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Integrating Blended Learning in Teacher Training: A Comprehensive Review

Mohammed Chekour
Department of Computer Science,
Higher School of Education and Training
Ibn Tofail University
Kenitra, Morocco
mohamed.chekour@uit.ac.ma
ORCID: 0000-0003-0445-7094

Nadir El Morabit
Department of English Studies, Faculty of Literature and Human Sciences
Abdelmalek Essaadi University
Tetouan, Morocco
nadir.elmorabit@etu.uae.ac.ma
ORCID : 0000-0002-0889-5924

Issam Benqassou
Department of Physics, Higher School of Education and Training
Ibn Tofail University
Kenitra, Morocco
Issam.benqassou@uit.ac.ma
ORCID: 0000-0001-7066-613X

Abdelhamid Lechhab
Department of Physics, Higher School of Education and Training
Ibn Tofail University
Kenitra, Morocco
abdelhamid.lechhab@uit.ac.ma
ORCID: 0000-0001-5850-8120

Fouad El-hars
Department of Physics, Higher School of Education and Training
Ibn Tofail University
Kenitra, Morocco
fouad.elhars@uit.ac.ma
ORCID: 0000-0001-7827-4069

Moulay Mustapha Hafid
Department of Physics, Higher School of Education and Training
Ibn Tofail University
Kenitra, Morocco
moulaymustapha.hafid@uit.ac.ma
ORCID: 0000-0003-3539-7346

Abstract—**This article provides a holistic overview comprising an analysis of blended learning`s role in teacher training, as its growing significance and influence have become increasingly diverse in vocational education. Therefore, to emphasize the importance of blended learning in the field of teacher training, this paper summarizes key findings from the most cited ten articles over the last two decades, which touch upon the various methods used and the main outcomes enhanced through the blended learning approach. With a combination of integrated traditional classroom settings and digital platforms, this study demonstrates that blended learning also contributes to the adaptation of teachers' methods of training. The review highlights important trends, showcasing developed digital competencies and increased collaboration between teachers and teacher training institutions. Both pre-service and in-service training programs benefit from this integration. This synthetic study, which combines a review of current trends in blended learning with ongoing updates in the field under scrutiny, has become a key source of contemporary information. It not only aids researchers but also provides a platform for further development of ideas in vocational education.**

Keywords—blended learning; teacher training; digital skills; traditional and online modes; pre-service; in-service teachers.

I. INTRODUCTION

Blended learning (BL), which has significantly affected the teaching-learning-process, is designated as the interwoven combination of two common methods of teaching, namely traditional and online modes. Thus, it allows for education to take place in both traditional and online classroom settings [1]. This revolutionary approach has been increasingly prevalent in education as it offers both modes, conventional and online methods [2]. Research from the literature has shown that BL not only enhances students' engagement and learning experience but also significantly impacts learners' awareness of the teaching method and learning context [3].

Blended learning fosters enhanced interaction and communication abilities in students [4], promotes discussion and collaboration. This results in favorable experience as reported by students themselves [5]. Accordingly, this approach makes learners motivated, active, and more engaged in the process of learning, thereby creating a more captivating and immersive learning process [6].

Prior research has mostly focused on the implementation of blended learning and its likelihood to boost student learning outcomes [7], [8], [9], [10]. Nevertheless, there have been few investigations that have delved into the potential of BL to bolster in-service teacher training as well as pre-service teacher education. In order to fill this knowledge gap, this study seeks to review the so far published research that has explored the implementation of BL in the context of teacher training. To accomplish this goal, this paper examines and scrutinizes the most impactful articles to identify the methodologies employed and evaluate the effects of integrating BL on both in-service and pre-service teacher training (TT). Therefore, this study aims to answer the following research questions:

- What methodologies are employed by the most frequently cited articles?
- What is the prospective impact of BL integration on teacher training?

In this article, we will delineate the methodology used for our literature review analysis, offering an in-depth insight of the processes undertaken in-depth. Following this, we will strive to explore the results of our analysis, focusing on the evolving patterns and crucial themes discovered in the literature on blended learning. Eventually, we will analyze the ramifications of these findings for future study, considering the possible paths to more investigation and advancement.

II. METHODOLOGY

This study examines research trends on the impact of blended learning on teacher education over the past 20 years using resources from one of the largest and most reputable high-impact scientific databases: Scopus. Criteria were established for data collection from articles as follows: First, publications are indexed in the Scopus database. Second, there is a focus on blended learning in both initial and continuing teacher education. Third, publications are limited to indexed international journal articles, book chapters, and conference proceedings. Figure 1 illustrates the detailed search procedure.

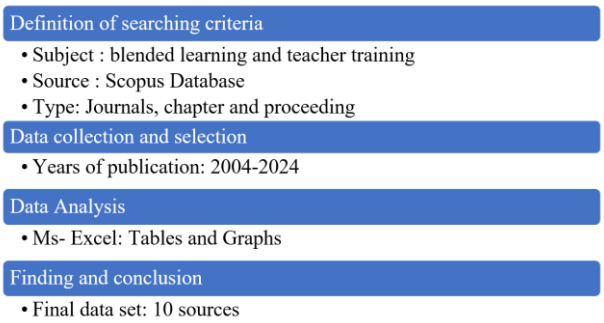

Figure 1. Research procedures

The key search terms were 'blended learning' combined with 'teacher training', 'instructor training', and 'teacher education'. The authors selected research from 2004 to 2024 to ensure the inclusion of the most recent information. On December 20, 2023, the inquiry began with an online search. Data analysis was conducted using MS-Excel software. The following table presents the search strategies, inclusion criteria, and the number of articles included in a study on blended learning and teacher training, outlined as follows:

TABLE I. SEARCHING STRATEGIES

Search strategies	Inclusion criteria	Number of articles included
Scanning Scopus using search terms	Written in English and published between 2004 and 2024	513
Examining the titles, abstracts, and full-text possibility	Resource related to blended learning and teacher training	106
Critical assessment of the articles regarded as significant	Fit for research	25
	Most cited	10

The initial strategy entailed scanning the Scopus database using specific search terms, targeting articles in English published from 2004 to 2024. This comprehensive search resulted in 513 articles. A subsequent, more focused review of titles, abstracts, and full-text availability refined the selection to 106 articles relevant to blended learning and teacher training. A critical evaluation further narrowed these to 25 articles, chosen for their pertinence and contribution to this study. From this refined group, the most seminal 10 articles, as determined by citation count, were selected for in-depth analysis.

III. RESULTS

The findings suggest that mixed methodology is the most frequently used in studies on blended learning applied to teacher training, representing 50% of the selected articles. Quantitative and qualitative approaches are also utilized, accounting for 40% and 10% of the articles, respectively. This suggests a diversity in the research methods employed to study the impact of blended learning on teacher training.

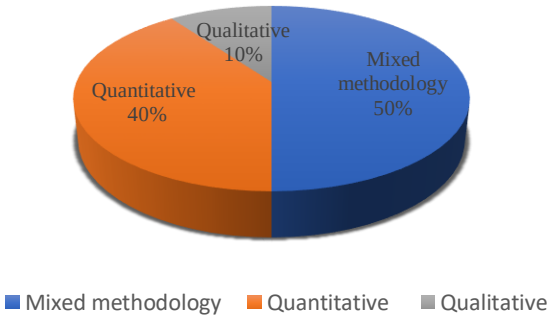

Figure 2: Distribution of selected BL articles for TT in terms of research Methodologies

The following table presents a list of articles along with their citation count, publication year, article type, and country of origin. The articles are categorized in descending order of citation count, highlighting the top two most cited articles: Kupetz [11] and Krasnova [12].

TABLE II. TOP 10 MOST CITED ARTICLES

No	Articles	Cited	Year	Type	Country
1	R Kupetz [11]	36	2005	Article	Venezuela
2	LA Krasnova [12]	36	2020		Russia
3	Z Kocoglu [13]	31	2011		Turkey
4	H Berger [14]	29	2008		Undefined
5	K Makri [15]	18	2014		Greece
6	L Knie [16]	11	2022		Germany
7	C Zagouras [17]	10	2022		Greece
8	MZ Asghar [18]	9	2022		Pakistan

9	O Ihnatova [19]	3	2022		Ukraine
10	PT Le [20]	3	2020		Vietnam

The following figure depicts the distribution of the number of articles based on the subject of training incorporating blended learning. The subjects include digital skills, English teacher education, pedagogical skills, physics, and computational thinking. It is evident that digital skills are the most frequently addressed subject. This result may be justified by the fact that the blended learning approach is well-suited for fostering the development of digital skills among teachers.

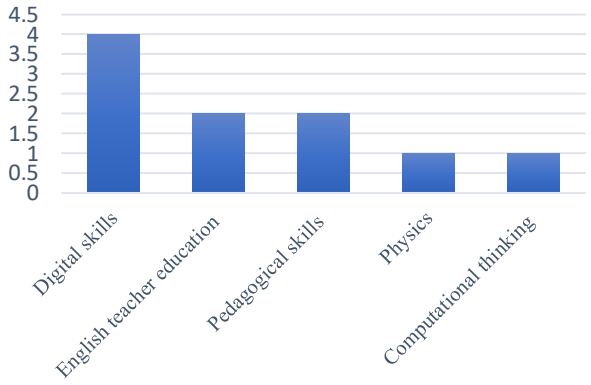

Figure 3. Distribution of articles by Training subject

The following figure provides a breakdown of the number of articles categorized by teacher discipline. The 'All disciplines combined' category encompasses a total of 5 articles, indicating a diverse range of subjects. Specifically, there are 3 articles focused on the discipline of English teaching and 2 articles dedicated to physics teaching.

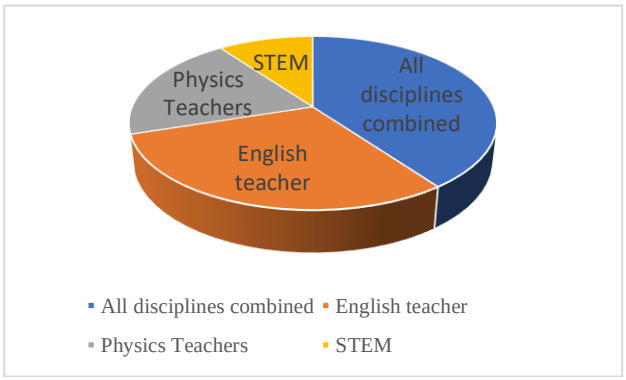

Figure 4. Distribution of articles by teacher discipline

The analysis of the ten most cited articles that address blended learning for currently in-service and future teachers (across all disciplines) shows that the combination of face-to-face and distance learning can only be beneficial for developing disciplinary and cross-disciplinary skills among teachers (across all disciplines), especially digital skills. A thorough analysis of the ten most cited articles reveals a positive effect of integrating blended learning on teacher training in the following aspects:

- The use of Learning Management Systems like Moodle in blended learning can effectively improve IT competencies and expand educational opportunities for teachers [11].
- Blended learning models can improve the quality of education and introduce innovative technologies into the teaching process [12].
- Research indicates positive influences of blended learning on student performance, participation, motivation, access, flexibility, cost-effectiveness, and active learning compared to traditional classes [13].
- Research indicates that blended learning positively affects teachers' attitudes, content knowledge, and motivation to transform practice. Also, blended learning can engage teachers in critical discourse, reflection, continuous learning, and construction of knowledge [14].
- The integration of Web 2.0 technologies in blended learning scenarios can lead to more collaborative and learner-centered approaches, improving the quality of student learning [15].
- The study on integrating computational thinking into a blended learning in-service training program for STEM teachers showed high satisfaction with the overall training program and the online CT module, indicating a positive impact of blended learning [16].
- Students or trainees engaged in blended learning have demonstrated higher performance in activities involving Information and Communication Technology (ICT), resulting in higher grades on certification exams [17].
- Blended learning with a balance between the face-to-face, online, and offline modes proved to be successful for in-service training vocational teachers [18].
- The data indicate that teachers trained in blended learning techniques demonstrate improvements, thereby reinforcing the benefits of this approach for the professional and digital skill development of educators [19].
- A deliberate blend in teacher education equips trainee teachers with practical experience in various online and traditional classroom environments, enabling them to adapt their learning and teaching methods [20].

IV. CONCLUSION

The investigation of blended learning as part and parcel of teachers' education reveals a great positive shift concerning the skills and methods required in developing the teachers' training. It is now possible for teachers to train either in face-to-face or online modes, which creates accessibility and flexibility of teacher training highlighting its growing significance and multi-faceted impact. Hereby, the review accentuates the feasibility of blended learning enabling teachers to get acquainted with the necessary digital and professional skills, which are nowadays, considered to be essential for teachers in technology-driven learning environments. A combined learning approach (traditional mode vs online mode) should be the subject of future research with the aim of reaching the broadest spectrum of validation and addressing the challenges of

blended learning. This will lead to its proper and successful implementation across various educational settings. The findings advocate for the idea of consistently combining learning technology with traditional teaching techniques to continuously enhance the educational process.

REFERENCES

[1] R. Al-Maroof, N. Al-Qaysi, S. A. Salloum, and M. Al-Emran, 'Blended Learning Acceptance: A Systematic Review of Information Systems Models', Technol. Knowl. Learn., vol. 27, no. 3, pp. 891–926, Sep. 2022, doi: 10.1007/s10758-021-09519-0.

[2] M. Chekour, M. A. Tadlaoui, Y. Z. Seghroucheni, and M. M. Hafid, 'Blended learning and simulation for teaching electrical concepts to high school pupils', J. Turk. Sci. Educ., vol. 19, no. 4, pp. 1119–1134, 2022, doi: https://doi.org/10.36681/tused.2022.165.

[3] B. Anthony et al., 'Blended Learning Adoption and Implementation in Higher Education: A Theoretical and Systematic Review', Technol. Knowl. Learn., vol. 27, no. 2, pp. 531–578, Jun. 2022, doi: 10.1007/s10758-020-09477-z.

[4] H. Hasanah and M. N. Malik, 'Blended learning in improving students' critical thinking and communication skills at University', Cypriot J. Educ. Sci., vol. 15, no. 5, pp. 1295–1306, 2020, Accessed: Apr. 11, 2024. [Online]. Available: http://eprints.unm.ac.id/18517/

[5] M. Robles Dimaano, 'Students' Experience on Blended Learning Approaches', in 2021 5th International Conference on Digital Technology in Education, Busan Republic of Korea: ACM, Sep. 2021, pp. 67–75. doi: 10.1145/3488466.3488472.

[6] F. Bouilheres, L. T. V. H. Le, S. McDonald, C. Nkhoma, and L. Jandug-Montera, 'Defining student learning experience through blended learning', Educ. Inf. Technol., vol. 25, no. 4, pp. 3049–3069, Jul. 2020, doi: 10.1007/s10639-020-10100-y.

[7] M. Chekour, Y. Zaoui Seghroucheni, M. Anouar Tadlaoui, Y. Hamzaoui, and A. Bouchaib, 'The Perception of the Combination of Simulations and Laboratory Experiments by Moroccan Students', in International Conference On Big Data and Internet of Things, Springer, 2023, pp. 362–375.

[8] M. Chekour, Y. Zaoui Seghroucheni, D. Elomari, and N. El Morabit, 'Design of Blended Learning Course Based on SPOC for Primary School Teachers: Case of Soft Skills', in International Conference On Big Data and Internet of Things, Springer, 2023, pp. 127–137.

[9] A. D. Samala, T. Usmeldi, Y. Indarta, M. H. Apdoludin, and K. Leong, 'Top 10 most-cited articles concerning blended learning for introductory algorithms and programming: A bibliometric analysis and overview', Int. J. Interact. Mob. Technol. IJIM, vol. 17, no. 5, pp. 57–70, 2023, Accessed: Apr. 11, 2024. [Online]. Available: https://chesterrep.openrepository.com/bitstream/item/568080/Top%2010%20Most-Cited%20Articles%20Concerning%20Blended%20Learning%20for%20Introductory%20Algorithms%20and%20Programming%20-%20A%20Bibliometric%20Analysis%20and%20Overview.pdf?sequence=1

[10] F. de Brito Lima, S. L. Lautert, and A. S. Gomes, 'Contrasting levels of student engagement in blended and non-blended learning scenarios', Comput. Educ., vol. 172, p. 104241, 2021, Accessed: Apr. 11, 2024. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0360131521001184

[11] R. Kupetz and B. Ziegenmeyer, 'Blended learning in a teacher training course: Integrated interactive e-learning and contact learning', ReCALL, vol. 17, no. 2, pp. 179–196, 2005, Accessed: Apr. 11, 2024. [Online]. Available: https://www.cambridge.org/core/journals/recall/article/blended-learning-in-a-teacher-training-course-integrated-interactive-elearning-and-contact-learning/3ADD8077F796CB3BB85DC30161DF20DF

[12] L. A. Krasnova and V. Y. Shurygin, 'Blended learning of physics in the context of the professional development of teachers', Int. J. Technol. Enhanc. Learn., vol. 12, no. 1, p. 38, 2020, doi: 10.1504/IJTEL.2020.103814.

[13] Z. Kocoglu, Y. Ozek, and Y. Kesli, 'Blended learning: Investigating its potential in an English language teacher training program', Australas. J. Educ. Technol., vol. 27, no. 7, 2011, Accessed: Apr. 11, 2024. [Online]. Available: https://ajet.org.au/index.php/AJET/article/view/908

[14] H. Berger, B.-S. Eylon, and E. Bagno, 'Professional Development of Physics Teachers in an Evidence-Based Blended Learning Program', J. Sci. Educ. Technol., vol. 17, no. 4, pp. 399–409, Aug. 2008, doi: 10.1007/s10956-008-9109-3.

[15] K. Makri, K. Papanikolaou, and A. Tsakiri, 'Blending the community of inquiry framework with learning by design: Towards a synthesis for blended learning in teacher training', Electron. J. E-Learn., vol. 12, no. 2, pp. pp183-194, 2014, Accessed: Apr. 11, 2024. [Online]. Available: https://academic-publishing.org/index.php/ejel/article/view/1690

[16] L. Knie, B. Standl, and S. Schwarzer, 'First experiences of integrating computational thinking into a blended learning in-service training program for STEM teachers', Comput. Appl. Eng. Educ., vol. 30, no. 5, pp. 1423–1439, Sep. 2022, doi: 10.1002/cae.22529.

[17] C. Zagouras, D. Egarchou, P. Skiniotis, and M. Fountana, 'Face to face or blended learning? A case study: Teacher training in the pedagogical use of ICT', Educ. Inf. Technol., vol. 27, no. 9, pp. 12939–12967, Nov. 2022, doi: 10.1007/s10639-022-11144-y.

[18] M. Z. Asghar, M. N. Afzaal, J. Iqbal, and H. A. Sadia, 'Analyzing an appropriate blend of face-to-face, offline and online learning approaches for the in-service vocational teacher's training program', Int. J. Environ. Res. Public. Health, vol. 19, no. 17, p. 10668, 2022, Accessed: Apr. 11, 2024. [Online]. Available: https://www.mdpi.com/1660-4601/19/17/10668

[19] O. Ihnatova, O. Zhovnych, and L. Drobakha, 'The effectiveness of blended learning in english teacher training', J. Teach. Engl. Specif. Acad. Purp., pp. 377–388, 2022, Accessed: Apr. 11, 2024. [Online]. Available: http://espeap.junis.ni.ac.rs/index.php/espeap/article/view/1259

[20] P. T. Le and H. T. T. Pham, 'Using blended learning in teacher training programs: Perspectives of pre-service teachers', J. Educ. Soc. Res., vol. 11, 2020, Accessed: Apr. 11, 2024. [Online]. Available: https://ideas.repec.org/a/bjz/jesrjr/1668.html