pfefferle, *et al.* [20] created new didactical and technical e-learning tools for Europe-wide use in nursing education. 1 article is about clinical medicine [21]. Makhdoom, *et al.* [21] assessed the effectiveness of blended learning in studying family medicine as an example of a clinical medical science. 1 article is about Intelligent virtual microscopy [22]. Schmidt, *et al.* [22] developed and integrated a novel virtual microscope, MyMiCROscope, into a face-to-face approach for teaching microscopic anatomy to improve the individual student's learning situation. 1 article focuses upon ill-health during pregnancy and childbearing [23]. Young and Randall [23] described the different teaching and learning methods which were blended together to create a module for second year pre-registration midwifery students in England, which focused upon ill-health during pregnancy and childbearing. 5 articles engaged in language teaching and learning [10], [11], [14], [24], [25], Jia, *et al.* [10] customized the open source course management system Moodle to build the individualized vocabulary review and assessment functions for English instruction. Hertsch [11] focused on the Moodle testing system, which offers an alternative to classical testing, to enrich its course system successfully. Hubackova, *et al.* [14] prepared on-line courses of professional English, courses of area studies of English speaking countries, courses of professional German, a course for translators, written business English course and others in order to facilitate the language study to students. Klimova and Semradova [24] listed the benefits of blended learning for the teaching of foreign languages and emphasised the importance of autonomous learning in this process. Maulan and Ibrahim [25] developed a blended learning pilot project for English for Academic Purposes and examined the students' perception, engagement and performance in the blended learning environment. 2 articles studied blended learning in mathematics [26], [27]. Kashefi, *et al.* [26] established a model of teaching and learning to support students' mathematical thinking in the learning of two-variable functions through a blended learning environment. Kashefi, *et al.* [27] also used blended learning environment based on mathematical thinking and Creative Problem Solving to support students' communication and teamwork skills in the learning of multivariable calculus. 2 articles studied blended learning in engineering [28], [29]. Kashefi, *et al.* [28] discussed and proposed a learning environment for supporting students' thinking and creative problem solving in engineering. Sivakumar, *et al.* [29] provided a framework on the implementation of blended learning (BL) for engineering undergraduate programmes. The other 6 articles are unclear for subject or multi-subjects.

C. Factors Influencing Blended Learning

There are 13 research articles explore factors in blended learning, among which 8 articles are about learner factors, in which 4 of them concerned the students' perceptions of blended learning [25], [30]-[32]. Maulan and Ibrahim [25] reported that there was no significant difference between students who involved in blended learning and those students who did not. Glogowska, *et al.* [30] developed a new model of CPD for health care practitioners based on a blended learning approach at a university in the south west of England. Owston,

et al. [31] examined the relationship between student perceptions in blended learning courses and their in-course achievement. Taplin, *et al.* [32] analysed the monetary value students place on having access, via the internet, to recorded lectures in a blended learning context. 1 article described the students' experiences of taking a blended learning postgraduate programme in a school of nursing and midwifery [33]. Smyth, *et al.* [33] indicated that blended learning as a pedagogical tool has the potential to contribute and improve nursing and midwifery practice and enhance student learning. 1 article provided evidence that there exist gender differences in the effect of playfulness in the student attitude toward a technology and the intention to use it [34]. 1 article examined the relationship between individual factors and students' satisfaction on blended learning [35]. 1 article explored personality traits, learning style, satisfaction and their correlation to educational outcomes in a blended learning scenario [36]. 4 articles are about institutional factors [37]-[40]. Graham, *et al.* [37] investigated six cases of institutional adoption of blended learning to examine the key issues that can guide university administrators interested in this endeavor. Carbonell, *et al.* [38] introduced Bottom-up managed change processes which offer the advantage to use the creative power of faculty to design and implement blended learning programs. Porter, *et al.* [39] compared U.S. institutional strategy, structure, and support approaches to BL adoption and identified patterns and distinctions. Porter, *et al.* [40] explored whether higher education faculty's innovation adoption category affects which measures facilitate or impede BL adoption. Only 1 article is about teacher factors. Jokinen and Mikkonen [41] described teachers' experiences of planning and implementing teaching and learning in a blended-learning-based adult nursing programme.

D. Evaluation

There are 38 research articles in our database concerning about evaluation of blended learning, in which 20 of them examined effectiveness of blended learning and gave the similar conclusion that blended learning was effective. For instance, Deschacht and Goeman [42] examined the effect of blended learning on adult learners' academic success and found out that blended learning improves exam results. 8 articles evaluated students' perceptions of blended learning. Most of them got positive results. For instance, Bentley *et al.* [43] investigated the learning experience and perceptions of the students, and showed a fairly high level of student satisfaction with the programme. Whereas, Wakefield *et al.* [44] found that students' views on blended learning varied. Some were positive, while others felt e-learning did not suit their preferred learning style, or the subject matter. 3 articles evaluated the specific instruments in blended learning environment [45]-[47]. Akkoyunlu and Yilmaz-Soylu [45] extended the evaluation of learners' views on blended learning and its implementation process by developing and validating an objective assessment instrument. Barnard, *et al.* [46] provided evidence toward the reliability and validity of the instrument and indicated that the OSLQ is an acceptable measure of self-regulation in the online and blended learning environments. Dias and Diniz [47] introduced a new model, namely FuzzyQoI, that, by employing fuzzy logic constructs,

it quantitatively estimates the users' (professors' and students') QoI with the LMS Moodle within a b-learning environment. 3 articles highlighted the issues or problems to be considered [48]-[50]. Alebaikan and Troudi [48] presented issues that have to be considered before employing online discussion in blended courses. Hussain and Huey [49] presented the issues faced while the student gives feedback, and subsequently what can be done to resolve the issues. Ramakrisnan, *et al.* [50] identified the problems faced using e-learning which only cover the scope of looking into student interest in learning and look at the research model that is related and show the findings of the appropriate ways of learning. 3 articles compared blended learning with face-to-face learning [51]-[53]. Smith [51] explored the impact of blended vs. face-to-face tuition over one year in a K-12 school in Auckland, New Zealand. Yigit, *et al.* [52] provided performance evaluation of students in traditional and blended education for Computer Engineering. Barrios, *et al.* [53] described the organization of the blended course in comparison with the traditional face-to-face course and presented preliminary data on student assessment, the use of educational resources, and the academic results obtained in the two enrolled groups. 1 article evaluated three blended learning patterns and concluded the best pattern among the three patterns [54].

E. Methodology

There are 25 research articles which are evident in their methodology in our database. 16 of them are case studies, in which 8 of them chose one university as the case [22], [55]-[61]. Schmidt, *et al.* [22] developed and integrated a novel virtual microscope, MyMiCROscope, in a blended learning model at Ulm University. Holley and Oliver [55] developed a model through cross case analysis of students' learning experiences at a post-1992 University. Taylor & Newton [56] provided a case study of an Australian regional university that investigated institutional processes and teaching and learning approaches that would facilitate diverse students' equitable access to learning. Moskal, *et al.* [57] used the evolution of blended learning at the University of Central Florida as a model and illustrated that with proper support and planning, blended learning can result in positive institutional transformation. Wai and Seng [58] used a case study design and 120 business school students enrolled at a private university being investigated. Koraneekij and Khlaisang [59] developed a model based on the survey of 360 students, and the interview from 3 administrators and 12 instructors at Faculty of Education, Chulalongkorn University, Thailand. Nazarenko [60] presented a case study research based on the experience of implementing a blended learning approach to a university lecture course for students of FLT methodology at the Faculty of Foreign Languages and Area Studies at Moscow State University. Park, *et al.* [61] employed a data-driven approach to extract common activity features of 612 courses in a large private university located in South Korea.

For the other 8 articles, Haron *et al.* [62] reported the adoption of blended learning among academicians in Malaysia. Ari and Taplamacioglu [63] conducted a case study of web-based blended e-learning for adults. Garrison and

Vaughan [64] conducted two case studies for institutional change and leadership associated with blended learning innovation. Snodin [65] conducted a case study of different degrees of autonomy achieved by individual learners. León and Castro [66] developed a career guidance project in a music conservatoire in Madrid (Spain). Ali *et al.* [67] developed a qualitative case study research based on the theoretical framework of constructive alignment. Turk *et al.* [68] proposed a case-based blended learning framework, synergistically combining textbook, e-learning cases and a simulated patient course in medical education. Ruokonen and Ruismäki [69] conducted a qualitative case study of 16 students' experiences of studying group composing in a blended learning environment. There are 9 articles for comparative studies, in which 5 of them are comparisons between blended and face-to-face learning [51], [70]-[73]. Smith [51] explored the impact of blended vs. face-to-face tuition over one year in a K-12 school in Auckland, New Zealand. Comparisons between the groups were based on assessed work, a survey of student perceptions and regular teacher reflections. Ginns and Ellis [70] explored the relationships between on-line and face-to-face teaching and learning and showed that the approaches students take to learning, and the subsequent quality of their learning, is closely related to their perceptions of their learning experience. Sung, *et al.* [71] suggested that blended learning integrating e-learning and face-to-face instruction in the classroom is useful for enhancing medication knowledge. Vernadakis, *et al.* [72] investigated the impact of traditional and blended instruction in students' performance in a Physical Education in Early Childhood course. Šafranč [73] compared blended learning approach to the traditional teaching English for Mechanical Engineering for students at Faculty of Technical Sciences, University of Novi Sad. 2 of them are comparisons between blended and online learning [46], [74]. Barnard, *et al.* [46] collected data from two samples of students (online course format and blended course format) and indicated the OSLQ is an acceptable measure of self-regulation in the online and blended learning environments. Akyol, *et al.* [74] discussed findings of a mixed method research project with the goal to study the development of a community of inquiry in online and blended learning environments. Besides, Ramakrisnan *et al.* [50] compared three research models: Gupta, S, Packham *et al.*, and Khan, identified the problems faced using e-learning. Makhdoom *et al.* [21] conducted a comparative cross-sectional university-based study to assess the effectiveness of blended learning.

F. Review

There are 10 review articles in our database. Bliuc *et al.* [75] reviewed representative research into blended learning in universities, taking into account the methodology used, the focus of the research and the relationship between the two. Arbaugh *et al.* [76] examined and assessed the state of research of online and blended learning in the business disciplines. King [77] wrote a review of what was found were best practices in creating a blended nursing pharmacology course, the elements that were useful, and those activities that were not successful. Ramakrisnan *et al.* [50] reviewed three

blended learning models: Gupta, S, Packham *et al.*, and Khan and identified the problems faced using e-learning. Owston [78] summarized eight articles in blended learning policy and implementation and suggested areas of future policy and implementation research. Drysdale *et al.* [79] analyzed the research of 205 doctoral dissertations and masters' theses in the domain of blended learning. Halverson *et al.* [80] determined the most frequently cited books, edited book chapters, and articles on blended learning, as well as the journals in which these highly cited articles appeared, and looked at what the conversations on blended learning are really about. Kaur [81] gave the overview of the concept of Blended Learning from different perspectives. Güzer and Caner [82] reviewed and analyzed the studies carried out on blended learning through reflecting on the past, the present and the future. Sophonhiranrak *et al.* [83] investigated factors affecting creative problem solving in a blended learning environment from the selected papers.

IV. DISCUSSION, CONCLUSION AND LIMITATION

It can be seen from the proportions that articles about evaluation of blended learning are the most (38 articles), and then design of blended learning (29 articles). It shows that the research of blended learning is still undergoing the beginning period so that most articles aimed at identifying the effectiveness of blended learning and designing the blended learning. Review articles are the least in our database, which reflects the significance and necessity of our research. For the articles which are about blended learning design, most articles tried to develop a model which is suitable for blended learning, there is no common approved model till now, which may be the reason why this kind of research is the common interest for the researchers. Some articles emphasize online component, in which moodle is currently the most used online tool for the researches. For the articles which utilize blended learning as a strategy, only four subjects are concerned, this shows that blended learning should be used as a strategy in more subjects in the future. For the articles which concern about factors influencing blended learning, most of them concern learner factors, there must be more factors which should be studied in the future like teacher factors, administrator factors, policy factors, culture factors, etc. For the articles concerning about evaluation of blended learning, most articles got the conclusion that blended learning are effective. Only three articles are about issues and problems in blended learning, which should be studied more to improve the blended learning in the future. For the methodology, comparative study and case study were most used in blended learning researches and we agree that comparative study and case study may be the most suitable research methodology for blended learning till now. For the review articles in our database, there are only 10 articles, some of them only review 3 or 8 articles, which is not enough for review of blended learning. More review articles for blended learning are needed, which reflects this significance of this paper. Whereas there are still potential limitations that exist, one of them is that it is impossible to cover all the research articles available for blended learning, so this paper can only be taken

as a reference and further review including more research articles and from other perspectives are still needed in the future.

REFERENCES

- [1] C. R. Graham, "Blended learning systems: Definition, current trends, and future directions," *The Handbook of Blended Learning: Global Perspectives, Local Designs*, pp. 3-21, San Francisco, CA: Pfeiffer Publishing, 2006.
- [2] J. Watson, "Blending learning: The convergence of online and face-to-face education," *Promising Practices in Online Learning*, pp. 4-5, 2008.
- [3] R. T. Osguthorpe and C. R. Graham, "Blended learning environments: Definitions and directions," *The Quarterly Review of Distance Education*, vol. 4, no. 3, pp. 227-233, 2003.
- [4] A. Ates, "The handbook of blended learning: Global perspectives, local designs," *Turkish Online Journal of Distance Education-TOJDE*, vol. 10, no. 4, 2009.
- [5] A. Ateş, Y. Turah, and Z. Güneyc, "Using blended learning model in teacher education: A case study," in *Proc. the 2nd International Computer and Instructional Technologies Symposium*, pp. 1118-1130, 2008.
- [6] D. R. Garrison and N. D. Vaughan, "Blended learning in higher education," *Canadian Journal of University Continuing Education*, vol. 35, no. 2, pp. 109-123, 2009.
- [7] B. Colis and J. Moonen, *Flexible Learning in a Digital World: Experiences and Expectations*, London: Kogan-Page, 2001.
- [8] P. Hemingway and N. Brereton, "What is a systematic review? What is Series," *Bandolier*, April 2009.
- [9] M. Muscarà and S. Beercock, "The wiki — A virtual home base for constructivist blended learning courses," *Procedia — Social and Behavioral Sciences*, 2010.
- [10] J. Jia, Y. Chen, Z. Ding, and M. Ruan, "Effects of a vocabulary acquisition and assessment system on students' performance in a blended learning class for English subject," *Computers & Education*, 2012.
- [11] M. F. Hertsch, "Multimedia-based enrichment for foreign language teaching," *Procedia — Social and Behavioral Sciences*, 2013.
- [12] R. Derntl and Motschnig-Pitrik, "The role of structure, patterns, and people in blended learning," *The Internet and Higher Education*, 2005.
- [13] J. A. M. ández and E. J. Gonz áez, "A reactive blended learning proposal for an introductory control engineering course," *Computers & Education*, 2010.
- [14] S. Hubackova, I. Semradova, and B. F. Klimova, "Blended learning in a foreign language teaching," *Procedia — Social and Behavioral Sciences*, 2011.
- [15] T. Miyazoe and T. Anderson, "Discuss, reflect, and collaborate: A qualitative analysis of forum, blog, and wiki use in an EFL blended learning course," *Procedia — Social and Behavioral Sciences*, 2012.
- [16] U. Köse, "A blended learning model supported with web 2.0 technologies," *Procedia — Social and Behavioral Sciences*, 2010.
- [17] Y. Yeh, L. Huang, and Y. Yeh, "Knowledge management in blended learning: Effects on professional development in creativity instruction," *Computers & Education*, 2011.
- [18] J. Bleiker, K. M. Knapp, and I. Frampton, "Teaching patient care to students: A blended learning approach in radiography education," *Radiography*, 2011.
- [19] A. H. Mahnken, M. Baumann, M. Meister, V. Schmitt, and M. R. Fischer, "Blended learning in radiology: Is self-determined learning really more effective?" *European Journal of Radiology*, 2011.
- [20] P. I. Pfefferle et al., "The LEONARDO-DA-VINCI pilot project "e-learning-assistant"—Situation-based learning in nursing education," *Nurse Education Today*, 2010.
- [21] N. Makhdoom, K. I. Khoshhal, S. Algaidi, K. Heissam, and M. A. Zolaly, 'Blended learning' as an effective teaching and learning strategy in clinical medicine: a comparative cross-sectional university-based study," *Journal of Taibah University Medical Sciences*, 2013.
- [22] C. Schmidt, M. Reinehr, O. Leucht, N. Behrendt, S. Geiler, and S. Britsch, "MyMiCROscope — Intelligent virtual microscopy in a blended learning model at Ulm University," *Annals of Anatomy — Anatomischer Anzeiger*, 2011.
- [23] N. Young and J. Randall, "The use of blended learning to create a module about ill-health during childbirth for pre-registration midwifery students," *Nurse Education in Practice*, vol. 14, issue 1, pp. 87-91, 2014.
- [24] B. F. Klimova and I. Semradova, "The teaching of foreign languages and ICT," *Procedia Technology*, 2012.
- [25] S. B. Maulan and R. Ibrahim, "The teaching and learning of English for academic purposes in blended environment," *Procedia — Social and Behavioral Sciences*, 2012.
- [26] H. Kashefi, Z. Ismail, Y. M. Yusof, and R. A. Rahman, "Supporting students mathematical thinking in the learning of two-variable functions through blended learning," *Procedia — Social and Behavioral Sciences*, 2012.
- [27] H. Kashefi, Z. Ismail, and Y. M. Yusof, "The impact of blended learning on communication skills and teamwork of engineering students in multivariable calculus," *Procedia — Social and Behavioral Sciences*, 2012.
- [28] H. Kashefi, Z. Ismail, and Y. M. Yusof, "Supporting engineering students' thinking and creative problem solving through blended learning," *Procedia — Social and Behavioral Sciences*, 2012.
- [29] S. Sivakumar, M. T. Namasivayam, and S. R. Al-Atabi, "Pre-implementation study of blended learning in an engineering undergraduate programme: Taylor's University Lakeside campus," *Procedia — Social and Behavioral Sciences*, vol. 103, pp. 735-743, 2013.
- [30] M. Glogowska, P. Young, L. Lockyer, and P. Moule, "How 'blended' is blended learning?: Students' perceptions of issues around the integration of online and face-to-face learning in a continuing professional development (CPD) health care context," *Nurse Education Today*, 2011.
- [31] R. Owston, D. York, and S. Murtha, "Student perceptions and achievement in a university blended learning strategic initiative," *The Internet and Higher Education*, 2012.
- [32] R. H. Taplin, R. Kerr, A. M. Brown, "Who pays for blended learning? A cost-benefit analysis," *The Internet and Higher Education*, 2013.
- [33] S. Smyth, C. Houghton, A. Cooney, and D. Casey, "Students' experiences of blended learning across a range of postgraduate programmes," *Nurse Education Today*, 2012.
- [34] A. Padilla-Mel ández, A. R. D. Aguila-Obra, and A. Garrido-Moreno, "Perceived playfulness, gender differences and technology acceptance model in a blended learning scenario," *Computers & Education*, 2013.
- [35] N. A. A. Rahman, N. Hussein, and A. H. Aluwi, "Satisfaction on Blended Learning in a Public Higher Education Institution: What Factors Matter?" *Procedia — Social and Behavioral Sciences*, vol. 211, pp. 768-775, 2015.
- [36] T. Vasileva-Stojanovska, T. Malinovski, M. Vasileva, D. Jovevski, and V. Trajkovik, "Impact of satisfaction, personality and learning style on educational outcomes in a blended learning environment," *Learning and Individual Differences*, vol. 38, pp. 127-135, 2015.
- [37] C. R. Graham, W. Woodfield, and J. B. Harrison, "A framework for institutional adoption and implementation of blended learning in higher education," *The Internet and Higher Education*, 2013.
- [38] K. B. Carbonell, A. Dailey-Hebert, and W. Gijsselaers, "Unleashing the creative potential of faculty to create blended learning," *The Internet and Higher Education*, 2013.
- [39] W. W. Porter, C. R. Graham, K. A. Spring, and K. R. Welch, "Blended learning in higher education: Institutional adoption and implementation," *Computers & Education*, vol. 75, pp. 185-195, 2014.
- [40] W. W. Porter, C. R. Graham, R. G. Bodily, and D. S. Sandberg, "A qualitative analysis of institutional drivers and barriers to blended learning adoption in higher education," *The Internet and Higher Education*, vol. 28, pp. 17-27, 2016.
- [41] P. Jokinen and I. Mikkonen, "Teachers' experiences of teaching in a blended learning environment," *Nurse Education in Practice*, vol. 13, issue 6, pp. 524-528, 2013.
- [42] N. Deschacht and K. Goeman, "The effect of blended learning on course persistence and performance of adult learners: A difference-in-differences analysis," *Computers & Education*, vol. 87, pp. 83-89, 2015.
- [43] Y. Bentley, H. Selassie, and E. Parkin, "Evaluation of a global blended learning MBA programme," *The International Journal of Management Education*, 2012.
- [44] A. B. Wakefield, C. Carlisle, A. G. Hall, and M. J. Attree, "The expectations and experiences of blended learning approaches to patient safety education," *Nurse Education in Practice*, 2008.
- [45] B. Akkoyunlu and M. Yılmaz-Soylu, "Development of a scale on learners' views on blended learning and its implementation process," *The Internet and Higher Education*, 2008.

- [46] L. Barnard, W. Y. Lan, Y. M. To, V. O. Paton, and S. Lai, "Measuring self-regulation in online and blended learning environments," *The Internet and Higher Education*, 2009.
- [47] S. B. Dias and J. A. Diniz, "FuzzyQoI model: A fuzzy logic-based modelling of users' quality of interaction with a learning management system under blended learning," *Computers & Education*, vol. 69, November 2013, pp. 38–59, 2013.
- [48] R. Alebaikan and S. Troudi, "Online discussion in blended courses at Saudi Universities," *Procedia — Social and Behavioral Sciences*, 2010.
- [49] R. M. R. Hussain and Z. N. Huey, "A qualitative research on teacher trainees as the feedback-giver in a blended learning environment," *Procedia — Social and Behavioral Sciences*, 2010.
- [50] P. Ramakrisnan, Y. B. Yahya, M. N. H. Hasrol, and A. A. Aziz, "Blended learning: A suitable framework for e-learning in higher education," *Procedia — Social and Behavioral Sciences*, 2012.
- [51] N. V. Smith, "Face-to-face vs. Blended Learning: Effects on Secondary Students' Perceptions and Performance," *Procedia — Social and Behavioral Sciences*, vol. 89, pp. 79-83, 2013.
- [52] T. Yigit, A. Koyun, A. S. Yuksel, and I. A. Cankaya, "Evaluation of blended learning approach in computer engineering education," *Procedia — Social and Behavioral Sciences*, vol. 141, 25 August 2014, pp. 807-812, 2014.
- [53] M. Barrios, A. González-Teruel, A. Cosculluela, A. Fornieles, and J. Turbany, "Structure and performance assessment in traditional face-to-face and blended learning statistics courses," *Procedia — Social and Behavioral Sciences*, vol. 141, pp. 1259-1262, 2014.
- [54] J. Yen and C. Lee, "Exploring problem solving patterns and their impact on learning achievement in a blended learning environment," *Computers & Education*, 2011.
- [55] D. Holley and M. Oliver, "Student engagement and blended learning: Portraits of risk," *Computers & Education*, 2010.
- [56] J. A. Taylor and D. Newton, "Beyond blended learning: A case study of institutional change at an Australian regional university," *The Internet and Higher Education*, 2013.
- [57] P. Moskal, C. Dziuban, and J. Hartman, "Blended learning: A dangerous idea?" *The Internet and Higher Education*, 2013.
- [58] C. C. Wai and E. L. K. Seng, "Exploring the effectiveness and efficiency of blended learning tools in a school of business," *Procedia — Social and Behavioral Sciences*, vol. 123, pp. 470-476, 2014.
- [59] P. Koraneekij and J. Khlaisang, "Development of learning outcome based e-portfolio model emphasizing on cognitive skills in pedagogical blended e-learning environment for undergraduate students at faculty of education, Chulalongkorn University," *Procedia — Social and Behavioral Sciences*, vol. 174, pp. 805-813, 2015.
- [60] A. L. Nazarenko, "Blended learning vs traditional learning: What works? (A case study research)," *Procedia — Social and Behavioral Sciences*, vol. 200, pp. 77-82, 2015.
- [61] Y. Park, J. H. Yu, and I. Jo, "Clustering blended learning courses by online behavior data: A case study in a Korean higher education institute," *The Internet and Higher Education*, vol. 29, pp. 1–11, 2016.
- [62] H. Haron, W. F. Abbas, and N. A. A. Rahman, "The adoption of blended learning among Malaysian academicians," *Procedia — Social and Behavioral Sciences*, vol. 67, 2012, pp. 175-181, 2012.
- [63] M. Ari and M. C. Taplamacioglu, "Web-based blended e-learning for adults; a case study," *Procedia — Social and Behavioral Sciences*, 2012.
- [64] D. R. Garrison and N. D. Vaughan, "Institutional change and leadership associated with blended learning innovation: Two case studies," *The Internet and Higher Education*, 2013.
- [65] N. S. Snodin, "The effects of blended learning with a CMS on the development of autonomous learning: A case study of different degrees of autonomy achieved by individual learners," *Computers & Education*, 2013.
- [66] L. P. d. Leão and P. L. Castro, "ICT in career guidance. A case study of a "blended learning" career guidance programme for music students," *Procedia — Social and Behavioral Sciences*, vol. 116, pp. 2049-2058, 2014.
- [67] M. F. Ali, G. Joyes, and L. Ellison, "Building effective small-group team working skill through blended learning at Malaysia tertiary institution," *Procedia — Social and Behavioral Sciences*, vol. 112, pp. 997-1009, 2014.
- [68] B. R. Turk, R. Krexner, F. Otto, T. Wrba, and H. Löffler-Stastka, "The ghost in the machine: Transforming patient data into e-learning cases within a case-based blended learning framework for medical education," *Procedia — Social and Behavioral Sciences*, vol. 186, pp. 713-725, 2015.
- [69] I. Ruokonen and H. Ruismäki, "E-learning in music: A case study of learning group composing in a blended learning environment," *Procedia — Social and Behavioral Sciences*, vol. 217, 5 February 2016, pp. 109-115, 2016.
- [70] P. Ginns, and R. Ellis, "Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning," *The Internet and Higher Education*, 2007.
- [71] Y. H. Sung, I. G. Kwon, and E. Ryu, "Blended learning on medication administration for new nurses: Integration of e-learning and face-to-face instruction in the classroom," *Nurse Education Today*, 2008.
- [72] N. Vernadakis, M. Giannousi, V. Derri, M. Michalopoulos, and E. Kioumourtoglou, "The impact of blended and traditional instruction in students' performance," *Procedia Technology*, 2012.
- [73] J. Šafran, "Using information technology in English language learning procedure: Blended learning," *Procedia — Social and Behavioral Sciences*, vol. 83, pp. 514-521, 2013.
- [74] Z. Akyol, D. R. Garrison, and M. Y. Ozden, "Development of a community of inquiry in online and blended learning contexts," *Procedia — Social and Behavioral Sciences*, 2009.
- [75] A. M. Bliuc, P. Goodyear, and R. A. Ellis, "Research focus and methodological choices in studies into students' experiences of blended learning in higher education," *The Internet and Higher Education*, 2007.
- [76] J. B. Arbaugh, M. R. Godfrey, M. Johnson, B. L. Pollack, B. Niendorf, and W. Wresch, "Research in online and blended learning in the business disciplines: Key findings and possible future directions," *The Internet and Higher Education*, 2009.
- [77] V. J. King and J. L. King, "Personal experiences and lessons learned from building a blended nursing pharmacology course," *Teaching and Learning in Nursing*, 2010.
- [78] R. Owston, "Blended learning policy and implementation: Introduction to the special issue," *The Internet and Higher Education*, 2013.
- [79] J. S. Drysdale, C. R. Graham, K. J. Spring, and L. R. Halverson, "An analysis of research trends in dissertations and theses studying blended learning," *The Internet and Higher Education*, 2013.
- [80] L. R. Halverson, C. R. Graham, K. J. Spring, J. S. Drysdale, and C. R. Henrie, "A thematic analysis of the most highly cited scholarship in the first decade of blended learning research," *The Internet and Higher Education*, vol. 20, pp. 20–34, 2014.
- [81] M. Kaur, "Blended learning — Its challenges and future," *Procedia — Social and Behavioral Sciences*, vol. 93, pp. 612-617, 2013.
- [82] B. Güzer and H. Caner, "The past, present and future of blended learning: An in depth analysis of literature," *Procedia — Social and Behavioral Sciences*, vol. 116, pp. 4596-4603, 2014.
- [83] S. Sophonhiranrak, P. Suwannathachote, and S. Ngudgratoke, "Factors affecting creative problem solving in the blended learning environment: A review of the literature," *Procedia — Social and Behavioral Sciences*, vol. 174, pp. 2130-2136, 2015.



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