The state of the art in blended learning research in a time of the Covid-19 pandemic: Coronavirus diaries in the educational realm

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Abstract: The Covid-19 pandemic was a crisis on a global scale, and it impacted not only our lives but also our understanding of the educational landscape. There were many waves of the pandemic at varying levels and as these waves hit our globe, the way we live and see the world has been changing. Consequently, we entered a time which was called the new normal which required being flexible, resilient, and adaptive. The educational landscape has also been challenged by the waves of the pandemic. The onsite (face-to-face) learning was replaced by online distance learning which was attributed as emergency remote teaching and learning in many cases. As the new normal forced us to change our traditional notions and practices, many higher education institutions adopted blended learning to benefit from opportunities of both modalities, that is, onsite and online learning. In this regard, this study implements a systematic approach to examine papers published in the first two years of the pandemic on blended learning. For this purpose, the study adopts social network analysis and text mining to examine a total of 104 peer-reviewed publications. The initial findings identified four broad themes. Accordingly, these are (1) diversity and confusion in the blended learning terminology, (2) Learning experiences and effectiveness of blended learning practices, (3) technology-dominated and online-mediated blended learning approaches, and (4) blended learning for applied and practical courses. The paper discusses these themes, provides suggestions, and explains implications for future research directions.

Keywords: Blended learning, flexible learning, educational technology, online learning, Covid-19 pandemic.

Introduction

The Covid-19 pandemic revealed that we need to adopt flexible strategies to ensure the sustainability of educational systems. Upon the advent of the Covid-19 pandemic, to minimize the disruption and enable the continuity of the course delivery, many of the educational institutions not only adopted already known blended learning strategies but also crafted new blended learning strategies (Bozkurt, 2022; Pelletier et al., 2021). Blended learning refers to "combining onsite and online learning by blending the strengths of one modality and neutralizing the weaknesses of the other to provide flexibility to learners, instructors, and educational institutions. The flexibility can be afforded to time, space, path, and pace through sequential or parallel designs" (Bozkurt & Sharma, 2021, p. 3). As a result of the emerging need for blended learning during the pandemic (Bhuwandeep & Das, 2020), the Covid-19 crisis not only accelerated the wide adaptation of blended learning modalities (Pelletier et al., 2021) but in the meantime, it increased the existing confusion in terminology and practice (Hrastinski, 2019; Irvine, 2020). Motivated by the increasing interest in blended learning during the Covid-19 pandemic, this study adopts a systematic approach to examine papers published during the early waves of the pandemic on blended learning and intends to identify emerging research themes.

Literature Review

Some studies examined blended learning during the Covid-19 pandemic. For instance, in a study examining HyFlex learning during the pandemic, it was reported that while a great degree of flexibility was ensured, communication challenges were obvious in the HyFlex course (parallel design) and a higher degree of motivation and self-regulated skills are required (Kohnke & Moorhouse, 2021). Investigating blended learning through flipped learning (sequential

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design), another study reported that flipped learning with adaptive learning strategies decreases the perceived load, burden, or stressors emerging in fully online courses (Clark et al., 2021). In a similar study that approached blended learning through flipped learning, it was noted that transactional distance is a significant factor and learners found more opportunities to collaborate and communicate by using different communication channels (Rigou et al., 2021). In a comparative study that reported blended learning practices in a higher education institution, it was highlighted that blended learning grants more flexibility and autonomy to learners which in turn increases the possibility to drop out from courses (Lorenzo-Lledó et al., 2021). The same study also reported that the sense of isolation, motivational and communicational factors along with technical issues are factors to consider to implement blended learning in the future (Lorenzo-Lledó et al., 2021). In all, the studies on blended learning show that the need for socializing and communication is prioritized by learners (Mali & Lim, 2021), and learners would prefer onsite, face-to-face instruction if pandemic wouldn't force them to attend courses designed through blended learning models (Kohnke & Moorhouse, 2021; Lorenzo-Lledó et al., 2021; Mali & Lim, 2021; Rigou et al., 2021).

Methodology and Research Procedure

In order to identify broad research themes, this paper used data mining and analytic approaches (Fayyad, et al., 2002) to systematically review (Gough et al., 2012) research on blended learning and used analytic techniques such as text mining (Feldman & Sanger, 2007) and social network analysis (Scott, 2017). We have used Leximancer for text mining and NodeXL for social network analysis. In order to build a research corpus and then elicit research themes, authors used boolean formatted search strings (See Table 1) and crawled the metadata of the publications on the Covid-19 pandemic and blended learning. In order to build a research corpus that is directly focused on the research in question, one of the inclusion criteria is identifying search strings to appear at the titles of the publications. After adopting the PRISMA Framework (Page et al., 2021), a total of 104 publications were included in the final research corpus (See Table 1). The research corpus was built in January 2022 and covered roughly the first two years of the pandemic. During the screening process, we have removed irrelevant publications and included peer-reviewed publications in order to form a sound research corpus.

Table 1. Search strings and PRISMA Framework protocol.

Search strings	TITLE ("Covid" OR "pandemic" OR "coronavirus") AND TITLE ("blended learning" OR "blended teaching" OR "blended education" OR "flipped classroom" OR "flipped learning" OR "flipped teaching" OR "hyflex" OR "hybrid learning" OR "hybrid teaching" OR "hybrid education" OR "inverted classroom").
Database	Scopus
Identification	• A total of 117 records were identified.

Screening	• Three irrelevant publications were removed.
	• Ten non-peer-reviewed publications were removed.
	  ○ Editorial (n=3)
	  ○ Letter (n=3)
	  ○ Note (n=3)
	  ○ Book Chapter (n=1)

Included	• A total of 104 records were included in the final research corpus

Findings and Discussions

After examining the textual data of the final research corpus through text mining (Figure 1) and social network analysis (Figure 2), the following themes were identified: (1) diversity and confusion in the blended learning terminology, (2) comparison of the modalities and learning experiences in blended learning practices, (3) technology-dominated and online-mediated blended learning approaches, and (4) blended learning for applied courses. These themes are

explained and discussed in the following section. However, while interpreting the identified themes, it should be worth noting that the research covering the pandemic period is different from the research from pre-pandemic times in two aspects. First, the data of the studies that constitute the research corpus of the current study is collected when both learners and instructors are affected by the trauma, stress, and anxiety stemming from the pandemic conditions. Second, learners perceived blended learning implementations not as an option but as an obligation as a result of the efforts to ensure the continuity of education.

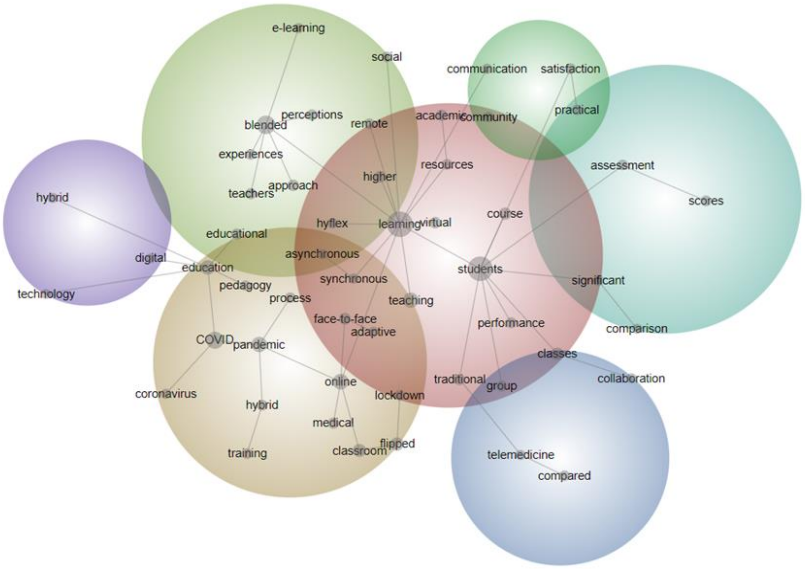

Figure 1. Text-mining of titles and abstract that depicts lexical relationships

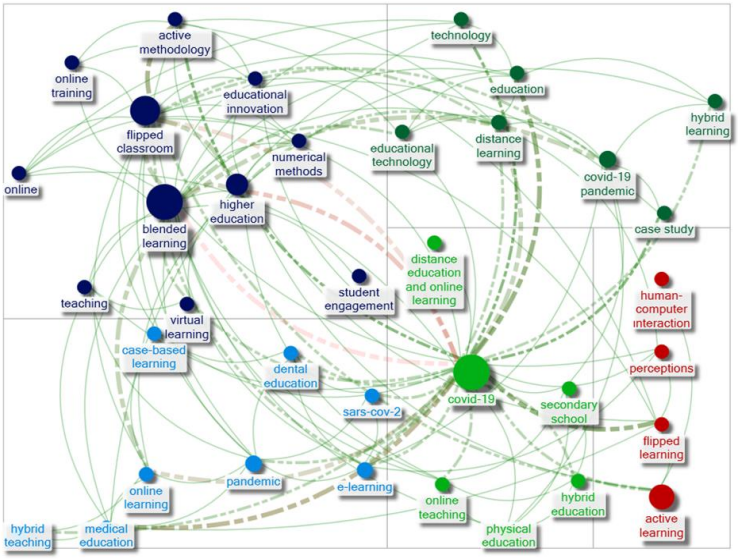

Figure 2. Social network analysis of the keywords to identify key terms.

Theme 1 - Diversity and confusion in the blended learning terminology (See connected nodes in Figure 1: *blended learning, flipped classroom, flipped learning, hybrid education, hybrid teaching, hybrid learning*; See connected paths in Figure 2: *hybrid, education, digital, Covid, pandemic, hybrid, training* and *online, classroom, flipped* and *HyFlex, learning, synchronous, asynchronous).* Blended learning is a generic, umbrella term that refers to combining instructional elements (e.g., time, space, path, and pace) through sequential or parallel designs (Bozkurt & Sharma, 2021). That is, blended learning is a multilayered process that uses educational technologies and is evolving constantly which makes it difficult to understand semantically and in practice (Irvine, 2020). Expectedly, such a view creates confusion in terminology (Hrastinski, 2019). Similar to the pre-pandemic research patterns (Ashraf et al., 2021; Hrastinski, 2019; Irvine, 2020), it was seen that research conducted during the pandemic times used the term loosely without specifying the research context and blended learning model adopted, which, in turn, exacerbated the confusion in terminology. It is also worth noting that the immediate necessity to increase the flexibility in educational delivery, the new terms such as "hybrid" and "HyFlex" learning first emerged in public domains during the pandemic. Those terms quickly gained public popularity and crawled into academic literature as if they were the same as blended learning without establishing a conceptual clarity of their own.

Theme 2 - Learning experiences and effectiveness of blended learning practices (See connected nodes in Figure 1: *Covid-19, perceptions, flipped learning, blended learning, higher education, student engagement*; See connected paths in Figure 2: *performance, students, significant, comparison, course, satisfaction, assessment, scores,* and *experiences, blended, perceptions).* Similar to pre-pandemic studies (see Park, & Shea, 2020; Parkinson et al., 2003), research during the pandemic period on blended learning mostly focuses on students' learning experiences and perceived satisfaction with the multi-modal approaches to course design. It can be assumed that a collective aim of those studies was to develop a general understanding and somewhat reach a tentative conclusion about the effectiveness of the blended learning approach to their concerned educational contexts. To achieve the aim, authors in the research corpus paid attention to learner variables such as academic achievement, engagement or satisfaction, often comparing those variables in different modalities (e.g., online or onsite learning).

Theme 3 - Technology dominated and online mediated blended learning approaches (See connected nodes in Figure 1: *education, technology, distance learning, educational technology, Covid-19 pandemic, hybrid learning, online, blended learning, flipped classroom, virtual learning, higher education, educational innovation*; See connected paths in Figure 2: *blended, learning* and *virtual, remote, learning, HyFlex*, and *technology, education, hybrid, and* online, classroom, flipped). Research conducted prior to pandemic demonstrates that the information and communication technologies (e.g., learning management systems, social media, and Web 2.0 tools) are a hot research area in blended learning studies (see for example Akgündüz & Akınoğlu, 2017; Holmes & Prieto-Rodriguez, 2018). Likewise, in the studies conducted during the pandemic, innovative technologies are regarded as an essential component of blended learning. While blended learning requires onsite and online learning, and two modalities represent a whole, research on blended learning conducted during the pandemic specifically focuses on online modality which is considered as a bottleneck for blended learning research.

Theme 4 - Blended learning for applied and practical courses (See connected nodes in Figure 1: *Covid19, blended learning, higher education, flipped learning, flipped classroom, active methodology, active learning, dental education, pandemic, medical education, hybrid learning, physical education, hybrid education*; See connected paths in Figure 2: *adaptive, face-to-face, online, medical, classroom, flipped* and *coronavirus, Covid, pandemic, hybrid, training,* and *students, traditional, telemedicine).* As mentioned earlier, blended learning pursues to get the right balance between onsite and online learning for effective and efficient learning experiences. In many cases, while online learning is used for theoretical or conceptual discussions, onsite learning is used for applied parts of the learning processes such as hands-on tasks, demonstrations, lab experiments, etc. However, pivoting to heavily online learning due to the requirements stemmed from pandemic conditions, all courses migrated to online learning and some courses adopted blended learning as they see onsite learning as a must for applied courses. For instance, medicine and health education approached blended learning as a solution to deliver applied courses through onsite learning and this trend further popularized applications such as telemedicine and telehealth (see for example Iancu et al., 2020; Muntz et al., 2021).

Conclusions and Suggestions

This study examined blended learning research conducted during the Covid-19 pandemic. The findings indicate that blended learning, as an umbrella term, refers to a set of different approaches (e.g., hybrid, flipped, HyFlex) and during the pandemic period these models were effective, and in many cases, they served as a pragmatic solution to deliver education. However, it was also seen that the necessity to blend time, space, path, and pace through sequential or parallel designs created confusion in terminology. Besides, the opportunity to blend different components through onsite and online learning led to innovative new approaches. Speaking of online and onsite modalities, it was also seen that the research conducted during the pandemic has a tendency to compare the effectiveness of both modalities while these modalities represent a single pedagogical approach. Another noteworthy finding was the interest in online modality and technology use in blended learning practices. One assumption for such a trend might be perceiving onsite learning as a gold standard and, therefore, focusing more on online modality. The intriguing finding of this study is the use of blended learning in courses in which applied teaching and practical learning is essential. Considering that online learning is approached with suspicion in applied courses, blended learning can provide working solutions for such suspicions with blended learning designs.

This study suggests that future research should establish a good balance between conceptual diversity and clarity in blended learning research. Although it is a welcoming phenomenon that there has been a rapid increase in both public and academic interest in blended learning practice, seeing the innovative potential for the post-pandemic world, it is alarming to see new terms and notions without rigorous theoretical underpinnings and considerations permeating literature. As a related point, it is important to increase the conceptual rigour and approach blended learning as a single pedagogical design rather than seeing onsite and online modalities as two separate components. Such a view implies that rather than comparing and competing modalities of blended learning, instructional designers can focus on how to effectively blend these modalities and provide smooth transitions between them. It is, therefore, important to move beyond the comparison between modalities and also focus and deepen on other aspects beyond academic achievement, engagement, or satisfaction (found in the study), as prior research has done - and current also does - independently of the pandemic context (instructor's role, institutional conditions, learning design, self-regulated learning, etc.).

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