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Characteristics of effective and meaningful blended education: A literature review

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INTRODUCTION

Digitalization of education has been high on the agenda of many higher education institutions for a while now. With the corona pandemic, the implementation of online and blended education (BE) has taken a big impulse. The rapid shift to online education shed light on future opportunities of digital tools and technology in education, but it also reminded us of the value of face-to-face teaching and learning (El-Soussi, 2022). As higher education institutions gradually transition back to operating on-site, many turn to the prospect of integrating some elements of online teaching and related digital technologies into face-to-face education, thereby bringing together the best of both worlds. This trend has gone hand in hand with increasing research into BE, with promising findings regarding the possibilities it may offer for optimizing learning outcomes (e.g., Birgili et al., 2021; Castro-Rodríguez et al., 2021; McKenzie et al., 2013; Means et al., 2013; Müller & Mildenberger, 2021), as well as increasing flexibility (e.g., Boelens et al., 2017).

BE is often defined as a combination of online and face-to-face learning activities, although the term has also been used to describe a variety of other "blends", such as combinations of classroom-based and practice-based learning environments, or asynchronous and synchronous instruction (Norberg, 2017). Several authors argue that BE requires a conscious integration of online and face-to-face activities, where both activities are aligned with and reinforce each other (Oliver & Trigwell, 2005; Prinsen & Terbeek, 2021; Van Valkenburg et al., 2020). Online here refers to all learning activities that happen digitally outside of the class ("off campus"), such as a discussion board, whereas face-to-face concerns all learning activities that take place on campus with both teacher and students present, such as a lecture in a lecture hall.

At the request of the Executive Board of the University of Amsterdam, this literature review was conducted in order to synthesize research on what characterizes effective and meaningful BE. The aim of providing such insight is to inform blended course design and pedagogical practices, as well as contributing to the institutional digitalization strategy of the University of Amsterdam.

This study was guided by the following research question: "Which key considerations emerge from the literature pertaining to effective and meaningful blended course design and teaching practices in higher education?". To gain insight into this, we analyzed 29 articles

(see Appendix) published between 2010 and 2022 on blended teaching practices in higher education. Articles were included if they focused on BE in higher education, were in English, and reported on empirical studies or review studies. Below we present a synthesis of key findings emerging from the studies included in the review, pertaining to the key considerations for blended course design and teaching practices. In addition to these two categories, we briefly discuss a third distinct category that emerged from the findings, pertaining to teachers' qualities and competences needed for effective BE delivery.

FINDINGS

Blended course design

For blended course design, we distinguished four topics that teachers can take into consideration while designing a blended course: (1) considerations about ratio; and (2) (dis)advantages, (3) sequence, and (4) integration of online and face-to-face components.

CONSIDERATIONS ABOUT RATIO

A key consideration in designing and implementing a blended course is determining the ratio in which to combine online and face-to-face components of BE. In fact, this aspect of ratio is so prominent that it is sometimes explicated in the definitions of what constitutes a blended course. For example, Allen et al. (2007) define blended courses as having "between 30 percent and 79 percent of the course content delivered online" (p. 5). Still, specific considerations about the ratio of online and face-to-face activities in blended courses were found in only two studies included in this review (Owston & York, 2018; Seredycz, 2021). Both studies investigated the association between different ratios in blended courses, and subsequent student satisfaction and performance; however, their findings are somewhat inconsistent with one another. Seredycz (2021) observed that as the ratio of online instruction increased, student satisfaction decreased. On the other hand, Owston and York (2018) reported that students perceived BE more favorably and performed significantly higher when 33% to 50% of the instruction is online, compared to when the amount of online instruction falls below 30%. However, this paper only looked at courses where the proportion of online instruction is 50% or below. It was therefore noted by the authors that student performance might be impacted differently in courses where the proportion of online instruction exceeds 50%.

Overall, both studies echoed the sentiment that there is no one-size-fits-all strategy to determining ratio in BE, and that a variety of contextual factors ought to be considered. Several of such contextual factors were outlined in the study by Alammary et al. (2015). Specifically, teaching and course-design experts from a variety of academic disciplines were asked to identify criteria which teachers should consider when deciding the ratio in their blended courses, as well as to rank the importance of each criterion for the design process. These criteria were categorized as: institution, course, teacher- and student-related. In most categories, the highest ranked criteria pertained to accessibility and convenience, mainly: availability of technical support (institution-related), availability of technology to enable online delivery (course-related) and students' access to campus (student-related). In the teacher-related category, teachers' willingness to try new methods was ranked as most important.

(DIS)ADVANTAGES OF ONLINE AND FACE-TO-FACE COMPONENTS

When designing a blended course, the strengths and limitations of online and face-to-face components should be considered. Regarding the online component, several considerations can be distilled from the literature. Firstly, limited and artificial social interaction is the most prominent drawback of the online environment emerging from the literature. Due to the physical (and sometimes also temporal) distance inherent in the online component of blended courses, the psychological distance between teachers and students can become amplified (Boelens et al., 2017; Futch et al., 2016; Rasheed et al., 2020). Also referred to as transactional distance (see Moore, 1993), this psychological and communicational gap has been found to adversely impact learning experiences (Boelens et al., 2017; Glogowska, 2011). Interestingly, however, some studies also discussed the potential advantages of the more structured and impersonal communicational space that is typical for online interactions. Specifically, it has been observed that more introverted students may feel safer sharing their opinion and voicing their concerns in an online setting compared to a face-to-face setting, due to the perceived anonymity and more structured communicational space (Calderón et al., 2021; Futch et al., 2016; Parlangeli et al., 2012).

Another advantage of the online setting is the opportunity it offers to personalize students' learning process through the combination of teacher-directed and computer-adaptive student monitoring and differentiation (Alamri et al., 2021; Boelens et al., 2017). Adapting content difficulty and level to students' needs and abilities has been found to

support students' need for perceived competence, as well as help them manage their cognitive load effectively (Alamri et al., 2021; Chiu, 2021). Additionally, students have reported appreciating the opportunities offered by the online setting to choose learning resources, as well as proceeding through the content at their own pace (Boelens et al., 2017; Calderón et al., 2021; Chiu, 2021).

In terms of the face-to-face component of BE, no specific disadvantages were discussed in the articles included in this review as they mostly focused on the online component of BE. The most prominent advantage of the face-to-face component identified in the literature seems to be the opportunities it offers for spontaneous interactions and collaborative learning (Boelens et al., 2017; Gecer, 2013). As noted by Boelens et al. (2017), in comparison with online instruction, the face-to-face component of BE contributes to facilitating interaction, as it has possibilities for both verbal and non-verbal communication during class.

Taken together, the findings outlined above suggest combining the affordances of both the online and face-to-face component of a blended course in a way that makes use of their strengths and addresses the potential drawback of delivering instruction through one component alone. Specifically, the opportunities for meaningful social and interpersonal interactions offered by the face-to-face component can be complemented by the flexibility offered by the online component, not only in terms of time and location (i.e., opportunities to follow or revisit lessons at students' own pace), but also in the variety of communicational spaces in which students can express their opinions and voice their concerns.

SEQUENCE OF ONLINE AND FACE-TO-FACE COMPONENTS

The order in which online and face-to-face activities are conducted and its impact on students' learning experiences was addressed in a study by Liaw et al. (2019), where various instructional sequences in BE were compared in terms of improving healthcare students' interprofessional competences. It was observed that the most effective instructional sequence was the one wherein web-mediated instruction was followed by a face-to-face simulation exercise. Other studies recommend organizing introductory meetings face-to-face, as it offers opportunities to familiarize students with practical matters (e.g., digital tools, learning management software, course demands, etc.), as well as opportunities to establish a foundation for social cohesion and create communities of exchange before meeting in an online setting (Boelens et al., 2017; Futch et al., 2016).

Three studies (Hassan & Othman, 2021; Kim et al., 2014; Müller & Wulf, 2021) focused on the flipped classroom, a frequently used sequence in BE. In the flipped classroom, knowledge transfer, for example in the form of short videos that students watch, is followed by an interactive and collaborative in-class meeting guided by the teacher. In two studies (Hassan & Othman, 2021; Müller & Wulf, 2021), such sequence has been shown to improve student performance and satisfaction as compared to a more conventional or traditional classroom approach where both knowledge transfer and collaborative work take place during classroom time. In another study, Kim et al. (2014) investigated flipped classroom design across three disciplines (i.e., engineering, social studies, and humanities) to derive general design principles. Among the proposed principles specifically focused on sequence, were to "Provide an opportunity for students to gain first exposure [to learning materials] prior to class" (p. 43), "Provide an incentive for students to prepare for class" (p. 44), and "Provide clear connections between in-class and out-of-class activities" (p. 45).

Overall, the literature suggests that, in blended course design, careful consideration must be given to the sequence of face-to-face and online components, and the types of activities to be proposed within each component so that they align.

INTEGRATION OF ONLINE AND FACE-TO-FACE COMPONENTS

Several studies pointed out that for students to move between the online and face-to-face components of a blended course seamlessly, it is important that the content covered face-to-face relates meaningfully to that covered online, and vice versa (Boelens et al., 2017; Calderón et al., 2021; Futch et al., 2016; Glogowska et al., 2011; Heilporn et al., 2021; Ustun & Tracey, 2021). This can be done by building on previously introduced or discussed content. For example, in a study by Heilporn et al. (2021) interviewing teachers regarding their strategies to motivate students, one teacher fostered students' cognitive engagement by combining expert videos and a synchronous discussion with the expert. In another study, blended course instructors recommended avoiding planning too far ahead, in order to be able to use interesting in-class discussions as online writing prompts, and vice versa, to be able to reference students' online discussions during face-to-face instruction (Futch et al., 2016). This way, it was explained, it would be clearer to students that the two components are interconnected, and that the teacher is present and paying attention to what they say.

To ensure that the reasons behind switching between modalities are apparent to students, several studies suggest organizing blended courses transparently, that is by

communicating properly the goals of each modality to students, thereby also enhancing student engagement and motivation (Boelens et al., 2017; Calderón et al., 2021; Glogowska et al., 2011; Heilporn et al., 2021; Lane et al., 2021; McKenzie et al., 2013). For example, Lane et al. (2021) describe a flipped classroom design where online videos watched before class were used as preparation for discussion in class. However, because communication about this objective was poor, students misinterpreted the online materials as replacing lecture time, which decreased satisfaction about the course. Thus, the authors noted that teachers should provide students with rationales about the different activities in the different modalities.

Main takeaways pertaining to blended course design

- There is no one-size-fits-all approach to determining the optimal ratio in blended courses. Contextual factors play a role, e.g., availability of technology, teacher competences, and access to campus.
- Affordances of both the online setting (e.g., opportunities to personalize and differentiate instruction) and face-to-face setting (e.g., opportunities for meaningful interpersonal interaction and collaboration) should be combined in BE in a way that makes use of the affordances of either setting on its own.
- The optimal sequence of activities in a blended course design depends on the goals of the activities. For instance, in a flipped classroom model, face-to-face meetings for in-depth content discussion and elaboration are preceded by web-mediated instructions as preparation.
- The connection between face-to-face and online learning activities should be transparent and therefore clearly communicated to students.

Blended teaching practices

For blended teaching practices, we distinguished three topics that teachers can take into consideration while teaching a blended course: (1) creating a supportive learning environment and positive learning climate, (2) accommodating diverse learning needs and circumstances, and (3) managing flexibility.

CREATING A SUPPORTIVE LEARNING ENVIRONMENT AND POSITIVE LEARNING CLIMATE

A safe, positive, and supportive learning environment can be an important mediating factor for students' success (Futch et al., 2016). Because of the switching between online and face-to-face settings, as well as synchronous and asynchronous learning activities, navigating blended courses can be more demanding on students than following only on-campus education. Students have to get accustomed to the different learning tools and learning activities that characterize a blended course (Futch et al., 2016; Lane et al., 2021). Teachers can support students in this navigating process by being actively present in both face-to-face and online environments (Chiu, 2021; Lane et al., 2021). Lane et al. (2021) stress that maintaining personal connections with students, as far as the course size allows this, as well as encouraging interaction between students by using collaborative and active learning strategies, is important for both students' satisfaction with and performance in BE courses. Moreover, Boelens et al. (2017) argue that special attention should be paid to including affective elements in online activities in BE, such as using humor with anecdotes, showing empathy by checking in with students explicitly, or through a warming-up activity and giving extra cues to get students' attention for certain tasks (Boelens et al., 2017).

ACCOMMODATING DIVERSE LEARNING NEEDS AND CIRCUMSTANCES

One of the most prominent affordances of BE is the opportunity to personalize the learning process based on students' individual needs, preferences, and abilities (Boelens et al., 2017; Dias & Diniz, 2014; Futch et al., 2016; Lai et al., 2016). Specifically, as noted by Dias and Diniz (2014), because BE involves different instructional activities, it has both the human and technological potential to accommodate students with different learning needs. Similarly, Kandakatla et al. (2020) found that students particularly valued the fact that blended learning environments accommodate their diverse learning situations and their individual learning rhythms.

There are different ways in which tailoring instruction, or differentiation, can be approached in the enactment of BE. In a literature review by Boelens et al. (2017), two general approaches were identified. One approach consists of adapting tasks and/or content based on students' prior knowledge and capabilities by giving a prior knowledge test to students. Based on this, three scenarios could unfold: 1) students get the same course documentation but differentiated instruction methods during the self-paced learning process, 2) a personal study plan can be developed for the learner or 3) homogenous groups of

students can be created for group work. The second approach consists of having students prepare for in-class activities during self-paced, online activities. This way, teachers can ensure that all students can enter class with similar prior knowledge. In another study, Boelens et al. (2018) conducted semi-structured interviews with instructors regarding the specific strategies they use to differentiate instruction in relation to students' individual needs. These strategies concern four ways to match classroom instruction to students' individual differences, namely through: content (e.g., providing various learning materials), process (e.g., combinations of whole group, small group and individual instruction), product (e.g., different instructions for completing assignments) and affect (e.g., creating success experiences).

In another study, Chiu (2021) recommends keeping in mind how, in a blended environment, it is crucial to consider how different instructional formats support varying student expertise and thinking levels. For example, some students might already have prior knowledge about a specific topic whereas other students do not. They recommend using scaffolding designs, such as level-up exercises (where students have to complete exercises of a lower difficulty in order to progress to more advanced ones), to create understanding of the technological learning environment, as well as creating flexible learning pathways. Other authors also advise being mindful of students' diverse living situations when personalizing their learning experiences (Huang, 2021; Alammary et al., 2015; Castro-Rodríguez et al., 2021; Kandakatla et al., 2020), such as for students with family or work commitments or who live far away from campus (Alammary et al., 2015).

MANAGING FLEXIBILITY

Another key affordance of blended courses are the possibilities they provide for creating a flexible learning environment. Several studies have found that students particularly value the flexibility that comes with being able to access and engage with online materials (e.g., pre-recorded lectures, scaffolding exercises, etc.) at their own time (Birgili et al., 2021; Glogowska et al., 2011; Boelens et al., 2017; Calderón et al., 2021; Ustun & Tracey, 2021). However, some authors advise teachers to be mindful of students' self-regulation skills, as well as their need for structure and guidance (Boelens et al., 2017; Pisoni, 2019; Futch et al., 2016). As Boelens et al. (2017) note, several self-regulation skills are necessary for students to successfully participate in blended courses, namely: organization, discipline, time management, the ability to use digital tools to support one's learning process, and self-

control. The authors outline four categories of strategies that can be used to assist students' learning processes in BE environments: 1) orienting and planning (e.g., introducing the course and activating students' prior knowledge), 2) monitoring (e.g., administering regular tests to assess students' competences and progress), 3) adjusting (e.g., providing additional feedback, if necessary, based on the results of the monitoring activities), and 4) evaluating (e.g., providing summative tests and sample exams).

Main takeaways pertaining to blended teaching practices

- Switching between online and face-to-face settings in BE can be experienced as challenging by students. Teachers can address these challenges by being actively present, maintaining personal connections with students, and using affective elements in the blended course.
- Teachers can use the unique affordances of either the face-to-face or online component in BE to accommodate different learning needs and circumstances of students.
- The flexibility offered by BE makes an appeal to students' self-regulation. Teachers can assist students in planning, monitoring, and adjusting learning through, among others, the use of formative assessments.

Teachers' qualities and competences

Bruggeman et al. (2021) identified teacher qualities that were helpful for the implementation of a blended course, among which: student-centered pedagogical beliefs, addressing urgent pedagogical needs by innovating, daring to experiment, sharing needs and concerns with fellow teachers, being able to critically self-reflect, and applying creativity in connecting technology to the learning process. The authors also found that for teachers who are implementing BE, it is important to have a clear understanding of what BE is. That is, teachers need knowledge about what BE can look like, how it works, and about its pedagogical affordances. As an example of assumptions that teachers can have about BE, teachers might expect that the online component of BE might cut time and take away workload, whereas designing and implementing BE usually takes more time and effort in the beginning, whereas the workload often decreases over time (Bruggeman et al., 2021).

> **Main takeaways**
>
> - Openness to innovation and a clear and realistic conception of what BE entails are needed for teachers to effectively design and deliver a blended course.

CONCLUSION AND DISCUSSION

The present review aimed to synthesize recent literature regarding BE course design and teaching practices in the context of higher education, by looking at the following research question: "Which key considerations emerge from the literature pertaining to effective and meaningful blended course design and teaching practices in higher education?". Overall, teachers are encouraged to adopt a comprehensive and flexible approach to both blended course design and facilitation of blended courses. Mainly, the idea that there is no 'one-size-fits-all' approach in BE was often reiterated in the reviewed literature, and authors frequently cautioned that decisions regarding BE ought to be made with close consideration of the educational context at hand.

Nevertheless, despite this emphasis on the benefits of a tailored approach in BE, some general recommendations were distilled for teachers to consider as they navigate the challenges and opportunities of blended teaching methods.

In terms of *blended course design*, the following four themes emerged from the literature: (1) considerations about ratio; and (2) (dis)advantages, (3) sequence, and (4) integration of online and face-to-face components. The following recommendations can be distilled concerning these themes:

- In determining the most appropriate ratio of online and face-to-face components, it is important to take contextual factors into account, such as access to campus and availability of technology.
- The online and face-to-face components of a blended course have unique advantages that can be used to overcome any drawbacks of using either modality on its own. It is worth exploring how to take advantage of these complementary affordances.
- In order to determine the most appropriate sequence of online and face-to-face activities in a blended course, learning goals of the course should be leading.
- Effective communication of blended course design decisions to students is important in order to promote their engagement and motivation with the course. Students need

to understand how the blended format of the course is meant to work in order to be able to participate effectively.

In terms of *blended teaching practices*, the following three themes were identified: creating a supportive learning environment and positive learning climate, accommodating diverse learning needs and circumstances, and managing flexibility. Concerning these themes, the following recommendations can be distilled:

- Teachers can enhance students' blended learning experience by actively establishing a supportive and positive learning climate for students in both the online and face-to-face components of a blended course.
- Online and face-to-face components of blended courses offer unique opportunities for adapting instruction to the diverse needs and backgrounds of students. This promotes making changes on the go depending on students' needs, ensuring that all students can succeed in the blended course.
- As flexibility is one of the most notable affordances of BE, teachers can greatly support the learning of their students in blended environments by finding a balance between providing autonomy and guiding or providing structure where needed.

Besides blended course design and teaching practices, a third category emerged from reviewing the literature. This category pertains to *teachers' qualities and competences* to effectively deliver a blended course. From the literature, the recommendation can be distilled that it is important for teachers to be aware of their beliefs and (mis)conceptions about BE, to be open to (technological) innovation, and to share knowledge with colleagues.

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APPENDIX

Table 1

Summary of Literature Review Findings

	Source	Focus	Findings
1	Alammary et al. (2015) – Identifying criteria that should be considered when deciding the proportion of online to face-to-face components of a blended course	Criteria that teachers should consider when deciding the proportion of online and face-to-face components in a blended course	Four categories of criteria identified: course-related, student-related, teacher-related, and institution-related. Institution-related criteria ranked as most important.
2	Alamri et al. (2021) – Learning technology models that support personalization within blended learning environments in higher education	Personalized learning and related technology in blended environments	Three technological models that support personalized learning within blended environments in higher education revealed: open digital badges, competency-based learning technology, and adaptive learning technology
3	Birgili et al. (2021) – The trends and outcomes of flipped learning research between 2012 and 2018: A descriptive content analysis	Trends and outcomes in research into flipped classrooms, published between 2012 and 2018	Various research trends observed (i.e., in terms of research design, subject area, participant demographics, etc.). Various benefits of flipped classroom emerged: positive influence on student performance, students' cognitive

		domain and affective domain, soft skills, and student satisfaction
4	Boelens et al. (2017) – Four key challenges to the design of blended learning: A systematic literature review	Literature insights into four key challenges to designing blended courses	Multiple strategies proposed in terms of each of the four challenges: incorporating flexibility, facilitating interaction, facilitating students' learning processes, and fostering an affective climate
5	Boelens et al. (2018) – The design of blended learning in response to student diversity in higher education: Instructors' views and use of differentiated instruction in blended learning	Instructors' strategies for and beliefs about differentiated instruction in BE	Three instructor profiles for designing BE to address student diversity emerged: disregard (instructors considered no additional support to match student needs), adaptation (instructors believed that increased support in the existing blended arrangements was sufficient), and transformation (instructors believed that blended arrangements should be tailored to student characteristics)
6	Bruggeman et al. (2021) – Experts speaking: Crucial teacher attributes for implementing blended learning in higher education	Teacher attributes contributing to the implementation of BE	Seven adaptive attributes: teaching and education at the center, student-centered pedagogical beliefs, realizing a pedagogical need for change, daring to experiment, sharing needs and concerns, being able to critically self-reflect, and connecting technologies to learning processes. Four maladaptive attributes: prioritizing other tasks over teaching, teacher at the epicenter, unclear understanding of blended, and feeling anxious about technology

7	Calderón et al. (2021) – An integrated blended learning approach for physical teacher education programmes: Teacher educators' and pre-service teachers' experiences	Physical education teacher educators' and pre-service teachers' (PSTs) enactment and experiences of BE	PSTs' experiences: a well-planned and clear structure was appreciated, the module was easy to engage with, and positive reactions to recorded lectures and blogs as assessment method. Teacher educators' feedback: embed tasks in videos, include links to other resources, and have a clear follow-up from the recorded lecture to the next synchronous meeting. Both PSTs and teacher educators acknowledged that a blended approach should be scaffolded throughout the program
8	Castro-Rodríguez et al. (2021) – Mapping of scientific production on blended learning in higher education	Research trends and outcomes related to BE in higher education	Many authors observe that methodological success of studies is related to cultural context and access to devices and materials. BE has a positive impact on students' motivation and learning effectiveness, as well as promoting student autonomy
9	Chiu (2021) – Digital support for student engagement in blended learning based on self-determination theory	Digital support designs for students' innate psychological needs and student engagement in blended environments	Teacher support was closely related to student engagement. The relationship between digital support and student engagement varied: perceived digital autonomy support had close relationships with behavioral, cognitive, and agentic engagement; perceived digital competence support was strongly associated with cognitive engagement; and perceived digital

			relatedness support was strongly associated with emotional engagement
10	Dias and Diniz (2014) – Towards an enhanced learning management system for blended learning in higher education incorporating distinct learners' profiles	Student needs and perceptions regarding the learning management system (LMS) environment	Students value interactivity in an LMS environment, as it contributes to their motivation and interest in the subject matter at hand, and due to its flexibility. Better ICT literacy was observed to be an emerging need for both lecturers and students
11	Futch et al. (2016) – "Comfort" as a critical success factor in blended learning courses	Lecturer strategies for combining online and face-to-face components effectively in a blended course	"Comfort" emerged as a mediating factor for student success, with organization, communication, and support as underlying themes
12	Gecer (2013) – Lecturer-student communication in blended learning environments	Student perceptions about roles, responsibilities, and communication in blended environments	Students stated 3 roles for a lecturer teaching in a blended environment: leader, guide, and model. Most students preferred the face-to-face communication environment since they feel more comfortable this way
13	Glogowska et al. (2011) – How "blended" is blended learning? Students' perceptions of issues around the integration	Students' perceptions of blended modules in a health care context	Three main themes emerged from the interviews relating to the 'blended' nature of the blended modules: issues around the opportunities for discussion of online materials versus face-to-face, issues of what material should be

of online and face-to-face learning in a continuing professional development health care context		online versus face-to-face, and balancing online and face-to-face components
14	Hassan & Othman (2021) - Flipped classroom approach in rigid body dynamics: A case study of five-semester observation	Effectiveness of the flipped classroom method	The flipped classroom was found to increase students' performance. Also, students preferred the method compared to a more traditional classroom approach
15	Heilporn et al. (2021) – An examination of teachers' strategies to foster student engagement in blended learning in higher education	Teacher strategies to foster student engagement in BE in higher education	Teachers' strategies are classified in three categories: course structure and pace, selection of teaching and learning activities, and the teachers' role and course relationships. Key findings to foster engagement were having a well-structured and paced course, integrating the (a)synchronous modes of BE, clearly communicating expectations, establishing trusting relationships at the start of the semester, using various digital tools, and stimulating co-construction between students
16	Huang (2021) – Using PLS-SEM model to explore influencing factors of	Factors influencing student satisfaction in BE	Perceived ease of use affects perceived usefulness, which has a positive impact on learning motivation and in turn on learning satisfaction. Thus, perceived

		learning satisfaction in blended learning	usefulness as an intermediary factor of perceived ease of use has an indirect impact on learning motivation and satisfaction
17	Kandakatla et al. (2020) - Student perspectives on the learning resources in an active, blended, and collaborative (ABC) pedagogical environment	Student perceptions of the ways in which the blended environment contributed to their success	Students valued the blended structure due to the immediate and asynchronous access to learning resources. Also, being able to use multiple resources in tandem (e.g., videos, lecture books, discussion boards, tutorial rooms, etc.) provided students with multiple avenues to solve a problem
18	Kim et al. (2014) – The experience of three flipped classrooms in an urban university: An exploration of design principles	Flipped classroom design principles and students' experiences with this	Students were overall satisfied with the flipped classroom activities. Classroom interaction contributed to their understanding of concepts. Flipped classroom activities were perceived as more student-oriented than traditional classroom activities. There was a need for clear instructions on how to complete learner-centered activities
19	Lai et al. (2016) – Design principles for the blend in blended learning: A collective case study	Blended design principles	Two major, not mutually exclusive, principles differentiating blended courses designs are identified: consolidation (combining different components so that students can consolidate their knowledge by engaging in different types of activities) and extension (extension of

			learning from one space to another, so that the face-to-face and online components complement each other)
20	Lane et al. (2021) – Engagement and satisfaction: Mixed-method analysis of blended learning in the sciences	Relationship between students' background and engagement in an undergraduate blended course	Emotional engagement was found to be a significant predictor of student satisfaction. Other forms of engagement inconsistently related to student satisfaction. Student satisfaction was found dependent on students' perceptions of an instructors' emotional openness, vulnerability, and creation of a supportive environment in blended courses
21	Liaw et al. (2019) – Finding the right blend of technologically enhanced learning environments: Randomized controlled study of the effect of instructional sequences on interprofessional learning	Relationship between instructional sequence and student learning outcomes in blended environments	No significant difference was found in self-efficacy between the WI-VR-SE (Web-based instruction – Virtual Reality – Simulation Exercise) and WI-SE-VR group, but participants in the SE-WI-VR reported significantly lower posttest scores than those in the WI-SE-VR group. Most participants selected the WI-VR-SE sequence as their top preference
22	McKenzie et al. (2013) – A blended learning lecture delivery model for	BE using personalized learning technology in a	Students who completed the online formative assessments had significantly higher scores on summative assessment tasks. Scores

	large and diverse undergraduate cohorts	large, diverse classroom	were even higher for students who used the resources repeatedly
23	Müller and Wulf (2021) – Blended learning environments that work: An evidence-based instructional design for the delivery of qualitative management models	Antecedents of effectiveness of BE and blended instructional design	The authors recommend adopting a flipped format in which learners first acquire and construct knowledge, after which classroom time is used for interactive discussions and applications
24	Owston and York (2018) – The nagging question when designing blended courses: Does the proportion of time devoted to online activities matter?	Relationship between the proportion online in a blended course and student perceptions and performance	Students perceived the blended course more favorably when between 33% and 50% of the course was online. Students performed significantly better when 33% to 50% of the course was online
25	Parlangeli et al. (2012) – Disentangled emotions in blended learning	Emotional experience of students in BE	Both face-to-face and online settings induced generally positive emotions, but some individual emotions were different in the two environments. Anger was evaluated as a scantly felt emotion, but with lower intensity in face-to-face lessons. Embarrassment was felt more intensely in the face-to-face lessons, and curiosity was felt more strongly in the online setting

26	Pisoni (2019) – Strategies for pan-European implementation of blended learning for innovation and entrepreneurship education	Strategies for introducing BE from the perspectives of lecturers and program coordinators	Modules need to be well-integrated with course work in order to make sense to the students. Teachers cautioned not to overload students and to allow students flexibility to follow courses at their own pace, and that online content should be an integral part of the course. Lack of in-person contact was seen as a drawback of the online component, but it allowed students to have cross-university collaborations, being adaptable to different local contexts
27	Rasheed et al. (2020) – Challenges in the online component of blended learning: A systematic review	Challenges in the online component of BE from different perspectives	Self-regulation challenges and challenges in using learning technology emerged as key challenges for students. Flexibility and freedom of learning at one's own pace contributed to this. Use of technology emerged as the key teacher challenge
28	Seredycz (2021) – Higher ratios of face-to-face blended learning is positively related to student satisfaction	The effect of different ratios on student satisfaction in BE	Students who selected lower intervals of online instruction and higher intervals of face-to-face instruction are more likely to report higher levels of overall satisfaction with the course

| 29 | Ustun and Tracey (2021) – An innovative way of designing blended learning through design-based research in higher education | Blended course development through a design-based research method | Students benefited from the online learning activities as it helped them to be more involved with and accountable for their work. The blended environment helped students to become more active instead of passive learners. Google Docs and Blackboard were highlighted as particularly useful digital learning resources |