2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
Paper ID #53661

IUSE: Merging Self-Paced Instruction with Real-Time Feedback for Enhanced Learning Engagement

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Abstract

Online courses involve a tradeoff between the flexibility of asynchronous instruction and the immediacy of interaction in synchronous settings. This paper presents an instructional approach that integrates self-paced video lectures with time-anchored instructor-mediated feedback. Students control lecture pacing while asking questions tied to specific moments in the video; responses are preserved as contextualized learning resources for future learners.

The “Choose Your Own Lecture” web-based platform was implemented across five semesters in upper-level engineering courses at two universities. Survey data indicate that students perceived receiving more feedback, learning the content more efficiently, and feeling more comfortable interacting with instructors than in traditional lecture-based courses. Students also valued access to shared, time-anchored explanations at their own pace. These results suggest that embedding contextualized instructor feedback within self-paced lectures can enhance learning while preserving autonomy.

Introduction

Engineering education increasingly relies on online and hybrid instructional models to serve students with diverse backgrounds, schedules, and learning needs. Asynchronous delivery methods such as prerecorded video lectures offer flexibility and learner control over pacing but often lack timely, personalized instructor feedback, a strong predictor of conceptual learning [1,2]. In contrast, fully synchronous formats provide real-time interaction but can limit flexibility and disadvantage students who require additional time to process complex material. These tradeoffs are particularly pronounced in engineering courses, where conceptual understanding often develops unevenly and timely clarification is critical to learning [2,3].

This paper introduces and evaluates a hybrid instructional approach designed to combine the flexibility of self-paced instruction with contextualized instructor support. The “Choose Your Own Lecture” (CYOL) platform integrates instructor-mediated feedback directly into the lecture experience, enabling time-anchored interaction while preserving learner autonomy and avoiding the need for real-time attendance or pre-scripted learning paths. This paper summarizes the platform and its initial implementation in upper-level engineering courses at two institutions and presents survey-based results on students’ perceptions of learning support and effectiveness.

Background and Related Pedagogy

Prior research has documented persistent tradeoffs between synchronous and asynchronous instructional modalities. Synchronous instruction supports immediacy and interaction but can limit flexibility and disadvantage students who need additional time or face scheduling constraints [4,5]. In contrast, asynchronous instruction provides learner control and flexibility, yet often suffers from delayed feedback and reduced instructor presence, which can negatively affect learning outcomes in complex domains [3,6].

Studies examining blended and hybrid approaches suggest that combining synchronous and asynchronous elements can mitigate these tradeoffs [4,7]. However, common implementations, such as prerecorded lectures paired with discussion boards, frequently decouple student questions from instructional context, leading to fragmented interactions and delayed clarification [8]. Asynchronous discussion formats have also been shown to disproportionately benefit students who are already well prepared, while students needing immediate clarification may struggle to engage effectively [9].

The importance of timely, contextualized feedback is well established in learning theory. Feedback that occurs close to the moment of confusion has been shown to support deeper understanding and more efficient learning, particularly in cognitively demanding subjects [2]. Autonomy-supportive instructional approaches further emphasize the value of giving students control over pacing and engagement while still providing access to instructional support when needed [10]. Prior work on learner autonomy demonstrates that allowing students to selectively engage with supplemental material can increase motivation, perceived competence, and communication with instructors [11,12].

CYOL builds on these principles by embedding instructor-mediated responses directly within the lecture timeline. Unlike adaptive learning systems that require extensive pre-authored pathways and high development overhead [13,14], the CYOL platform allows personalization to emerge organically from authentic student questions. The resulting time-anchored repository of shared explanations preserves instructional context while enabling optional engagement, aligning with prior work on annotated and interactive video systems in higher education [8]. By combining learner autonomy with persistent, instructor-generated information, this platform offers a scalable approach to enhancing asynchronous engineering instruction without imposing rigid learning pathways or continuous, real-time participation.

Methods

CYOL Platform and Usage

The CYOL browser-based platform, shown in Figure 1, is designed to combine the flexibility of asynchronous video instruction with instructor-mediated feedback. Students access prerecorded lecture videos and retain full control over playback, including pausing, rewinding, skipping, and adjusting playback speed, allowing them to spend additional time on challenging material while progressing efficiently through familiar content.

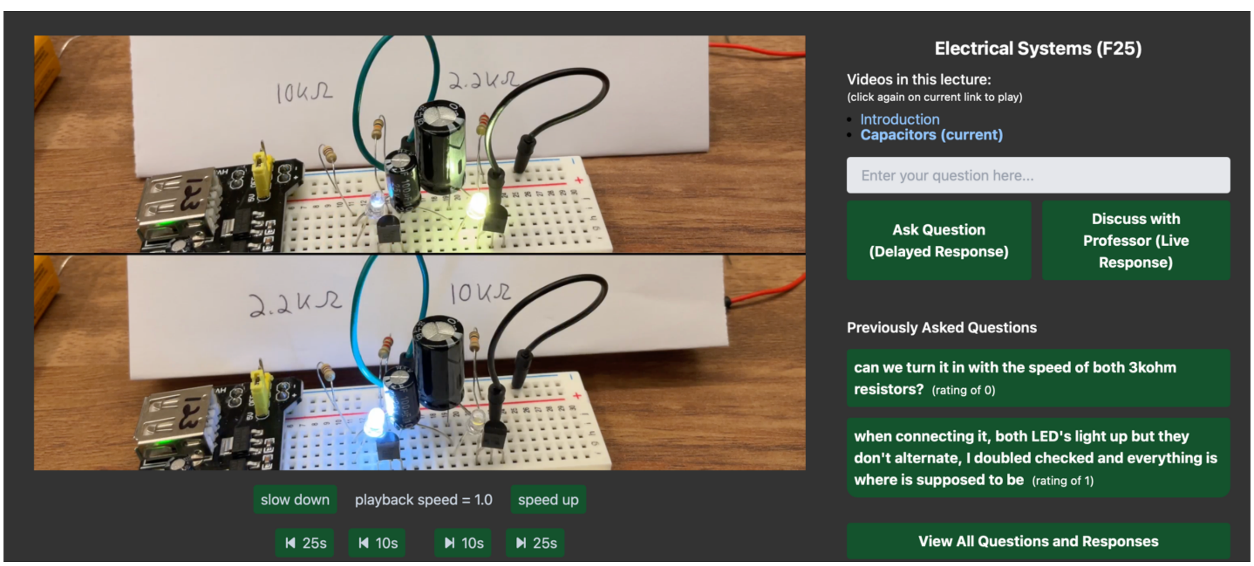

Figure 1. The Choose Your Own Lecture interface with video controls (below video) and questions (to right of video). Clicking on a question brings up a video answering that question.

The defining feature of the CYOL platform is a question-and-answer interface that is explicitly tied to the lecture timeline. While watching a lecture, students can view answers to previously asked questions associated with the current time in the lecture. Each question appears as an optional element, enabling students to engage with the corresponding response or continue watching the main lecture uninterrupted. Students may submit new questions directly from the video interface at the moment confusion arises. Questions are automatically time-anchored to the lecture and may be answered live with a discussion during scheduled interaction periods or asynchronously with a delayed response. Response videos are linked to the relevant point in the lecture and those answers become available to all students as shared instructional resources.

Data Analysis

Data were collected across five academic semesters at two institutions. At the University of South Florida (USF), CYOL was implemented over three semesters in an "Electrical Systems for Mechanical Engineers" course. In this context, the platform was used to guide students through hands-on electronics activities using take-home laboratory kits, with the CYOL platform videos providing step-by-step instructional support similar to an at-home lab environment. At Johns Hopkins University (JHU), the platform was deployed over two semesters in a Haptics course taught in a flipped classroom format, where students used CYOL to engage with conceptual and analytical lecture material before attending an in-person class.

All students used the CYOL platform as part of the regular course instruction. However, only data from students who consented to participate in the research study were included in the analysis. Participation required signed informed consent, and all study procedures were approved through the institutional review boards at both universities. Survey data were collected and managed independently by an external evaluation firm, Magnolia Consulting. Instructors were not informed which students had consented to participate until after the semester had ended.

Results

Student Perceptions Compared to Traditional Lecture

Student perceptions of using CYOL, relative to traditional lecture-based instruction, are summarized in Table 1. Across all semesters, students indicated that they received more feedback when the platform was used (3.42/5), with one semester showing a different trend, and felt more comfortable interacting with the instructor (3.59/5) compared to traditional lecture-based courses.

Students also reported perceived benefits related to learning effectiveness. In particular, students indicated that the platform helped them learn course content more quickly (3.59/5) and engage with more challenging material (3.51/5). These trends were observed across both courses, despite differences in instructional format and content.

Table 1: Survey: "Compared to a traditional lecture (not using CYOL), in this course…"

F=Fall, S=Spring	USF			JHU		Weighted
Likert scale: 1 = Strongly disagree … **5** = Strongly agree	F 2024	S 2025	F 2025	F 2024	F 2025	average *
…I received more feedback	3.6	3.5	3.5	3.2	2.9	3.42
…I was able to learn the content more quickly	3.8	3.6	3.9	3.1	3.4	3.59
…I was able to learn more challenging content	3.7	3.7	3.5	3.3	3.2	3.51
…I felt more comfortable interacting with the instructor	3.9	3.5	3.6	3.5	3.2	3.59
* Number of students (average weighted by students)	62	46	53	44	21	

Perceived Helpfulness of the CYOL Platform Features

Student ratings of specific CYOL platform features are presented in Table 2. Among the features evaluated, the ability to watch lecture videos at one's own pace, including pausing, rewinding, and adjusting playback speed, received the highest overall ratings (3.69/4). Students also rated watching responses to questions posted by classmates as helpful (3.33/4), highlighting the value of shared, time-anchored explanations. Opportunities for direct interaction were also perceived as beneficial. Students rated the ability to ask questions for immediate response (3.25/4) and post questions with delayed response (3.15/4) as helpful learning supports.

Table 2. Survey: "How helpful were the following features of CYOL for your learning in this course?"

F=Fall, S=Spring	USF			JHU		Weighted
Likert scale: 1 = Strongly disagree … **4** = Strongly agree	F 2024	S 2025	F 2025	F 2024	F 2025	average *
Options to watch the video at my own pace…	3.8	3.8	3.8	3.3	3.6	3.69
Watching responses to questions posted by my classmates	3.4	3.7	3.4	3.1	2.9	3.33
Asking questions for "immediate response"	3.5	3.4	3.3	2.9	2.9	3.25
Posting questions with "delayed response"	3.3	3.1	3.4	2.7	3.1	3.15
* Number of students (average weighted by students)	62	46	53	44	21	

Supporting Learning Processes

Student responses regarding how the CYOL platform helped them learn are summarized in Table 3. A large majority of students reported that having access to other students' questions supported their learning, with a weighted average of 78.1% selecting this option. Similarly, many students indicated that CYOL allowed them to review instructor responses at their own pace and on their own schedule (66.9%), highlighting the importance of asynchronous access to explanations. Fewer students selected items related to immediate interaction, such as asking questions as soon as they arose (34.2%) and receiving immediate feedback when help was needed (26.5%).

Table 3. Survey: "In what ways has CYOL helped you overcome challenges in the course?"

F=Fall, S=Spring	USF (%)			JHU (%)		Weighted
Percentage based on checking all that apply	F 2024	S 2025	F 2025	F 2024	F 2025	average *
I was able to ask questions as soon as they came up	41	28	30	33	42	34.2
I received immediate feedback when I needed help	36	28	24	27	0	26.5
I had access to other students' questions	83	85	85	60	68	78.1
I was able to review answers on my own timing	78	63	61	69	53	66.9
* Number of students (average weighted by students)	62	46	53	44	21	

Discussion

The findings from this study suggest that the perceived instructional benefits of the CYOL approach extend beyond a single course, institution, or pedagogical implementation. Despite differences in course content and instructional context, including a Haptics course taught in a flipped classroom format and a hands-on at-home circuits course, students reported similar patterns in how the platform supported their learning. This consistency indicates that the underlying instructional mechanisms of the platform are robust across multiple formats and not tightly coupled to a specific discipline or delivery style.

A large proportion of students reported benefiting from access to peer questions and the ability to review instructor responses on their own time, while fewer emphasized the importance of immediate feedback. This pattern aligns with CYOL's emphasis on time-anchored explanations that persist beyond the moment they are delivered and transform individual questions into reusable instructional assets for future learners.

Taken together, the results highlight the value of combining self-paced instruction with instructor-mediated interaction while preserving learner autonomy. Students consistently rated features associated with pacing control and access to shared explanations as highly beneficial, while placing comparatively less emphasis on continuous real-time interaction. This balance aligns with the central design goal of the CYOL platform: to mitigate the tradeoffs between asynchronous and synchronous instruction by allowing students to engage with instructional support when it is most relevant to their individual learning needs. Rather than forcing all learners into a uniform pace or interaction model, the platform enables optional engagement that adapts naturally to differences in background knowledge and learning speed.

From an instructional perspective, these findings suggest that CYOL may help instructors address heterogeneous preparation levels without fragmenting the learning experience [9]. Students who require additional explanation can access it without slowing the progress of others, while students who are comfortable with the material can continue uninterrupted. This approach complements, rather than replaces, traditional in-person or synchronous instruction by extending its benefits asynchronously and at scale.

Conclusions and Future Work

This study provides early evidence that the CYOL approach is perceived by students as a valuable instructional model for supporting learning in engineering courses. Across multiple courses and institutions, students reported benefits related to access to instructor feedback, learning efficiency, and flexibility in engaging with course content. Collectively, these findings suggest that embedding time-anchored instructional support within self-paced lectures can enhance the learning experience without sacrificing learner autonomy.

The platform continues to be used and expanded into additional courses taught by additional faculty. Ongoing and future work will move beyond survey-based measures to examine how students interact with the platform itself, including patterns of question asking, response viewing, and timing of engagement, whether this reduces help-seeking avoidance, and how this affects performance in the course. These analyses will provide deeper insight into how time-anchored interaction influences learning behaviors and instructional effectiveness.

Acknowledgments

This material is based upon work supported by the National Science Foundation under Grant No. 2315353. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. The authors thank Professor Autar Kaw of University of South Florida for his insights and advice on this project.

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