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HyFlex Course Design: Outcomes, Challenges, and Supports for Students and Instructors

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HyFlex course design: outcomes, challenges, and supports for students and instructors

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Abstract

Since it was first developed in 2006, the hybrid flexible, or HyFlex, course model has been growing in prevalence in higher education. HyFlex courses are defined as those allowing students to decide whether to experience course material in person, online synchronously, or asynchronously on a weekly or daily basis without warning to, or permission from, the course's instructor. Empirical research regarding this instructional approach is still relatively limited despite increased attention during and following the COVID-19 pandemic. Increasing interest in providing alternatives to fully in-person instruction has made it necessary to closely examine the existing body of research to determine the effectiveness of HyFlex instruction, challenges that it presents, strategies used to meet these challenges, and gaps in knowledge that must be filled by future studies. This systematic review analyzed 57 empirical studies focusing on the HyFlex course model during the last 10 years to determine its learning outcomes, challenges, beneficial technologies, instructional strategies and supports, and recommendations for future mitigation efforts.

Keywords Hybrid flexible · HyFlex · Hybrid learning · Hybrid instruction · Multimodal instruction · Multimodal learning

Institutions of higher education have historically made an effort to extend instruction beyond the physical campus. From Sir Isaac Pitman's implementation of the first distance education course in the 1840s, which relied on postcards to send and receive assignments (Singh et al., 2021), to the Massive Open Online Courses (MOOCs) of

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today, both institutions and learners have sought ways to tailor learning to students' needs regardless of geographic location. The growing population of non-traditional college students and rising educational costs have made it even more necessary to avoid a "one size fits all" approach to higher education (Cain, 2015). In addition, technological advances have given colleges and universities new methods of increasing class sizes and course offerings without compromising instructional quality (Calafiore & Giudici, 2021). Fully in-person and online course delivery formats have now been joined by a variety of multimodal models developed to give students opportunities to experience the benefits of both face-to-face and remote instruction within a single course (Cain, 2015). Within these options, the hybrid flexible, or HyFlex, course model offers one of the most individually customizable approaches to instruction.

Background

In 2006, Beatty (2019) and colleagues in San Francisco State University's Instructional Technologies graduate program developed the HyFlex course model in response to both student and faculty concerns about insufficient course participation options and lack of institutional support for fully online instruction. Beatty (2019) defined HyFlex courses as "class sessions that allow students to choose whether to attend classes face-to-face or online, synchronously or asynchronously" (p. 13). These attendance choices can be made on a weekly or even daily basis without warning to, or permission from, the instructor teaching the course. When implemented well, HyFlex courses adhere to four fundamental values: learner choice, equivalency, reusability, and accessibility. As a result, regardless of their mode of attendance, learners should be able to participate equally meaningfully in all learning activities and use artifacts generated by both online and in-person students (Beatty, 2019).

Beatty (2019) intended that the HyFlex course model benefit students, faculty, and the institution at large. Ideally, students gain increased access to courses, flexibility in attendance, and access to the more robust instructional materials required to meet the needs of students participating in multiple modes. Instructors are given the ability to serve a greater number of students with the same resources, develop online teaching experience without relinquishing in-person instruction opportunities, and avoid class scheduling conflicts. Institutions gain the ability to increase enrollment beyond the university's physical capacity and without incurring large additional costs associated with hiring additional instructors or building new facilities.

In the past two decades, a number of instructional approaches have arisen that mix online and face-to-face learning. While these approaches are sometimes referred to interchangeably, and some are very similar to the HyFlex brand, as shown in Table 1, there are, in fact, important differences in attendance options among many of these approaches.

Although some institutions have embraced HyFlex instruction since its inception, the need for flexibility during the COVID-19 pandemic has recently brought this course model into greater prominence. Prior to the 2020-21 academic year, the majority of classes in traditional four-year institutions were offered in face-to-face format

Table 1 A comparison of hybrid learning models

Brand	Year	Similarities to HyFlex	Differences from HyFlex
Mode-Neutral	2008	Fluid asynchronous virtual, synchronous virtual, and in-person attendance options	Constructivist philosophy; authors' belief in universal applicability
Multi-Access Learning	2009	Session-by-session attendance choice (asynchronous virtual, synchronous virtual, and in-person)	Brand name
Synchronous Learning in Distributed Environments (SLIDE)	2011	Both online synchronous and in-person attendance	Students are geographically separated, so fluidity of attendance is not feasible
gxLearning	2011	Use of Web-conferencing software to connect geographically separated learners	Students attended in-person classes on two different campuses and were connected virtually
Blendsync	2011	Both online synchronous and in-person attendance	Students do not move fluidly between attendance modes
FlexLearning	2012	Session-by-session attendance choice (asynchronous virtual, synchronous virtual, and in-person)	Brand name
Converged Learning	2012	Session-by-session attendance choice (asynchronous virtual, synchronous virtual, and in-person)	Brand name
Peirce Fit	2014	Session-by-session attendance choice (asynchronous virtual, synchronous virtual, and in-person)	Brand name
Multi-Options	2014	Fluid asynchronous virtual, synchronous virtual, and in-person attendance options	Attendance options chosen weekly; each attendance choice has its own workload requirements
Flexible Hybrid	2014	Multiple attendance options	Online, hybrid, and flipped attendance options
Blendflex	2016	Session-by-session attendance choice (asynchronous virtual, synchronous virtual, and in-person)	Brand name
Comodal	2016	Fluid asynchronous virtual, synchronous virtual, and in-person attendance options	Attendance options chosen weekly
Flexibly Accessible Learning Environment (FALE)	2018	Fluid asynchronous virtual, synchronous virtual, and in-person attendance options	Attendance options chosen weekly
Remote Live Participation (RLP)	2018	Both online synchronous and in-person attendance	Students do not move fluidly between attendance modes; online and in-person students are not considered enrolled in the same course

Note. Adapted from Hybrid-flexible course design: Implementing student-directed hybrid classes by Beatty, 2019, EdTech Books

(Singh, 2021). In March 2020, institutions of higher education worldwide moved instruction almost entirely online, and for nearly a year, millions of students, faculty, and staff were forced to alter their approach to learning and delivering instruction with little preparation, leading to the development of what has been termed *emergency remote teaching* (Hodges et al., 2020). While this form of instruction primarily consisted of transferring in-person content to an online learning environment to meet a crisis (Bhagat & Kim, 2020), Benito et al., (2021) have noted that this experience also created an impromptu “global laboratory” (p. 52) in which institutions of higher education investigated the possibilities of more purposefully planned online instructional methods and revisited their previous expectations for academic programs, terms, and attendance (Govindarajan & Srivastava, 2020; LeBlanc, 2020). When colleges and universities began a return to in-person instruction, it became apparent that fundamental changes in the higher education landscape had occurred that prompted a rethinking of traditional instructional approaches (Colfer et al., 2021; Singh et al., 2021). As a result, HyFlex instruction gained in prominence (Athens, 2023; Wilson & Alexander, 2021).

Theories supporting HyFlex course design

HyFlex course design is closely related to three instructional theories that focus on the learner’s experiences beyond the educational environment and central role as an active participant in the learning process, as well as the interplay of multiple factors that shape educational experiences that include online components. The findings of the studies included in this review reflect the centrality of these variables on the success of students in HyFlex courses.

Self-regulated learning (SRL)

As a result of its highly individualized nature, HyFlex instruction is best suited to self-regulated learners with a well-developed internal locus of control. Pintrich (2000) described self-regulated learners as those who “set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features of the environment” (p. 453). Zimmerman (1994) suggested that self-regulated learners engage in a three-phase cycle of self-regulation in which they identify their goals and the best path to meet them, manage and monitor their learning and environmental conditions to meet their goals, and reflect on their process so that future improvements can be made. Driscoll (2014) explained that “learners must be given choices in and control over learning and motivation, with many opportunities for self-appraisal” (p. 331) in order to develop self-regulation strategies.

Moore’s theory of transactional distance

The HyFlex learning environment’s intersection of in-person and synchronous and asynchronous virtual instruction makes Moore’s (2019) theory of transactional dis-

tance a relevant theory when examining the interaction of student and instructor-controlled elements of this course design. Moore (2019) explains “transactional distance” as “the gap between the understanding of a teacher (or teaching team) and that of a learner” (p. 34). Bridging this divide relies on two variables: structure and dialogue. A course with a less rigidly defined structure, such as one that is offered online, allows students to determine their own paths through content and negotiate instructional variations (Moore, 2019). Transactional distance in online courses is decreased by maintaining dialogue between students and instructors and among students through communications technology (Iloh, 2019; Moore, 2019). The HyFlex modality’s synchronous and asynchronous virtual options allow for structural flexibility that both allows for learner autonomy and raises the possibility of increased transactional distance if dialogue is not maintained, making the effective use of communication technology invaluable.

Garrison’s community of inquiry (COI) framework

Garrison et al.’s (2000) community of inquiry (CoI) framework is also useful when considering the experience of learners who choose a HyFlex course’s virtual attendance options. Based on the understanding that a sense of community is essential to online students’ perception of learning (Garrison & Arbaugh, 2007), Garrison et al., (2000) proposed that the quality of a student’s online educational experience relies on three elements: cognitive, social, and teaching presence. Cognitive presence refers to learners’ ability to use inquiry, interactions with other learners, and reflection to create meaning (Garrison et al., 2001). Doing so relies at least in part on their sense of social presence, or the learner’s ability to interact socially and emotionally in a virtual environment in ways that make them seem “real” to others (Garrison & Arbaugh, 2007, p. 158). Teaching presence is required to guide these cognitive and social processes in purposeful directions so that they result in meaningful learning experiences (Garrison et al., 2001). When these three presences interact well, learners perceive that their online instructional experiences as satisfying and effective (Garrison & Arbaugh, 2007). The community of inquiry framework helps contextualize learners’ perceptions of their HyFlex courses and guides proposals for ways to mitigate the challenges of this instructional model.

Purpose of research

In the ongoing conversation about post-pandemic higher education, both fully online and hybrid learning options have become increasingly relevant as many universities have begun to adopt multimodal mediums of instruction (Singh, 2021). Embracing any form of instruction without research demonstrating its effectiveness is problematic, however, and formal studies of HyFlex instruction’s success are still somewhat limited. In a systematic review, Raes et al. (2020) have noted a lack of empirical research investigating the pedagogical, technical, and social benefits and drawbacks of synchronous hybrid courses as a whole. Even fewer studies have investigated HyFlex course design specifically, although the body of research has grown in the

past four years as a result of the COVID-19 pandemic. With the increasing interest in providing alternatives to fully in-person instruction, it becomes necessary to more closely examine the existing body of research to determine the current effectiveness, challenges, and mitigation strategies involved in HyFlex instruction and identify the gaps in knowledge that must be filled by future studies.

As a result of these needs and uncertainties, this systematic review seeks to answer the following research questions:

1. What learning outcomes of HyFlex instruction have been reported in higher education courses that have used this model?
2. What challenges have been identified in the implementation of HyFlex courses in higher education?
3. Which technologies have been found to best support instruction in a HyFlex learning environment?
4. Which instructional strategies and supports have been found to mitigate the challenges of a HyFlex learning environment?
5. What recommendations have been made for future mitigation efforts?

Methods

Selection criteria

To answer these research questions, the following criteria were employed to identify relevant articles:

1. Research must have been published within the last ten years (2015 to 2025) to ensure that information is current and relevant to the rapidly changing nature of HyFlex instruction.
2. Research must be published in the English language in peer-reviewed academic journals.
3. Research must explicitly identify the “HyFlex” or “hybrid flexible” modality as its primary focus. Articles briefly mentioning these modalities within a broad discussion of synchronous or asynchronous online instruction or hybrid online learning, as well as those focusing primarily on other models or brand names of instruction that combine in-person and remote options, were excluded.
4. Research must address the use of hybrid flexible course design in the environment of higher education. Papers focusing on other instructional environments, such as K-12 education, professional development, or technology education, were excluded.
5. Research must consist of empirical studies that present primary data collected using qualitative, quantitative, or mixed methods. Literature reviews, conceptual articles, conference papers, dissertations, and unpublished works were excluded.

Identification of eligible studies

Identification phase

As illustrated in Fig. 1, the process of selecting eligible studies was conducted in three steps, the first of which began with a combined search of four databases: Educational Research Information Center (ERIC), Education Research Complete (ERC), Academic Search Complete (ARC), and Education Source. A combined keyword search for “HyFlex” or “hybrid flexible” without inclusion of unwanted terms frequently returned in conjunction with these keywords (“EDM,” “root canal,” “heat pipe,” “electromagnetic,” “flowshop,” “nanotube,” “electrode,” or “dental”) and with applied limiters for English language, peer reviewed, What Works Clearinghouse (WWC) reviewed as “meets evidence standards without reservations,” academic journal, and dates ranging from January 2015 to January 2025 returned 183 results. The second selection phase included a search of Google Scholar using the keywords “HyFlex” or “hybrid flexible” and within a date range of 2015 to 2025. An additional 26 articles appeared to address Hyflex instruction and were added to the total number of records. The final phase of selection involved snowballing and yielded an additional 21 studies that were not repeated articles. After duplicates were removed, the identification phase of research yielded a total of 216 articles.

Screening phase

The remaining articles were then assessed for adherence to the research criteria, and 54 articles were removed from consideration because they were unrelated to the topic of course design, did not pertain to higher education, were not peer reviewed, had not been translated into English, or were classified as dissertations, conference papers, literature reviews, or unpublished works. A total of 162 articles were then screened

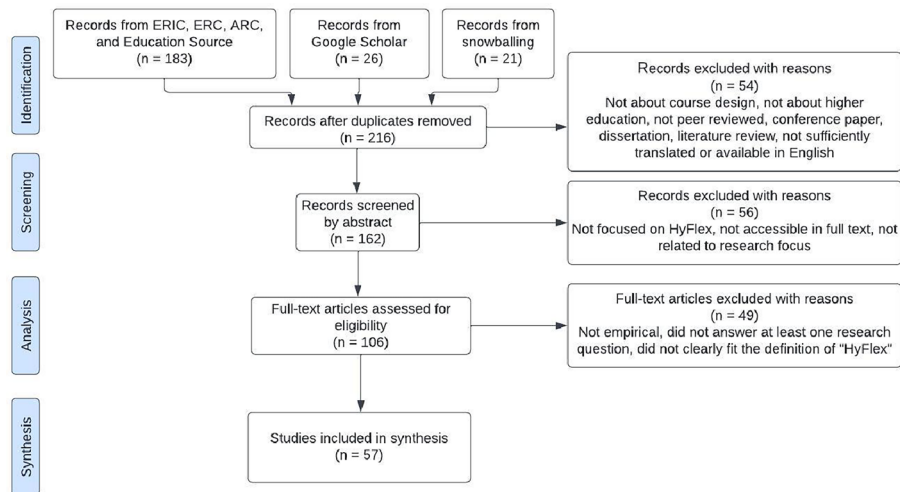


Fig. 1 Flowchart illustrating article selection process

based on the content of their abstracts. An additional 56 records were excluded because they included only brief references to HyFlex course design within a broader discussion of multimodal instruction, were not accessible in full text, or did not relate to the research focus.

Analysis phase

The 106 articles that were retained following the screening phase were carefully assessed as full texts to determine their adherence to the selection criteria and relevance to the research questions. Articles that did not qualify as empirical studies or provide the answer to at least one of the five research questions were excluded. In addition, articles that did not clearly adhere to Beatty's (2019) definition of a HyFlex course design were removed from consideration. Two very brief articles were removed based on lack of sufficient detail, and one study was excluded because the quality of its translation made it difficult to analyze. As a result of this process, 57 studies were determined to meet the review criteria.

Results

Learning outcomes

To determine the learning outcomes that have been reported in HyFlex higher education courses, each publication was analyzed to determine how success was measured. Outcomes were grouped into categories relating to *academic performance*, *student engagement*, and *satisfaction*, as shown in Table 2.

Academic performance

Although few studies have focused on academic performance exclusively, many have included academic data in their overall findings. Several studies have found HyFlex instruction to be associated with better academic outcomes than face-to-face instruction (Mentzer et al., 2023; Verrecchia & McGlinchey, 2021; Weathers & McNeely, 2021), although Verrecchia and McGlinchey stressed this advantage was very slight. Several studies, however, have determined no statistically significant difference between modalities on measures of content mastery, such as written exams, multiple-choice quizzes, final course grades (Calafiore & Giudici, 2021), weekly learning journals (Binnewies & Wang, 2019), course completion (Athens, 2023), or critical thinking skills (Zehler et al., 2021). Other studies have indicated that academic success in HyFlex classes depends on additional factors, such as connection to the instructor (Mentzer et al., 2024), level of engagement (Adeel et al., 2023), or attendance choices, with those who attended synchronously, either online or in person, earning higher final course grades than those who attended asynchronously (Hapke et al., 2021; Liu & Rodriguez, 2019). Although Mentzer et al. (2023) found that attendance choices did not impact students' mean semester grades, they did note differences in in-person and online students' grade distributions, with in-person students

Table 2 Student learning outcomes by measure of success

Measure	Finding	Studies
Academic performance	No difference between in-person and online synchronous	Adeel et al. (2023); Binnewies and Wang (2019); Liu and Rodriguez (2019); Mentzer et al. (2023); Zehler et al. (2021)
	No difference among in-person, online synchronous, and asynchronous	Wilson and Alexander (2021)
	No difference between Hybrid and HyFlex	Calafiore and Giudici (2021)
	Higher HyFlex grades compared to traditional	Mentzer et al. (2023); Verrecchia and McGlinchey (2021); Weathers and McNeely (2021)
	No difference between traditional and HyFlex	Athens (2023); Hagge (2024)
	Higher synchronous compared to asynchronous	Hapke et al. (2021); Liu and Rodriguez (2019)
	HyFlex course completion rate	Wong (2022)
Student engagement	Motivation	Abdelmalak and Parra (2016); Athens (2023); Adeniji-Neill et al. (2018); Binnewies and Wang (2019, 2023); Kohnke and Moorhouse (2021)
	Attendance	
	<i>Mostly online synchronous</i>	Tian (2021)
	<i>Mostly F2F</i>	Mahande et al. (2023); Nussli and Oh (2024)
	<i>F2F or online asynchronous</i>	Khan et al. (2023); Malczyk (2019)
	<i>Varied between course sections or over time</i>	Boylan et al. (2022); Detyna and Koch (2023); Hapke et al. (2021); Hagge (2024); Liu and Rodriguez (2019); Stewart and Bishop (2022)
	<i>No attendance in any mode</i>	Abdelmalak and Parra (2016)
Connection to classmates/instructor		
<i>Connected</i>	Baker et al. (2024); Buckley et al. (2023); Cheng (2023); Eduljee et al. (2023); Mentzer et al. (2024); Mentzer et al. (2022, 2023); Mentzer & Mohandas (2022); Stewart & Bishop (2022); Wright (2017)	
<i>Disconnected</i>	Baker et al. (2024); Bartolata et al. (2024); Athens (2023); Cheng (2023); Eduljee et al. (2023); Kohnke and Moorhouse (2021); Malczyk (2019); Song et al. (2024); Zehler et al. (2021)	

Table 2 (continued)

Measure	Finding	Studies
Student satisfaction	Appreciation of convenience, flexibility, autonomy, and empathy	Abdelmalak and Parra (2016); Alexander et al. (2024); Athens (2023); Baker et al. (2024); Bockorny et al. (2023); Boylan et al. (2022); Buatois et al. (2022); Calafiore and Guidici (2021); Cheng (2023); Detyna and Koch (2023); Eduljee et al. (2023); Hagge (2024); Hapke et al. (2021); Khan et al. (2023); Kohnke and Moorehouse (2021); Mentzer et al. (2024); Mentzer et al. (2022); Mentzer and Mohandas (2022); Song et al. (2024); Stewart and Bishop (2022); Tian (2021); Wilson and Alexander (2021); Wong (2022); Wright (2017)
	Quality of instruction	
	<i>Satisfied</i>	Abdelmalak and Parra (2016); Adeniji-Neill et al. (2018); Adi Badiozaman et al. (2024); Alexander et al. (2024); Athens (2023); Binnewies and Wang (2019); Bartolata et al. (2024); Bockorny et al. (2023); Boylan et al. (2022); Buatois et al. (2022); Cheng (2023); Eduljee et al. (2023); Hapke et al. (2021); Malczyk (2019); Mentzer et al. (2022); Mentzer and Mohandas (2022); Nelson et al. (2022); Nussli and Oh (2024); Stewart and Bishop (2022); Wright (2017); Zehler et al. (2021)
	<i>Dissatisfied</i>	Kohnke and Moorhouse (2021); Malczyk (2019); Zehler et al. (2021)

earning both more F's and A's than their online counterparts. The differences in these studies' academic findings may reflect the importance of secondary factors, such as personal attributes or social context, in determining HyFlex students' academic success. Wong (2022), for instance, noted that all but one student enrolled in a HyFlex course completed it successfully at a time during the pandemic when health concerns would likely have caused many students to fail had the course been in person.

Student engagement

Students' engagement in HyFlex courses was measured as a factor of regular attendance, participation in course activities, and students' perceptions of their connection to their classmates and instructors. Several studies identified a great deal of variance in preferred attendance patterns in HyFlex courses over the duration of the course (Boylan et al. 2022; Detyna & Koch, 2023; Liu & Rodriguez, 2019; Malczyk, 2019). Mahande et al. (2023) and Nussli and Oh (2024), however, found that HyFlex students overwhelmingly preferred face-to-face instruction while Hapke et al. (2021) noted that students expressed preferences for different forms of delivery based on the focus of individual lessons within a course. Although most studies found a mixture of attendance patterns within each course, Malczyk (2019) described a situation in which no students chose to attend synchronously online, and one study described a course in which some students did not engage in any mode (Abdelmalak & Parra, 2016).

Generally, however, students reported feeling as motivated (Athens, 2023) or more motivated to learn and participate in a HyFlex course than in traditional courses (Abdelmalak & Parra, 2016), which Binnewies and Wang's (2019) finding of above-

average completion rates of weekly learning journals and peer review assignments supports. Within the HyFlex modality, Bockorny et al. (2023) found no significant difference in engagement levels with respect to students' primary method of attendance, and Buatois et al. (2022) found that in-person and remotely attending students only differed significantly with respect to listening to presentations, with in-person students self-reporting slightly more attentiveness. Within HyFlex courses, Adeniji-Neill et al. (2018) found that virtual and in-person students contributed roughly equally while other studies found that face-to-face students were more participatory (Detyna & Koch, 2023; Kohnke & Moorhouse, 2021; Wong, 2022). Khan et al. (2023) noted that students primarily participated asynchronously but were less engaged in measures of skill and performance than those who participated either in person or online synchronously.

When engagement was measured as a factor of perceived connection to classmates and instructors, there was a great deal more variation in the studies' results. Several studies reported that students felt strongly connected to each other and to their instructor (e.g., Buckley et al., 2023; Mentzer et al., 2024; Mentzer & Mohandas, 2022; Wright, 2017). Other studies, however, found that students were frustrated with an inability to interact or connect with classmates (Athens, 2023; Bartolata et al., 2024; Malczyk, 2019), participate easily in collaborations (Kohnke & Moorhouse, 2021; Zehler et al., 2021), or ask for and receive help from the instructor during discussions (Malczyk, 2019) or in a timely manner (Bartolata et al., 2024). Baker et al. (2024), Cheng (2023), and Eduljee et al. (2023) found that students within the same study had differing perceptions of their ability to connect to other learners in this modality. These findings suggest that engagement in HyFlex is highly context-specific and varies depending on its method of measurement.

Student satisfaction

Satisfaction as measured by survey results was the most widely studied student outcome in these studies. Many students liked the option to choose attendance options based on convenience (e.g., Bockorny et al., 2023; Buatois et al. 2022; Calafiore and Giudici, 2021; Cheng, 2023; Eduljee et al., 2023; Hapke et al., 2021; Kohnke & Moorhouse, 2021; Mentzer & Mohandas, 2022; Wright, 2017), increased personal time (Tian, 2021), facilitation of school-work-life balance (Alexander et al., 2024), and the ability to accommodate individual learning preferences, thereby making them feel that they had control over their learning (Abdelmalak & Parra, 2016; Bockorny et al., 2023; Mentzer et al., 2024). The majority of students surveyed also indicated satisfaction with their ability to learn course content in this format (Adeniji-Neill et al., 2018; Binnewies & Wang, 2019; Bockorny et al., 2023; Cheng, 2023; Eduljee et al., 2023; Mentzer et al., 2022; Nelson et al., 2022). Students expressed that the rigor and quality of HyFlex instruction was equal to that of face-to-face courses (Malczyk, 2019; Mentzer & Mohandas, 2022), met their expectations (Wright, 2017), and did not affect their ability to think critically (Zehler et al., 2021). In three studies, students indicated that they actually preferred learning in a HyFlex format rather than traditionally (Abdelmalak & Parra, 2016; Adeniji-Neill et al., 2018; Adi Badiozaman et al., 2024). While the nursing students studied by Zehler et al. (2021) struggled with

participating in HyFlex simulations, the students indicated that they were preferable to computerized simulation experiences.

Challenges

While the results of many studies of HyFlex instruction indicated positive student outcomes, as shown in Table 3, nearly all of the studies reviewed identified challenges associated with HyFlex course design. At the institutional level, Malczyk (2019) noted that implementing this new course design may initially require additional financial resources. This and other studies also described issues with instructors' use of technology, teaching methods, and preparation for HyFlex delivery, but most were concerned with students' ability to navigate the necessary technology, communicate effectively, and exercise the self-management skills to succeed in this modality.

Table 3 Challenges of HyFlex course design

Affected party	Challenge	Studies
Institution	Financial	Malczyk (2019)
Students	Self-regulation	Abdelmalak and Parra (2016); Adeniji-Neill et al. (2018); Adi Badiozaman et al. (2024); Athens (2023); Bartolata et al. (2024); Calafiore and Giudici (2021); Keiper et al. (2021); Kohnke and Moorhouse (2021); Liu and Rodriguez (2019); Malczyk (2019); Tian (2021)
	Confidence	Detyna and Koch (2023)
	Technology Access	Abdelmalak and Parra (2016); Adeniji-Neill et al. (2018); Adi Badiozaman et al. (2024); Bartolata et al. (2024); Caparas and Yango (2023); Calonge et al. (2023); Eduljee et al. (2023); Kohnke and Moorhouse (2021); Romero-Hall and Ripine (2021); Zehler et al. (2021)
	Student user ability	Amiruddin et al. (2024); Adeniji-Neill et al. (2018); Tian (2021)
	Communication and collaboration	Athens (2023); Bartolata et al. (2024); Cheng (2023); Detyna and Koch (2023); Eduljee et al. (2023); Kohnke and Moorhouse (2021); Malczyk (2019); Nussli and Oh (2024); Song et al. (2024); Zehler et al. (2021)
Instructors	Instructor user ability	Adi Badiozaman et al. (2024); Bartolata et al. (2024); Detyna and Koch (2023)
	Technology	Athens (2023); Barr and Luo (2024); Boehm and Boerboom (2023); Calonge et al. (2023); Cheng et al. (2023); Cumming et al. (2024); Liu and Rodriguez (2019); Malczyk (2019); Padilla Rodriguez (2022); Romero-Hall and Ripine (2021); Song et al. (2024)
	Instructional preparation and delivery	Barr and Luo (2024); Binnewies and Wang (2019); Boehm and Boerboom (2023); Boylan et al. (2022); Cheng et al. (2023); Dawkins (2022); Leijon and Lundgren (2019); Malczyk (2019); Liu and Rodriguez (2019); Padilla Rodriguez (2022); Song et al. (2024)

Student challenges

Some of the most frequently noted difficulties in the studies of HyFlex students' success were associated with their inability to manage the processes needed to access instruction or demonstrate learning (Adi Badiozaman et al., 2024; Kohnke & Moorhouse, 2021; Liu & Rodriguez, 2019). Adi Badiozaman et al. (2024) found that students with self-regulation, decision-making, and problem-solving skills were most successful with HyFlex instruction. Conversely, students' lack of focus (Adeniji-Neill et al., 2018; Bartolata et al., 2024; Tian, 2021), insufficient engagement (Abdelmalak & Parra, 2016; Bartolata et al., 2024; Keiper et al., 2021; Kohnke & Moorhouse, 2021), failure to monitor their own progress or act upon feedback (Kohnke & Moorhouse, 2021), ineffective time management (Bartolata et al., 2024; Malczyk, 2019), unwise attendance choices (Athens, 2023), and inability to prioritize "needs" over "wants" (Tian, 2021) interfered with their ability to do well in HyFlex courses. While many studies focused on students' executive functioning skills, Detyna and Koch (2023) noted that online students' willingness to engage in synchronous class meetings was related to their level of confidence. Malczyk (2019) and Kohnke and Moorhouse (2021) found that some students felt that the online component of HyFlex instruction required a greater amount of work and self-instruction than a traditional course.

Access and communication issues made HyFlex instruction difficult for some students regardless of their motivation. In fact, Amiruddin et al. (2024) found that students' inability to manage the necessary technology may be related to an inability to self-regulate. Several studies noted that students experienced problems related to the learning management system (Abdelmalak & Parra, 2016; Adeniji-Neill et al., 2018), broken course links (Adeniji-Neill et al., 2018), meeting audio and video quality (Abdelmalak & Parra, 2016; Calonge et al., 2023; Song et al., 2024; Zehler et al., 2021), computer and internet access (e.g., Adi Badiozaman et al., 2024; Caparas & Yango, 2023; Eduljee et al., 2023; Kohnke & Moorhouse, 2021; Romero-Hall & Ripine, 2021), and navigation (Adeniji-Neill et al., 2018). Tian (2021) identified difficulties related to students' lack of experience with technology and online instruction, which Amiruddin et al. (2024) found to significantly affect their attitudes about the HyFlex approach overall. Online synchronous students appeared to struggle with interactions during live discussions (Kohnke & Moorhouse, 2021; Malczyk, 2019; Nussli & Oh, 2024; Song et al., 2024) and in paired and small-group assignments, particularly when the group mixed online and face-to-face learners (Cheng, 2023; Kohnke & Moorhouse, 2021; Malczyk, 2019; Zehler et al., 2021). Nussli and Oh (2024) found that intermodal interactions were rare, with instructors tending to group students by modality. These issues suggest that access and communication remain somewhat problematic in HyFlex courses.

Instructor challenges

Like their students, instructors also experienced challenges related to the use of technology, including frustration with inadequate (Barr & Luo, 2024; Boehm & Boerboom, 2023; Boylan et al. 2022) or malfunctioning equipment (Barr & Luo, 2024;

Calonge et al., 2023; Cheng et al., 2023), discomfort with unfamiliar technology (Liu & Rodriguez, 2019; Malczyk, 2019; Padilla Rodriguez, 2022; Romero-Hall & Ripine, 2021), or difficulty with a cumbersome learning management system (Romero-Hall & Ripine, 2021). Both Athens (2023) and Adi Badiozaman et al. (2024) found that instructors' inability to manage technology led students to have a sense of increased transactional distance and a less positive perception of their HyFlex experience. Unlike students, however, instructors faced the added difficulty of redesigning courses that they had previously taught using traditional structures so that all face-to-face activities had online equivalents, a process that required a considerable commitment of time and energy (Boehm & Boerboom, 2023; Boylan et al. 2022; Cheng et al., 2023; Dawkins, 2022; Malczyk, 2019; Padilla Rodriguez, 2022). These redesigned lessons required careful planning to achieve equity between online and in-person modalities with respect to content delivery (Leijon & Lundgren, 2019), access to learning resources and tools to complete learning tasks, assessments, feedback on assignments, and timely support (Binnewies & Wang, 2019).

HyFlex and other similarly designed courses are unique in allowing students to flow freely between modalities, thereby creating an additional challenge for instructors. Because they cannot know how many students will choose to attend a lecture in person, online synchronously, or online virtually on a given day (Malczyk, 2019), instructors may unexpectedly find themselves lecturing in empty classrooms (Dawkins, 2022; Liu & Rodriguez, 2019), which demoralized some instructors (Boehm & Boerboom, 2023), or managing both in-person and remote students (e.g., Boylan et al. 2022; Cheng et al., 2023; Padilla Rodriguez, 2022; Song et al., 2024), which presented the challenge of keeping online students engaged (Barr & Luo, 2024; Boylan et al. 2022; Cheng et al., 2023). In an extreme situation, an instructor might not even see students at all during the semester (Liu & Rodriguez, 2019). As a result, as Malczyk (2019) observed, HyFlex teaching requires a great deal of instructor flexibility. In meeting the challenges posed by fluctuating attendance, Dawkins (2022) found it essential to create lessons intended for asynchronous attendance that could be easily adapted if students unexpectedly appeared in person or synchronously online.

Technologies

A wide range of technologies were identified as useful in supporting HyFlex instruction, as shown in Table 4. Most frequently, studies emphasized that in order to present lectures to online synchronous students, instructors require Web conferencing and recording software (e.g., Athens, 2023; Calafiore & Giudici, 2021; Cheng, 2023; Eduljee et al., 2023; Heilporn & Lakhali, 2021; Kohnke and Moorhouse (2021); Liu & Rodriguez, 2019; Mentzer et al., 2023; Mentzer & Mohandas, 2022; Tian, 2021; Wigal, 2021; Wright, 2017; Zehler et al., 2021) and a learning management system (LMS) that houses the instructional content for all modes of delivery (Adeniji-Neill et al., 2018; Binnewies & Wang, 2019; Calafiore & Giudici, 2021; Eduljee et al., 2023; Hapke et al., 2021; Tian, 2021; Wigal, 2021). While some studies emphasize widely applicable hardware (Keiper et al., 2021; Mentzer & Mohandas, 2022; Sanchez-Pizani et al., 2022; Tian, 2021), software, and Web-based tools, other studies

Table 4 Technologies used to meet HyFlex challenges

Type of technology	Tool	Studies
Hardware	Smartphone	Keiper et al. (2021)
	SMART Board	Calonge et al. (2023); Stewart and Bishop (2022)
	T-bone GM5212 microphone	Calonge et al. (2023)
	Large screen	Calonge et al. (2023); Cumming et al. (2024)
	Portable microphone	Cumming et al. (2024)
	Bluetooth headset	Boylan et al. (2022)
	IPEVO V4K ultra high-definition USB document camera	Tian (2021)
	Built-in tracking camera	Cumming et al. (2024)
	Webcam	Mentzer and Mohandas (2022)
	Poly Studio E70 4 K Ultra HD Smart Video Conferencing camera	Calonge et al. (2023)
	ILS Synergy DW Smart Lectern	Calonge et al. (2023)
	Poly TC8 touch control	Calonge et al. (2023)
	Beam-forming microphone	Sanchez-Pizani et al. (2022)
	Wide pick-up microphone	Sanchez-Pizani et al. (2022)
	Limited pick-up microphone	Sanchez-Pizani et al. (2022)
	Pendant ceiling speakers	Calonge et al. (2023)
	Web-conferencing/ recording software	Adobe Connect
Zoom		Calonge et al. (2023); Cheng (2023); Cumming et al. (2024); Kohnke and Moorhouse (2021); Nussli and Oh (2024); Wigal (2021); Zehler et al. (2021)
Google Meet		Eduljee et al. (2023); Tian (2021)
Blackboard Collaborate		Cumming et al. (2024); Wright (2017)
Microsoft Teams		Athens (2023); Boylan et al. (2022); Cumming et al. (2024); Detyna and Koch (2023); Mentzer et al. (2024); Mentzer et al. (2023); Mentzer et al. (2022); Mentzer and Mohandas (2022); Stewart and Bishop (2022); Wigal (2021)
Bongo Virtual Classroom		Boylan et al. (2022)
Learning/ presentation software	Webex	Hagge (2024); Nussli and Oh (2024)
	SMART Learning Suite	Calonge et al. (2023)
Web-based tools	Microsoft PowerPoint	Hapke et al. (2021)
	External Web Resources	Binnewies and Wang (2019)
	Poll Everywhere	Bockorny et al. (2023)
	Word Cloud	Kohnke and Moorhouse (2021)
	Lino	Kohnke and Moorhouse (2021)
	Vizia	Binnewies and Wang (2019)
	Kahoot	Bockorny et al. (2023)
	Coggle	Bockorny et al. (2023)
Code Anywhere	Binnewies and Wang (2019)	
Nearpod	Bockorny et al. (2023)	

Table 4 (continued)

Type of technology	Tool	Studies
Learning management systems (LMS)	Piazza	Binnewies and Wang (2019)
	Canvas	Hapke et al. (2021); Wigal (2021)
	Blackboard Learn	Binnewies and Wang (2019); Calafiore and Giudici (2021); Hagge (2024)
	Moodle	Adeniji-Neill et al. (2018); Calonge et al. (2023); Cumming et al. (2024); Tian (2021)
	Brightspace	Eduljee et al. (2023)
e-learning platforms	Unspecified LMS	Tian (2021)
	Aplia	Calafiore and Giudici (2021)
	PebblePad	Binnewies and Wang (2019)
	MindTap	Hapke et al. (2021)
Social media Collaboration tools	BlazeVIEW integrated learning platform	Wright (2017)
	Facebook	Chen (2022)
	GoReact	Chen (2022)
	Scrum	Magana et al. (2022)
	Office365	Binnewies and Wang (2019)
	Padlet	Bockorny et al. (2023); Kohnke and Moorhouse (2021); Song et al. (2024)
	Flipgrid	Keiper et al. (2021)
	Jamboard	Bockorny et al. (2023)
	Google Docs	Binnewies and Wang (2019); Kohnke and Moorhouse (2021)
	Jigsaw	Bockorny et al. (2023)
Multimedia platforms	Aww App	Wigal (2021)
	ECHO360 active learning platform (ALP)	Adeel et al. (2023); Hapke et al. (2021)
Administrative tools	PhpMyAdmin	Binnewies and Wang (2019)

identified specific hardware models (Calonge et al., 2023) and discipline-specific technologies, such as Code Anywhere and PhpMyAdmin for use in an Informational Technology course (Binnewies & Wang, 2019). The need for collaboration tools to allow in-person and online students to work together on assignments was frequently mentioned as well (e.g., Bockorny et al., 2023; Keiper et al., 2021; Kohnke & Moorhouse, 2021; Magana et al., 2022). The array of technologies identified in these studies suggests that while certain types of tools are essential for managing HyFlex courses, instructors are offered a great deal of individual choice and flexibility in which specific tools they use to meet their needs.

Instructional strategies and supports

In addition to making use of many available technologies, instructors of HyFlex courses were observed to use a wide variety of instructional strategies and supports. While some of these techniques were necessitated by the unique requirements of the HyFlex modality, many were characteristics of effective teaching in any format.

Table 5 HyFlex instructional strategies and supports

Responsible party	Strategy	Studies
Institution	Infrastructure	Wright (2017)
	Support positions	Alexander et al. (2024); Cheng et al. (2023); Leijon and Lundgren (2019); Magana et al. (2022); Nussli & Oh, 2024
Instructor	Equity of access	Abdelmalak and Parra (2016); Binnewies and Wang (2019); Heilporn and Lakhal (2021); Romero-Hall and Ripine (2021)
	Engaging lectures	Adi Badiozaman et al. (2024); Binnewies and Wang (2019); Hapke et al. (2021); Heilporn and Lakhal (2021); Leijon and Lundgren (2019); Romero-Hall and Ripine (2021)
	Student-centered instruction	Barr and Luo (2024); Binnewies and Wang (2019); Cumming et al. (2024); Heilporn and Lakhal (2021); Romero-Hall and Ripine (2021)
	Feedback and assistance	Calafiore and Giudici (2021); Dawkins (2022); Heilporn and Lakhal (2021)
	Facilitation of communication and collaboration	Athens (2023); Binnewies and Wang (2019); Magana et al. (2022); Romero-Hall and Ripine (2021); Tian (2021); Zehler et al. (2021)
	Accountability measures	Mentzer and Mohandas (2022)
Learner	Removal of distractions, note-taking, and planning	Cheng (2023); Tian (2021)
	Motivation	Athens (2023)

As shown in Table 5, these strategies and supports can be classified broadly as the responsibility of the institution, the instructor, or the students themselves.

Institutional supports

A robust infrastructure and support system is the backbone of effective HyFlex instruction (Wright, 2017). Although HyFlex courses are largely under the control of the instructor, institutions can provide the financial means for both the necessary technology and support personnel. Several studies noted the importance of technology support services, such as those provided by the university library or instructional technology helpdesk (Alexander et al., 2024; Nussli & Oh, 2024), and a teaching assistant (Cheng et al., 2023; Leijon & Lundgren, 2019; Magana et al., 2022), such as a graduate student or facilitator, who can assist the lecturing instructor by using a laptop to respond to synchronous online students' questions, alert the instructor when more clarification is needed, and facilitate backchannel communication amongst students. Leijon and Lundgren (2019) also described a situation in which the facilitating instructor was responsible for preparing recorded lectures for online presentation. By providing these supports, institutions can help HyFlex instructors manage multiple modalities.

Instructor strategies

The majority of the studies in this review suggest that a great deal of the responsibility for HyFlex courses' success rests on the instructors' shoulders. Adi Badiozaman et al. (2024) found a strong correlation between students' perceptions of their HyFlex experiences and their instructors' ability to teach competently in multiple modalities. Many studies emphasized the importance of creating equity among the attendance modalities by making all course content available on the LMS, including instructions (Binnewies & Wang, 2019), practice opportunities (Heilporn & Lakhal, 2021), assessments (Binnewies & Wang, 2019; Romero-Hall & Ripine, 2021), links to practice activities and learning supports (Binnewies & Wang, 2019; Heilporn & Lakhal, 2021), and both audio and video recordings (Abdelmalak & Parra, 2016; Binnewies & Wang, 2019; Heilporn & Lakhal, 2021; Romero-Hall & Ripine, 2021). Additionally, studies noted the usefulness of student-centered approaches to instruction, such as Universal Design for Learning (UDL) (Cumming et al., 2024) and project-based and authentic assessments (Barr & Luo, 2024), and inquiry-based strategies (Romero-Hall & Ripine, 2021), such as alternately addressing online and in-person learners during lectures (Leijon & Lundgren, 2019) and increasing interactivity with polls (Hapke et al., 2021), surveys (Romero-Hall & Ripine, 2021), classroom response systems, embedded reflective questions (Binnewies & Wang, 2019), and active learning (Athens, 2023). Mentzer and Mohandas (2022) advocated that instructors increase accountability for students attending remotely by emphasizing the use of webcams, marking non-participatory students as absent, and using online peer evaluation to hold peers accountable during. Lastly, students often cited timely instructor feedback (Heilporn & Lakhal, 2021) and instructor assistance during office hours (Calafiore and Giudici, 2021) as one of the primary contributors to their success. Dawkins (2022) found timely instructor feedback crucial as well in maintaining student engagement.

One of the challenges to HyFlex students was communicating easily with both instructors and classmates, and as such, instructors' efforts to facilitate these interactions were emphasized. Chat rooms (Kyei-Blankson et al., 2014) and discussion boards (Romero-Hall & Ripine, 2021; Tian, 2021) were found to support asynchronous communication while live microphone chats were found useful during lectures (Kyei-Blankson et al., 2014). In addition, providing opportunities for students to peer review assignments fostered authentic connections (Binnewies & Wang, 2019). Groups of in-person and remote students (Binnewies & Wang, 2019; Zehler et al., 2021), particularly those that remained consistent throughout the semester (Heilporn & Lakhal, 2021), were found to connect students attending in different modalities, and Magana et al. (2022) found that explicit training in teamwork and conflict resolution were useful in improving the students' cooperative efforts.

Student behaviors and responsibilities

Despite the emphasis in most studies on external factors, both Athens (2023) and Tian (2021) noted that the learners themselves partly determine their success in HyFlex courses. Proactive, self-directed students have been shown to be most successful in

Table 6 Recommendations for future mitigation of hyflex course design challenges

Focus	Recommendation	Studies
Training	Use of technology	Alexander et al. (2024); Athens (2023); Cheng et al. (2023); Detyna et al. (2021); Song et al. (2024)
	Instructional design	Alexander et al. (2024); Barr and Luo (2024); Cheng et al. (2023)
	Collaborative techniques	Athens (2023); Kohnke and Moorhouse (2021); Romero-Hall and Ripine (2021); Song et al. (2024); Wright (2017)
	Self-regulation skills	Athens (2023); Bartolata et al. (2024)
Instructional strategies	Use of discussion platforms	Kohnke and Moorhouse (2021)
	Mixed-modality grouping	Kohnke and Moorhouse (2021); Zehler et al. (2021)
	Shortened synchronous sessions	Kohnke and Moorhouse (2021)
	Flipped classrooms	Kohnke and Moorhouse (2021)
	LMS use	Kohnke and Moorhouse (2021)
	Empathy	Cheng (2023)
	OER use	Romero-Hall and Ripine (2021)
Institutional supports and personnel	Consistent institutional policies	Barr and Luo (2024); Romero-Hall and Ripine (2021)
	Technical assistance	Barr and Luo (2024); Cheng et al. (2023); Detyna et al. (2021); Romero-Hall and Ripine (2017); Wright (2017)
	Support staff	Cheng et al. (2023); Cumming et al., 2024; Detyna et al. (2021); Romero-Hall and Ripine (2021); Zehler et al. (2021)
	Improved video and audio equipment	Detyna et al. (2021); Romero-Hall and Ripine (2021); Song et al. (2024); Zehler et al. (2021)
	Reliable devices and connectivity	Caparas and Yango (2023); Detyna et al. (2021); Kohnke and Moorhouse (2021); Romero-Hall and Ripine (2021)

HyFlex courses (Adi Badiozaman et al., 2024). Athens (2023) found that 17% of the students involved in their study reported struggling with motivation, although this issue may have been influenced by the larger struggle with mental health challenges that characterized the pandemic. Tian (2021) noted a similar difficulty with self-regulation in responses to an exit survey, with students admitting that planning ahead, taking notes during lectures, putting electronic devices away during class, and joining synchronous sessions from an environment free of distractions impacted their performance in their HyFlex programming course. Cheng (2023) also found that planning ahead and organizing their schedules helped students manage their HyFlex courses.

Recommendations for future mitigation efforts

The HyFlex modality is a relatively recent course design, and as such, most of the studies in this review identified ways to improve its implementation. As shown in Table 6, recommendations for future mitigation efforts can be classified as those relating to the training of both instructors and students, use of specific instructional strategies, and support structures and personnel provided by the institution.

Training

Several studies emphasized the need to train both instructors and students in using technologies and strategies that support HyFlex instruction. In addition to general professional development related to HyFlex instruction (Alexander et al., 2024; Barr & Luo, 2024; Cheng et al., 2023), five studies recommended that HyFlex instructors receive explicit training in strategies to enhance student collaboration (Athens, 2023; Kohnke & Moorhouse, 2021; Romero-Hall & Ripine, 2021; Song et al., 2024; Wright, 2017). In addition, both students and instructors should also be taught to use the technological skills needed to navigate a HyFlex course (Alexander et al., 2024; Athens, 2023; Cheng et al., 2023; Detyna et al. (2021); Song et al., 2024) and perhaps participate in a “practice” HyFlex experience prior to the first day of class (Barr & Luo, 2024; Zehler et al., 2021). Noting that the failures in HyFlex courses were highest among first-year students, Athens (2023) suggested that students should be explicitly taught self-regulation skills. Adequate preparation can prevent instructors and students from becoming frustrated by unexpected challenges arising in HyFlex courses during the semester.

Instructional strategies

Multiple instructional approaches were also suggested as potential ways to improve communication between instructors and students and among the students, including the increased use of instructor-mediated forums, blogs, built-in messaging systems (Kohnke & Moorhouse, 2021), and active learning exercises that build community across modalities (Athens, 2023). Several studies advocated the use of collaborative groups that combine face-to-face and online students (Kohnke & Moorhouse, 2021; Zehler et al., 2021); however, Zehler et al. (2021) recommended that instructors avoid situations in which only one participant in a hands-on activity is attending class in person. One study suggested methods to increase engagement, including limiting lectures to no more than one hour and utilizing the “flipped classroom” format in which live sessions enhance the work that students have already completed independently (Kohnke & Moorhouse, 2021). Kohnke and Moorhouse (2021) also advocated for the use of an LMS that allows for easy upload and download of materials. These ideas complemented Romero-Hall and Ripine’s (2021) suggestion that HyFlex courses use open education resources (OERs) that can be easily embedded in the LMS. Regardless of the instructional approaches used, Cheng (2023) emphasized the need to approach HyFlex instruction in general with empathy.

Institutional supports and personnel

Multiple studies also identified non-instructional strategies that could be used to support HyFlex instructors and students. Their recommendations included implementing consistent institutional policies for HyFlex courses (Barr & Luo, 2024; Romero-Hall & Ripine, 2021), technical support for both faculty and students (Barr & Luo, 2024; Detyna et al. 2021; Romero-Hall & Ripine, 2021; Wright, 2017), and support staff (Detyna et al. 2021; Romero-Hall & Ripine, 2021; Zehler et al., 2021) or a second

instructor (Cumming et al., 2024) to provide an “extra set of hands” during activities. These additional supports can help HyFlex instructors feel less overwhelmed by the need to juggle multiple responsibilities.

Improved access to technology for HyFlex courses was also suggested by multiple studies. Multiple authors stressed that HyFlex classrooms should be outfitted with quality video and audio equipment (e.g., Detyna et al. 2021; Romero-Hall & Ripine, 2021; Zehler et al., 2021). In addition, faculty and students need reliable devices and connectivity (e.g., Caparas & Yango, 2023; Detyna et al. 2021; Kohnke & Moorhouse, 2021; Romero-Hall & Ripine, 2021) to ensure equity regardless of attendance method. Noting significant inequity in students’ access to devices and internet connectivity, Caparas and Yango (2023) suggested university provided devices for students to check out, increased access to campus computer labs, and financial assistance for struggling students.

Discussion

As evidenced by multiple studies included in this review, HyFlex’s flexible attendance options are widely popular with students, suggesting that it may be a permanent addition to the higher education landscape. Since the COVID-19 pandemic, the number of studies focusing on this course design has grown; however, the large number of challenges noted within existing studies demonstrate a need for further research to improve the likelihood of its success.

Within the limited number of studies on HyFlex course design, there are even fewer quantitative studies measuring its academic outcomes compared to those of traditional courses. As shown in Table 2, 32 of the 57 articles included in this review included an assessment of students’ satisfaction with one or more components of their HyFlex courses. By comparison, 13 of the articles dealt with the students’ academic success in some form, and of these studies, only five compared students’ grades in HyFlex courses to those of students in traditional classes. The data that these studies reported suggests a much greater emphasis on student satisfaction and perceptions of the usefulness of instructional strategies than quantitative measures of learning.

Students’ satisfaction is certainly part of evidence-based decision making in higher education (Klemenčič & Chirikov, 2015) and has been shown to positively affect learning outcomes (Oja, 2011; Sockalingam, 2013). In addition, it is well established that learning involves changes in attitude in addition to acquisition of knowledge and skills that grades measure (Wittrock, 1977). However, it is important to note that students may like aspects of a course that have little relevance to instructional quality, such as instructors’ gender or attractiveness (Boring, 2016), or demonstrate evidence of the halo effect, which occurs when students do not discriminate between unrelated aspects of a course on a survey (Feeley, 2002). In addition, “satisfaction” is an ephemeral emotion that may not fully capture the quality of a learner’s experiences over the entirety of the course. According to Looi et al. (2010), satisfaction surveys “focus on examining short-lived learning experiences” and “fail to provide comprehensive perspectives on learners’ meaningful experiences across settings over time” (pp. 161–162). As a result, it would be beneficial to supplement studies of student

satisfaction with additional quantitative studies comparing academic achievement in HyFlex and traditional courses to further evaluate its effectiveness as an alternative course design.

Additional research is also needed to investigate methods of fostering the personal characteristics that are most associated with students' success in HyFlex courses. Consistent with the Theory of Self-Regulated Learning (SRL), the findings of multiple studies included in this review reinforce the relationship between success in a HyFlex course and self-regulation (Athens, 2023; Kohnke & Moorhouse, 2021), indicating, as Liu and Rodriguez (2019) argue, that HyFlex instruction most benefits autonomous learners. The flexibility of attendance modes in HyFlex courses means that students are entrusted with the responsibility of making wise decisions about how to access the information that will help them reach their goals (Abdelmalak & Parra, 2016; Binnewies & Wang, 2019). In addition, learners choose how they will demonstrate their understanding of material, form meaningful connections with classmates, and seek assistance from the instructor and other sources of information (Beatty, 2019). Unsurprisingly, the most successful HyFlex students seem to be those who are skilled in these behaviors before attempting a new mode of learning, as Calafiore and Giudici's (2021) observation of a strong positive correlation between students' prior GPA and performance in a HyFlex course seems to indicate.

Given the relationship between self-regulation and success in a HyFlex course, future research might investigate the impact of embedded self-regulation training within the context of HyFlex course designs. This training could include focused lessons in building such skills as using a course schedule to pre-plan attendance choices and study sessions, setting appropriate deadlines, and identifying potential resources when asynchronous work becomes too challenging. By building self-regulation training into HyFlex courses, particularly those taught to students in introductory level courses, institutions could potentially help students develop the mindsets and behaviors that are needed to excel in any non-traditional course.

Fortunately, it appears from these studies' results that a wide range of technologies have been shown to support HyFlex instruction. The lack of overlap in technologies shown in Table 4 creates a potentially overwhelming number of choices for both instructors and students and suggests little consistency among institutions or even within a single institution. To aid institutions and instructors in selecting the best technologies to suit their HyFlex courses' needs, more studies comparing and evaluating these technologies' benefits for HyFlex instruction would be beneficial.

Based on existing studies' results related to communication in HyFlex courses, effective use of technology and instructional strategies have already had some success in supporting the sense of community that Garrison et al. (2000) emphasized as crucial for meaningful learning and narrowing the transactional distance that Moore (2019) warned could separate online students and their in-person classmates and instructors. Some studies' results indicated serious concerns with communication in HyFlex courses (e.g., Caparas & Yango, 2023; Kohnke & Moorhouse, 2021; Malczyk, 2019; Padilla Rodriguez, 2022; Zehler et al., 2021) while other studies' authors observed collaborative techniques being utilized successfully. To ensure that all students and instructors are able to participate equally in the open communication required for learning (Moore, 2019), institutions must continue to provide the techno-

logical support and resources for HyFlex instructors and students. Studies included in this review noted that some students struggled with connectivity issues and outdated devices (e.g., Caparas & Yango, 2023; Eduljee et al., 2023; Kohnke & Moorhouse, 2021; Romero-Hall & Ripine, 2021), as well as inadequate classroom audiovisual equipment and quality (e.g., Abdelmalak & Parra, 2016; Padilla Rodriguez, 2022; Zehler et al., 2021). These difficulties suggest that the digital divide continues to present a challenge for higher education and that institutions must therefore work to eliminate inequalities in technology and internet access when implementing HyFlex instruction.

In addition to research focused on improving HyFlex instruction for students, the number of studies identifying technological and instructional challenges for instructors suggests that more research is needed to determine ways to support HyFlex instructors. As Garrison et al. (2000) stressed, teacher presence is essential to building an effective learning environment, which requires that instructors be able to successfully leverage the necessary tools and strategies. Studies included in this review noted that instructors must redesign their traditional courses to fit the HyFlex model (e.g., Dawkins, 2022; Malczyk, 2019), learn to use the technologies that it requires (Athens, 2023; Liu & Rodriguez, 2019; Malczyk, 2019; Padilla Rodriguez, 2022; Romero-Hall & Ripine, 2021), engage students attending in multiple modalities (Athens, 2023; Padilla Rodriguez, 2022), and even rethink the way they move in the classroom to accommodate a new delivery style (Leijon & Lundgren, 2019). As a result, Beatty (2019) acknowledged that “the clear cost to faculty (especially when getting started) with HyFlex is the additional time it takes to most to create two learning complete paths through a course in order to fully support both online and in-class participation” and noted that “some are compensated for the additional time they spend on course development” while “many are not, finding ways to rearrange their other work to allow for HyFlex development” (p. 26). Fifteen of the studies included in this review noted that instructors faced one or more challenges in preparing and implementing HyFlex courses (e.g., Athens, 2023; Barr & Luo, 2024; Boehm & Boerboom, 2023; Song et al., 2024), and three studies noted a connection between the instructor’s skill in teaching in this modality and the students’ satisfaction or perceptions of success (Adi Badiozaman et al., 2024; Bartolata et al., 2024; Detyna & Koch, 2023). As a result, ongoing research is needed to determine how instructors can best be supported when implementing HyFlex instruction.

This review synthesized only those studies published in the last 10 years, and its scope was limited to those search results that specifically focused on “hybrid flexible” or “HyFlex” instruction. While these terms are widely used to describe one form of multimodal learning, as Beatty (2019) has acknowledged, other instructional designers and universities have created their own synchronous learning experiences that offer many of the same flexible attendance features of HyFlex course design. To obtain a more comprehensive understanding of this form of instruction, future reviews might consider widening this focus to include other multimodal “brands.” In addition, this review was limited to published articles and conference papers, thereby excluding studies that were still undergoing the review process. It is recommended that investigations replicate this review’s search and synthesis process within the next

two years to include any recent additions to the literature on HyFlex that were not published at the time that this review was written.

This review encompassed a ten-year period that included the COVID-19 pandemic, and as such, its findings may be heavily influenced by the pandemic's impact on HyFlex instruction. Many of the studies included in this review focused on the implementation of HyFlex courses during the era of social distancing and, to different extents, overlap this modality with "emergency remote teaching (EMT), in which in-person instructional materials were hastily converted into online content to allow for social distancing (Bhagat & Kim, 2020; Hodges et al., 2020). Multiple studies explicitly note the importance of placing their research in the context of a unique emergency response rather than assuming it represents a traditional HyFlex experience (e.g., Boylan et al. 2022; Detyna & Koch, 2023; Eduljee et al., 2023; Magana et al., 2022; Nelson et al., 2022; Tian, 2021; Verrecchia & McGlinchey, 2021). As a result, it will be crucial to conduct a similar review in several years when the effects of the pandemic are less prominent in HyFlex literature.

Conclusion

HyFlex course design may be a relative newcomer to the higher education landscape, but its popularity among students and usefulness for institutions seeking ways to expand course offerings bode well for its future success. The studies included in this literature review suggest that HyFlex instruction is popular among students because of its increased flexibility and student-centered approach, and the few studies that investigated its academic effectiveness did not reveal a significant difference between HyFlex and traditional instruction, though more research is needed in this area. Furthermore, the communication gaps that can interfere with effective online learning were largely not found to be problematic in HyFlex courses with a few exceptions. To increase knowledge about HyFlex instruction, it is recommended that future research focus on conducting quantitative studies of its academic outcomes, exploring the role of self-regulation training in improving student success, evaluating the usefulness of the many technologies currently used in HyFlex courses, and investigating the experiences of instructors. Informed by additional research, institutions using the HyFlex modality can mitigate its current challenges and build upon its strengths to increase its success in higher education.

Declarations

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

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