A Bichronous Learning Model for Faculty Training and Online Course Conversion

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Abstract

This paper presents the framework and initial development of a faculty training program designed to support the transformation of traditional engineering courses into high-quality online offerings. The program employs a bichronous learning model, integrating asynchronous flexibility with synchronous engagement to enable faculty to design research-driven, interactive online courses. Grounded in evidence-based instructional practices, the curriculum incorporates active learning strategies, innovative technology applications, and community-building initiatives to improve faculty preparedness for online teaching. Although still in development, the program incorporates a structured course design process that culminates in a Course Design Document aligned with best practices in STEM education. A mixed-methods evaluation approach is proposed to assess the program's impact on teaching effectiveness and student outcomes. By addressing key challenges in online education, this program aims to provide actionable insights into faculty development and contribute to the broader discourse on transforming STEM education in blended and online contexts.

Keywords: Bichronous Online Learning, STEM Education, Faculty Training, Active Learning Strategies, Course Design

1. Introduction

The latest Changing Landscape of Online Education report (CHLOE 9) [1] highlights a sustained demand for online learning among students at U.S. higher education institutions. As part of this broader shift toward online education, the engineering school at a private research university has launched a strategic initiative to transform its in-person courses into online formats, aligning with student needs. This initiative aims to harness faculty expertise, broaden the online curriculum, and deliver a greater number of high-quality online options, ultimately enhancing student learning outcomes. The school is utilizing resources initially developed for emergency remote instruction during the pandemic. This includes repurposing live classroom lecture recordings from full-time, in-person programs to expand opportunities in part-time, fully online graduate engineering programs.

However, this in-person-to-online conversion is not without challenges. Many in-person courses were primarily designed for traditional classroom environments, and some faculty members have limited experience with online teaching. To address these challenges, a blended faculty training program is being developed, integrating both asynchronous and synchronous components. The program aims to elevate the quality of online courses and support the school's mission to deliver effective, high-quality education across its academic programs.

2. Literature Review

Blended Learning

Blended learning serves as an umbrella term often used interchangeably with concepts like hybrid learning [2], [3]. Despite some variation in definitions, there is broad consensus that blended learning refers to "learning experiences that integrate face-to-face and online instruction" [2, p. 174], with the online component typically accounting for 30 to 79 percent of the overall course [2], [4]. Over the past decades, researchers have explored various models and implementations of blended learning, recognizing its potential to personalize instruction for diverse learners and create environments that encourage student autonomy and ownership of learning [5].

Blended learning has become increasingly prevalent in higher education and is expected to become a dominant instructional model in the future [2], [4]. Research has demonstrated that blended learning can enhance student engagement, satisfaction, access, and flexibility while yielding improved learning outcomes compared to fully online or in-person formats [3], [6], [7]. Joosten et al. [3] identify four key dialectics in blended learning—technological, temporal, spatial, and pedagogical—highlighting the importance of strategically integrating these dimensions to create effective learning experiences. Among the variations is bichronous online learning, which emphasizes

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temporal integration to maximize engagement and flexibility [3], [8].

Bichronous Online Learning

Bichronous online learning represents a distinct form of blended learning that differs from traditional models, as it does not include any on-site component. As Martin et al. [8] describe, bichronous learning "combines both asynchronous and synchronous online learning, where students can participate in anytime, anywhere learning during asynchronous parts and engage in real-time activities for synchronous sessions." This model gained prominence during the remote instruction necessitated by the COVID-19 pandemic, demonstrating the adaptability and resilience of blended learning approaches in meeting the demands of challenging educational contexts.

Research suggests that the integration of asynchronous and synchronous elements enriches the overall learning experience. Asynchronous components offer students flexibility, while synchronous sessions provide opportunities for real-time interaction, mitigate feelings of isolation, and help build a strong sense of community [5]. When designed thoughtfully, bichronous online learning has been shown to enhance student outcomes, promote a sense of belonging, and improve retention rates [8, 9]. The model is also relevant for faculty training programs, which must equip instructors to design engaging, research-based, and technology-integrated learning experiences [3], [8], [9].

Active Learning Strategies in Blended Environments

Active learning strategies are pivotal in blended and bichronous environments, engaging students through interactive activities that foster critical thinking and problem-solving. The term "active learning" encompasses a range of approaches, including challenging questions, worksheet exercises, small group discussions, and problem-solving activities. Research highlights that these strategies prioritize deliberate practice in "thinking scientifically," enabling students to deepen their understanding through immediate feedback from instructors or peers [10], [11], [12].

Active learning approaches shift classroom dynamics from passive listening to active participation. Freeman et al. [12] highlight how active learning facilitates engagement by incorporating activities and discussions that promote higher-order thinking and collaboration. Their meta-analysis reveals the effectiveness of this approach, stating, “active learning engages students in the process of learning through activities and/or discussion ... as opposed to passively listening to an expert” [12, p. 8413-8414].

In STEM education, active learning strategies manifest in various forms. Deslauriers et al. [11] underscore the importance of practices such as reasoning, problem-solving, and frequent feedback to maintain student engagement and foster critical thinking. Similarly, Eddy et al. [13] defines active learning as any scenario where students actively address questions or problems, emphasizing the value of interactive and hands-on activities.

Sala et al. [14] stress the significance of designing activities that cultivate higher-order thinking skills, particularly in engineering education. They note that many blended learning models target lower to medium levels of Bloom’s taxonomy, often overlooking more complex cognitive tasks. To address this, they advocate for integrating activities that drive deeper cognitive engagement and critical analysis. These findings underscore the importance of intentionally designed active learning experiences that move beyond simple content delivery. In blended and online environments, leveraging diverse, evidence-based strategies—such as those outlined by Wieman, Deslauriers et al., Freeman et al., Eddy et al., and Sala et al. [10], [11], [12], [13], [14] —is crucial for promoting deep learning and meaningful engagement. Particularly in STEM disciplines, these approaches are instrumental in equipping students with the critical thinking, problem-solving, and analytical skills necessary for addressing complex challenges.

3. Methods

The research study outlines the design and theoretical foundation of a faculty training program that is currently in the developmental phase. Future research will focus on implementing and evaluating the proposed elements. The program is designed to incorporate active learning strategies aimed at improving course design and delivery. It equips faculty with evidence-based tools and techniques to create engaging online courses that foster student participation and enhance learning outcomes. The following sections detail the program's design, its key features, and the planned evaluation framework.

3.1. Program Design and Participants

The proposed program is developed using a mixed-methods approach to inform both its development and future evaluation. It leverages a bichronous learning model, combining asynchronous and synchronous online modalities to provide participants with a balance of flexibility and real-time interaction.

The program is aimed at engineering faculty members at a private research university. Upon implementation, instructors transitioning in-person courses to online formats will be invited to participate. This focused approach ensures the program effectively addresses the specific challenges faculty face in online course design and delivery.

3.2. Training Curriculum

The eight-week training program, to be hosted on the Canvas learning management system, is under development with interconnected modules. These modules are intended to guide faculty in transforming traditional courses into effective online formats using a Course Design Document (CDD) as a blueprint. The curriculum covers key topics, including learning objectives, assessment strategies, tools and technology, and course outlines.

The program incorporates asynchronous elements, such as readings, videos, practice exercises, discussions, and peer reviews, alongside optional synchronous sessions that have been planned for immediate interaction and feedback. It begins with an introduction to the administrative framework for course conversion, outlining core objectives, processes, and templates. Throughout the program, evidence-based instructional practices are emphasized, providing insights into active learning, feedback techniques, peer engagement, cooperative learning, and multimedia learning principles.

To address the specific needs of engineering faculty, the curriculum includes content tailored to STEM education. It highlights research by Carl Wieman, Nobel laureate and Stanford University professor of Physics, as well as other educators and researchers, showcasing the effectiveness of active learning techniques in science education. Practical examples, such as the use of Generative AI applications, demonstrate innovative teaching strategies. Participants are provided with sample prompts, AI-generated outputs, and examples based on existing work to support their course design efforts.

The curriculum follows a logical sequence aligned with the CDD, beginning with foundational elements such as learning objectives and progressing to topics like assessment strategies and technology integration. The final module emphasizes reflection and feedback, enabling faculty to refine their course designs and assess the effectiveness of their training experience. This structured approach is intended to reinforce effective instructional practices linked to positive student outcomes and supports faculty perceptions of the value of bichronous online learning [3, 9].

3.3. Active Learning Strategies

Active learning strategies have been developed as central to the faculty training program, designed to promote engagement and foster higher-order thinking. By integrating evidence-based practices drawn from research [10], [11], [12], [13], [14], [15], the program seeks to ensure that its activities are both effective and aligned with best practices in blended learning environments. The program incorporates a variety of active learning components that have been developed to support these goals. For instance, faculty will engage with a self-check quiz on multimedia learning principles within Canvas. To promote collaboration and critical evaluation, participants will be paired for peer review to exchange feedback on course assessment strategies. This activity is planned to be guided by a rubric to ensure that feedback is both constructive and targeted.

The curriculum includes opportunities to further enhance engagement through group discussions and opportunities for personal reflection, promoting critical thinking and collaborative problem-solving. These activities are intended to deepen participants' understanding of active learning principles and prepare them to transition from traditional lecture-based teaching to innovative methods that actively engage students and enhance learning outcomes.

Additionally, the program features a video presentation by Carl Wieman [15], which highlights empirical evidence on the impact of active learning on student performance in STEM disciplines. Drawing on Wieman’s research, the training encourages faculty to implement active learning techniques such as posing challenging questions, facilitating group problem-solving exercises, and adopting strategies that foster expert-like thinking [11], [12], [15] in their courses. These strategies, grounded in evidence-based instructional practices, are designed to support faculty in transitioning to blended learning environments. The program aims to equip faculty with active learning methods that enhance student engagement and improve learning outcomes.

3.4. Assessment

The course assessment strategy has been designed to align with the training's objectives and institutional quality benchmarks, employing authentic assessment methods [16] to provide faculty with opportunities to apply their learning in practical contexts. Formative assessments, such as quizzes, assignments, peer reviews, and discussions, are integrated throughout the program to offer continuous feedback and foster iterative improvement. These assessments are designed to encourage reflection on teaching practices and the meaningful integration of technology into course design.

Optional synchronous sessions have been planned to provide participants with immediate feedback, while discussions and peer critique exercises support the course design process. The summative assessment has been designed to consist of a phased development of a Course Design Document, with feedback to be provided at each stage to ensure alignment with best practices and training objectives.

The final reflection component has been designed to allow participants to evaluate their training experience and plan next steps for refining their course designs. This reflective process is intended to support ongoing improvement and the application of skills and strategies introduced during the program, contributing to sustained effectiveness in teaching practices.

3.5. Tools and Technology

A variety of technology tools have been selected to support the implementation of evidence-based instructional practices. Among the key tools are Miro and Kialo, which are intended to promote critical thinking and collaborative learning by empowering faculty to design activities that actively engage students with course material.

The program also incorporates creative tools such as Adobe Spark and StoryMaps to enhance content presentation. These technologies allow faculty to develop interactive materials that enrich the online learning environment and present course content in visually engaging and dynamic ways.

For real-time communication and group activities, Microsoft Teams and Zoom are introduced to foster interaction and cultivate a sense of community among students in virtual settings. Additionally, Office 365 and Google Workspace are employed for collaboration, file sharing, and course material management, streamlining administrative tasks and improving overall efficiency in online teaching.

The integration of generative AI technologies, such as ChatGPT, is another focus of the program. Faculty will be introduced to practical applications of AI, including generating case studies, creating practice assignments, and providing personalized feedback assisted by automated tools. These tools aim to enhance instructional design and delivery, facilitating dynamic active learning environments and creative teaching methods.

The program is designed to equip faculty with a wide range of tools and techniques to develop technology-enhanced learning environments that promote student engagement and active participation.

3.6. Community Building and Learner Engagement

The training program will emphasize the importance of fostering a strong learning community through a cohort-based structure designed to promote engagement and collaboration among participants. This structure is intended to encourage faculty to interact and support one another throughout the training process.

A key activity for community building is the planned peer review of assessment strategies, in which participants will share their course design approaches and provide constructive feedback to their peers. This exchange of ideas and feedback is intended to facilitate improvements in course designs while fostering a collaborative and purposeful cohort dynamic.

Asynchronous group discussions within Canvas will provide an additional platform for engagement. These discussions are designed to offer participants the opportunity to share experiences, address challenges, and exchange best practices related to course conversion. Active participation is expected to enable faculty to gain valuable insights from their peers while contributing to a collective knowledge base.

To further enhance engagement, the program plans to offer optional synchronous sessions via Zoom, which will be available for individual or group participation. These live sessions are intended to provide opportunities for personalized guidance and real-time feedback, addressing specific questions or concerns related to the training or course conversion process. Throughout the curriculum, the program will emphasize the importance of maintaining a supportive and collaborative learning environment. By encouraging continuous interaction and feedback, the program aims to establish a dynamic community of practice that will not only support participants during the training but also sustain collaboration and innovation in online course design well beyond its conclusion.

4. Expected Outcomes

By the end of the training program, faculty participants are anticipated to achieve several key objectives. They will integrate research-based practices to ensure their online courses apply proven pedagogical strategies. Additionally, they will utilize emerging technologies, such as generative AI, to develop engaging and interactive online learning activities that foster critical thinking, creativity, communication, and collaboration.

Participants will reconceptualize their course designs to align them with best practices in online education. This process will culminate in the completion of a Course Design Document, which will serve as a detailed framework for their redesigned courses. Faculty will be encouraged to engage in ongoing reflection, applying insights and feedback gained during the training to continually refine their teaching practices. This reflective process is intended to drive sustained improvements in course quality and ensure the delivery of effective and impactful learning experiences.

5. Discussion

Bichronous online learning combines the advantages of synchronous and asynchronous

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modalities, offering flexibility and opportunities for real-time engagement. However, it also presents challenges, such as scheduling conflicts, technical issues related to hardware or internet connectivity, and occasional confusion in navigating mixed-mode environments [8, 17]. These challenges highlight the need for careful planning, strategic integration of blended learning elements, and comprehensive training for both instructors and learners [3], [17]. This training initiative has been designed to immerse faculty members in a bichronous learning experience, enabling them to experience firsthand both the benefits and challenges of mixed-mode instruction. Through planned active learning strategies, such as peer reviews and problem-solving exercises, faculty will be encouraged to adopt interactive, student-centered pedagogies while addressing the unique requirements of online course design. The structured use of the Course Design Document is intended to further support this process, ensuring these strategies are effectively embedded in redesigned courses.

Technology plays a critical role in supporting blended learning environments; however, scholars emphasize that instructional methods, rather than the medium, are the primary drivers of learning outcomes [18], [19]. By aligning technology with evidence-based practices, the training initiative aims to equip faculty to design engaging, effective courses while mitigating barriers like technical proficiency.

The adoption of bichronous learning requires iterative refinements, guided by continuous evaluation and "context-driven research" [19, p. 186]. Faculty feedback is expected to be crucial in shaping future program iterations to address emerging challenges and ensure relevance and scalability. By emphasizing higher-order cognitive skills such as analysis and problem-solving, the program intends to address critiques of blended learning models that focus on lower-order tasks [14]. These iterative improvements are anticipated to be essential for adapting the program to diverse educational contexts and ensuring its long-term impact.

Building on this foundation, the following section outlines the evaluation strategy designed to measure the program's long-term impact on faculty teaching practices and student outcomes.

6. Future Research and Impact Evaluation

As this study continues, several future research directions and data collection strategies have been planned to evaluate the effectiveness of the training program. A key area of focus will be learning analytics, tracking faculty engagement through the Canvas LMS. Metrics, including module completion rates, discussion participation, and attendance in synchronous sessions, will be tracked to assess faculty engagement. These metrics will be analyzed to identify trends, such as which aspects of the program drive the highest participation, and to explore any correlation between engagement levels and program outcomes.

Beyond learning analytics, assessments are expected to be crucial in measuring the program's impact. The analysis will include quiz results, peer reviews, discussion posts, and the final Course Design Document created by faculty participants. These assessments are anticipated to help determine the extent to which faculty members apply the concepts learned during the training to their course designs.

Post-training faculty surveys are planned to evaluate changes in attitudes and perceptions regarding the program's effectiveness. These surveys aim to capture both the immediate impact of the training and participants' confidence in their readiness to implement online teaching strategies.

To gain deeper qualitative insights, semi-structured interviews are planned with a subset of participants. These interviews will explore their experiences, challenges, and the specific ways in which the training influences their teaching practices. This qualitative data is intended to complement the quantitative findings, offering a more holistic understanding of the program's impact.

Finally, a longitudinal impact assessment is planned to evaluate the long-term effects of the training on course quality and student outcomes. This phase of the research will involve revisiting participants' courses and teaching practices, analyzing student evaluations, and comparing student performance over time. The objective is to assess whether faculty continue to apply the strategies acquired during the training and whether these efforts result in measurable improvements in student learning.

By integrating these data collection methods, the study aims to contribute valuable insights into the effectiveness of the bichronous learning model in faculty training, with broader implications for educational practices across various instructional formats.

7. Conclusion

This study presents the ongoing development of a blended faculty training program designed to support the transition from traditional in-person courses to fully online formats. The program is intended to equip faculty with skills and strategies for effective online course design, employing a bichronous model that integrates asynchronous and synchronous learning. By incorporating research-based pedagogy, active learning strategies, and tools such as generative AI, the program explores practical approaches to addressing challenges in transitioning engineering courses to online formats. These features offer potential insights and a framework that could be adapted to similar challenges in diverse educational contexts.

Future research will evaluate the program's impact on faculty teaching practices and student outcomes to assess the sustainability and scalability of the bichronous learning model. Findings from this research are expected to guide refinements to faculty training initiatives and contribute to the evolution of best practices in online education once the program is evaluated.

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