Deepening Insights from Learning Analytics through Student Perspectives

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Abstract

Online learning generates student interaction data in learning management systems (LMS) that can provide engagement insights. However, traditional learning analytics often lacks the context behind student behaviors, limiting the effectiveness of interventions. In this work-in-progress at Rowan University, an analysis of asynchronous online courses identified LMS-captured behaviors such as skipping videos and rewatching content. To gain deeper insights from the data, interviews with former students were conducted to explore context by highlighting factors such as distractions, preconceptions, and instructor feedback. Analysis of the student interview data suggests that course design, instructor feedback, and content delivery influence student engagement in online courses. Integrating LMS-based learning analytics data with student perspectives has the potential for educators to create engaging, student-centered online environments that bridge skill gaps, improve learning experiences, and better address student needs for success.

Introduction

Learning analytics (LA) has become increasingly significant in higher education due to the transition to digital and online learning environments. "Learning analytics holds the potential to: 1) explain unexpected learning behaviors, 2) identify successful learning patterns, 3) detect misconceptions and misplaced effort, 4) introduce appropriate interventions, and 5) increase users' awareness of their own actions and progress"[1]. Although LA is adept at tracking behavioral metrics such as login activity, content interaction, and assignment completion, automated methods often lack the context needed to fully understand student motivations. For example, a study[2] on first-year engineering students and instructors found that while LA can monitor student engagement through quantifiable data, it may not capture the underlying reasons behind student behaviors, such as personal challenges or intrinsic motivations. Furthermore, Talbi and Ouared[3] indicates that while LA tools are effective at assessing student participation levels, they often overlook the qualitative elements of learning experiences, which are essential to understand the broader context of student engagement and motivation. Guzman-Valenzuela et al.[4] demonstrated that tracking behaviors alone often leads to incomplete conclusions about student needs, underscoring the necessity of integrating both quantitative and qualitative insights into learning analytics practices. Without this integration, it is challenging to design interventions that effectively target engagement and performance barriers[4].Therefore, investigating the reasons

behind student engagement and disengagement is essential for achieving a more comprehensive understanding of online learning. For instance, effective learning design, as seen at institutions such as the Open University in the UK, emphasizes student activity over content delivery, demonstrating LA's potential to foster practices that prioritize learner needs[5]. Combining behavioral data from LA with detailed contextual information enables a more tailored and effective approach to online education. Addressing the underlying reasons for student behaviors allows LA to become a tool for transformative and impactful interventions.

Despite extensive research highlighting the advantages of LA, its potential is often diminished by misinterpretation and lack of contextual understanding. A preliminary, unpublished study conducted at Rowan University, consisting of 79 students from two different courses, highlighted the necessity of integrating qualitative data with quantitative findings, as interaction data alone fail to explain the underlying reasons for student behavior. The varied experiences of students further complicate the establishment of clear patterns, emphasizing the need for additional contextual insights. Institutions adopting LA frequently encounter capability-related challenges, reflecting a growing need for expertise in evaluating technology during early adoption stages[6]. Access to analytics data alone is not enough, effective interpretation of the data is essential for creating learning environments that actively engage students and improve outcomes. Although learning analytics dashboards (LADs) have demonstrated potential in fostering engagement and interaction in online learning, their ability to significantly improve academic achievement and intrinsic motivation has been limited, largely due to methodological challenges and the absence of standardized evaluation frameworks[7]. This highlights the need for improved approaches to data interpretation to maximize their impact.

Key factors such as engagement, feedback, interaction, and course structure are consistently linked to student success. Student satisfaction decreased significantly when transitioning from traditional face-to-face instruction to remote learning, illustrating that directly replicating in-person lectures in an online format without modifications is ineffective[8]. Studies have shown that constructive feedback significantly influences instructor-learner engagement and outcomes[9]. Additionally, students consistently prioritize teaching quality as the most critical use of educational data, with the majority identifying it as highly important[10]. Course design is also rated as essential, highlighting its role in the shaping of effective learning experiences. However, metrics such as the frequency of lecture video views often fail to align with student performance, as passive content consumption without active participation rarely leads to meaningful understanding[8]. Educators often express concerns about the disparity between analytics data and instructional needs, emphasizing the need to bridge this gap. This highlights the value of qualitative data, which provides critical context to behavioral insights and supports actionable improvements in course design and learning environments.

Although LA offers numerous benefits, several challenges remain, particularly in aligning analytics with educational goals and stakeholder expectations. To address these challenges, this research first captures students' experiences and perceptions of online learning through student interviews. The insights gathered are designed to assist online course development and administration. This integrated approach lays the foundation for optimal design of courses to foster a learning environment that aligns closely with student needs.

Methodology

The research methodology consists of developing a survey questionnaire to examine engineering students' experiences with online courses, focusing on both the benefits and challenges they encountered, and subsequently analyzing and interpreting the collected data to derive meaningful insights.

Survey questionnaire

The survey questions were designed to investigate how specific aspects of online learning, such as engagement and feedback, influence learning outcomes. By incorporating a mix of rating-scale and open-ended questions, the study gathered both quantitative data and in-depth qualitative insights, providing a holistic view of student experiences. The questions were organized into four categories:

(a) *Engagement with online courses* assessed students' overall perceptions of online learning and their prior experience with such courses

(b) *Factors influencing engagement* focused on students' interactions with course materials and identified behavioral patterns

(c) *Impact on learning outcomes* explored elements students felt affected their success, such as the quality of feedback, and

(d) *Future recommendations* captured students' suggestions for improving course design and delivery, emphasizing areas they found most impactful.

The categories were derived from instructor interactions with students taking online courses. This structured approach ensured a comprehensive analysis of students' experiences, highlighting the strengths and limitations of online engineering education. The survey was approved by the Institutional Review Board of Rowan University (IRB #PRO-2024-310). The survey questionnaire is provided in Appendix A .

Study participants

The recruitment targeted engineering students at Rowan University who had completed at least one online course, inviting them to participate in one-on-one interviews to share their detailed experiences with online learning. Recruitment strategies included distributing flyers and sending targeted emails to potential candidates. Students who expressed interest were scheduled for interviews, each lasting approximately 30 to 45 minutes. The participants were compensated with a $\$15$ gift card or university merchandise of equivalent value for their time. Currently, eleven participants — eight male and three female — have been interviewed for this ongoing research, including nine undergraduate and two graduate students. Some students in the study had taken multiple online engineering courses, but each participant focused on a single course for the survey (see question (iv) in Appendix A).

Data analysis

All interviews were conducted via Zoom and recorded for analysis. The recordings were transcribed and anonymized to ensure participant confidentiality. The transcripts were cleaned for

clarity and accuracy before being tabulated to facilitate analysis. Both qualitative and quantitative responses were synthesized to identify behavioral patterns and contextual factors. An integrated approach, combining qualitative and quantitative methods, was employed in analyzing interview data to enable the identification of measurable trends and the factors associated with them[11]. Currently, the data has been analyzed manually. However, as more data is collected, language models such as GPT or BERT will be employed to automate the analysis, quickly processing large volumes of text and identifying complex patterns or sentiments that may not be immediately apparent through manual methods. This shift will improve the speed and depth of the analysis.

Results and Discussion

The interview data is extensive, and a comprehensive analysis of the data will provide an in-depth understanding of student experiences in online learning. However, for this preliminary study, we focused on studying three key elements: interactions with lecture videos, factors influencing engagement, and future recommendations.

Lecture Video Interactions

Lecture videos are a critical component of online learning as the primary medium of information delivery in online courses. The data provided information on the video viewing practices of the students. As seen in Figure 1 students engage with lecture videos in diverse ways.

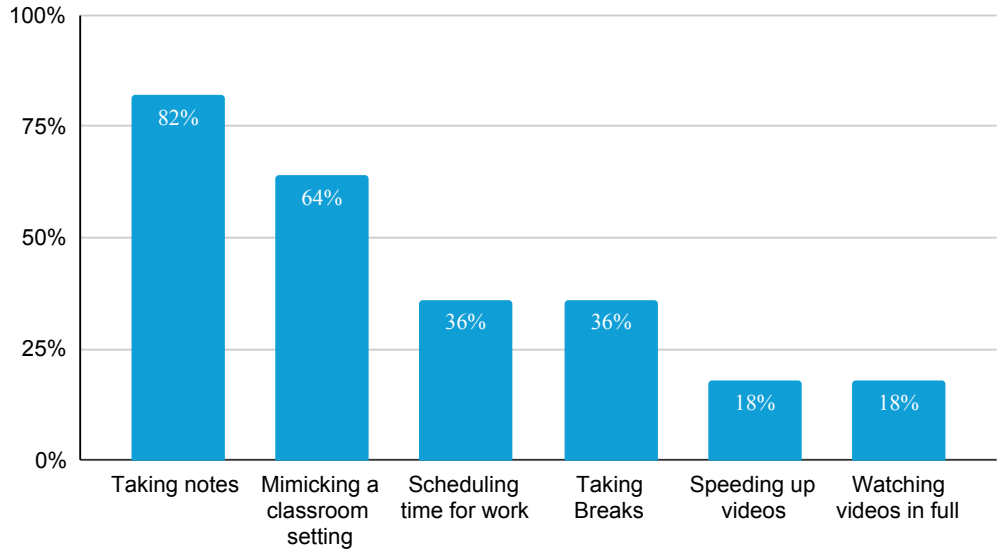

Figure 1: Student engagement methods for lecture videos across viewing preferences

A majority of students, around 82%, actively engage with the video content by taking notes, suggesting the attempt to retain and process the information more effectively. Additionally, 64% of students reported watching videos in distraction-free environments resembling classroom settings, indicating that many approach online courses in a manner similar to in-person lectures.

Around 36% students prefer to watch the videos at scheduled times, indicating a structured approach to learning. Meanwhile, 18% of the students speed up the videos, likely to consume the material quickly, suggesting a preference for efficiency. Around 36% of students take breaks during video watching, which implies they prefer to digest the content in smaller, manageable segments rather than viewing it all at once. Only 18% of students watch the videos straight through without interruption, reflecting a preference for uninterrupted, continuous viewing. These varying behaviors highlight the need for flexible video delivery methods that can accommodate different learning styles and preferences.

Several factors influence students' engagement with lecture videos as seen in Figure 2. A notable 36% of students observed that the video content was not always relevant to their learning needs, which could undermine their motivation to complete the lectures. Additionally, 36% reported that the sheer volume of videos presented a barrier, deterring them from fully engaging with the course material. In comparison, only 9% cited personal factors such as self-discipline or distractions as reasons for incomplete viewing. This result contrasts with the study[12] which reported a 40% drop in video lecture access by the term's end during an introductory mechanics course. These results challenge the notion that self-discipline or distractions are the primary obstacles to completing lecture videos, instead emphasizing the critical role of video relevance and alignment with course objectives.

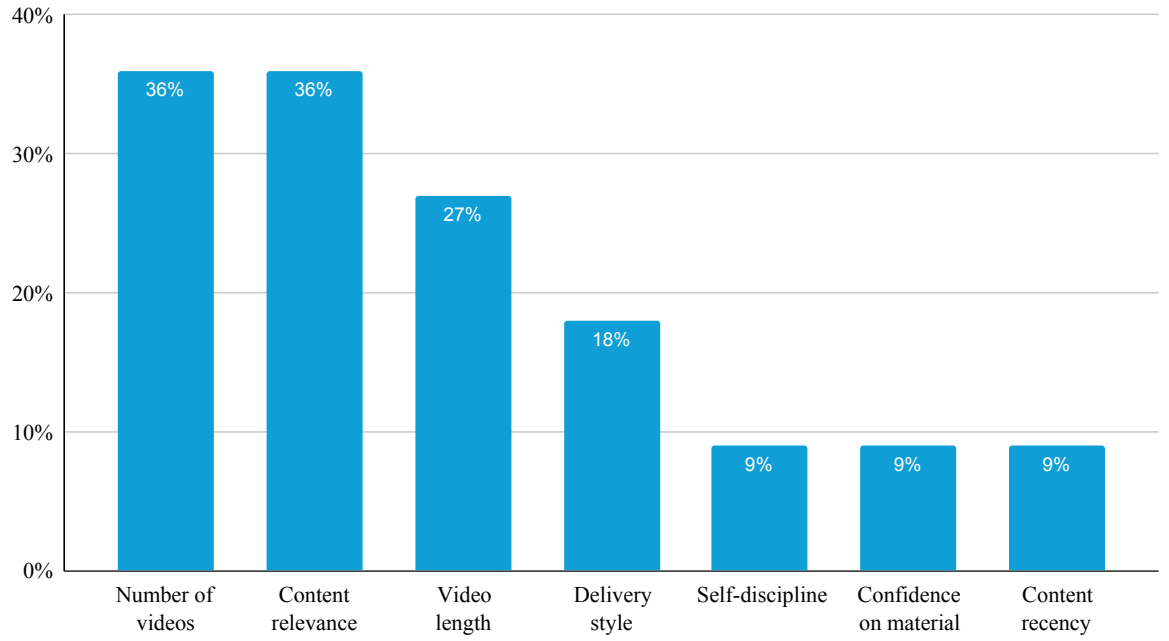

Figure 2: Factors negatively impacting student completion of lecture videos

These findings underscore the importance of optimizing the design and delivery of lecture videos, which are a vital element of online education. Creating videos that are concise, relevant, and closely aligned with course objectives can improve their effectiveness and better address the needs of a diverse student population.

Engagement Factors

The factors that impact students' engagement in an online course were also studied. Figure 3 shows 55% of students identified assignments as the primary factor. Projects and deadlines for other graded activities jointly ranked as the second most important factors for students to engage with course content. This suggests that well-defined timelines and graded activities play a crucial role in maintaining students' focus and interaction with the course. Discussion boards (DBs) — widely considered a valuable tool within LMS for threaded conversations to encourage interaction [13] — were expected to be a key component in engaging students. However, despite their intended purpose to promote collaboration and facilitate deeper learning through discussion, only 18% of students found them to be truly engaging. This indicates a disconnect between the intended function of DBs and how students perceive their value in the overall learning experience.

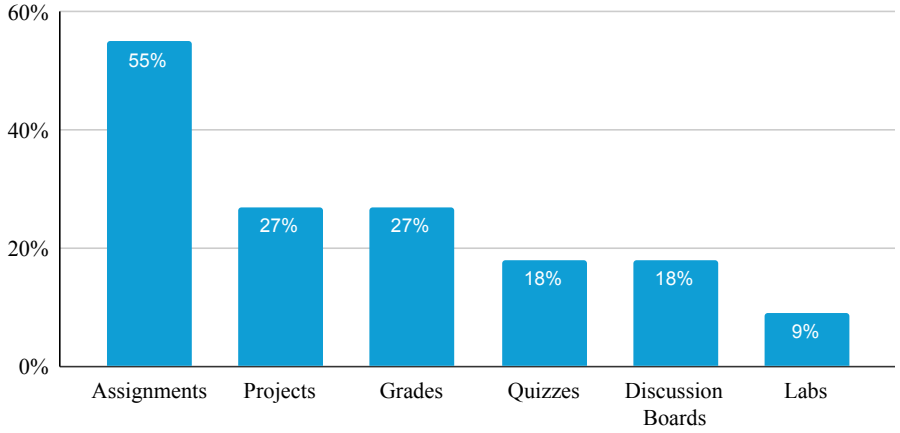

Figure 3: Factors influencing engagement with course content

Research has shown that students are more likely to continue a program when they feel connected and supported. Feedback plays a crucial role in this process [14], serving as an essential component of effective learning and sustained engagement. Figure 4 shows the quality of feedback received by the students. Around 36% students reported receiving personalized feedback, which is essential for addressing individual student needs. Around 64% of students reported receiving minimal feedback, and 55% felt the feedback did not substantially improve their learning outcomes. This reveals a clear gap between the feedback provided and the actionable insights students need to remain engaged with the course to improve their academic performance. This finding underscores the importance of implementing personalized, detailed, and constructive feedback mechanisms that cater to individual learning needs to promote deeper engagement and academic development.

Future Recommendations

The student recommendations gathered at the end of the interviews provide valuable insights for improving online course experiences. As shown in Figure 5, 36% of students emphasized the need for better-quality lecture videos. Recommendations included making the videos more

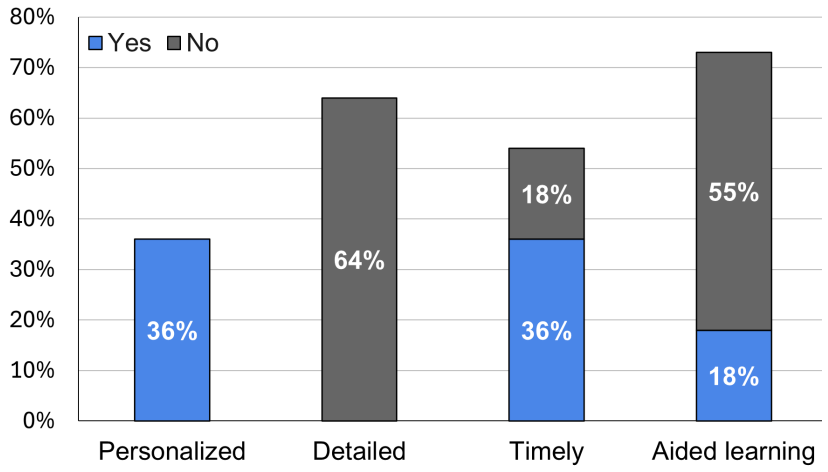

Figure 4: Quality of feedback received by students

concise and improving their overall clarity to improve comprehension and engagement. Discussion boards emerged as another a notable area for improvement, with 36% of students recommending either replacing or improving them. Many described discussion boards as "busy-work" that failed to contribute meaningfully to their learning. Additionally, 27% of students emphasized the importance of more manageable workloads and flexible deadlines to support self-paced learning, underscoring the need for courses to address diverse student needs. Other suggestions included better course organization, increased access to additional resources, and personalized, timely feedback to better support students' progress and learning.

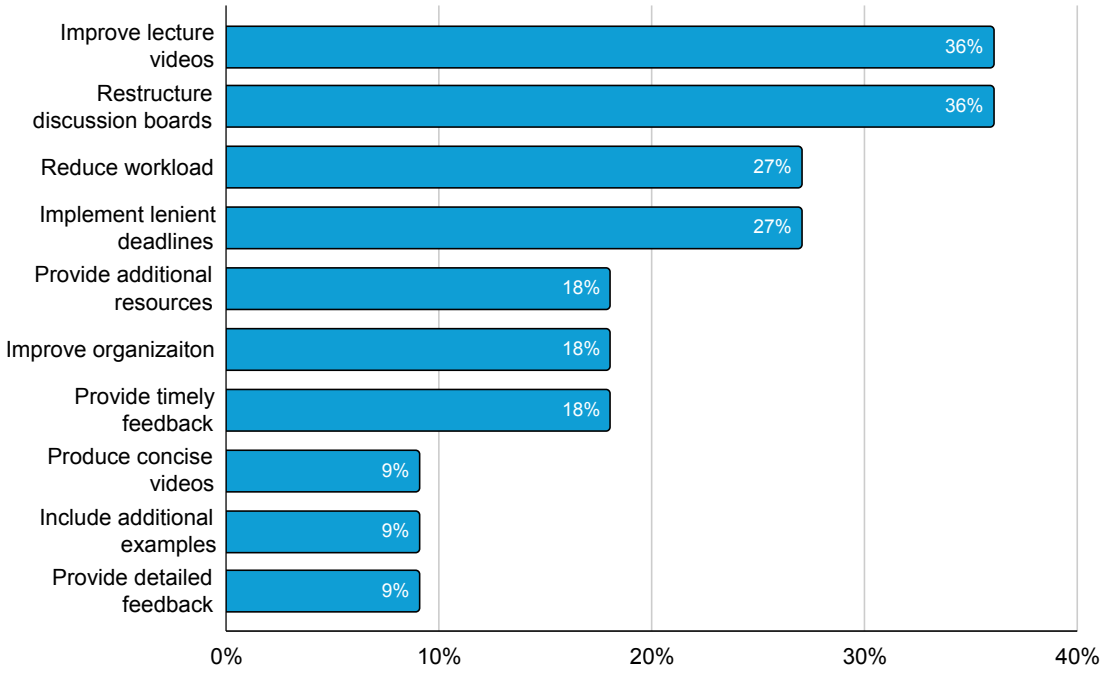

Figure 5: Student recommendations for improving online course experiences

Conclusion

This preliminary study highlights the complexities and challenges of online learning while offering actionable insights to improve course delivery and design. The findings emphasize the importance of understanding students' behaviors, preferences, and needs to create more engaging and supportive online environments. This study focused on studying three areas of online courses - lecture videos, engagement strategies, and student recommendations for improvement of online courses. Major recommendations from students to improve learning experience included improving lecture video design, reevaluating the role of discussion boards, and improving the quality of feedback.

While the study provides valuable insights, the results presented here are based on a small dataset of eleven interviews. As more data is collected, further analysis will help refine these findings. Given that students experienced different courses and instructors, it was challenging to develop specific recommendations. Instead, we identified broad themes that reflect common concerns across the sample. Future work will continue to explore both qualitative and quantitative data to provide a more comprehensive understanding of student behavior with a larger sample size. The integration of language models for analyzing student feedback will improve the efficiency of processing interview data, enable more sophisticated analysis, and uncover patterns that may be challenging to detect manually.

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Appendix A: Survey Questionnaire

Engagement with Online Courses

(i) How many courses have you taken that were entirely online at Rowan? 0, 1, 2, 3+

(ii) On a scale of 1 to 5 (1 = Low i.e., negative attitude and experience, 5 = High, i.e., very positive attitude and experience), rate your attitude and experience towards online learning?

(iii) What factors impact your decision to take an online course?

(iv) Please identify a specific course and the term for the next set of questions and please keep that course in mind as you respond.

Factors Influencing Engagement

(v) On a scale of 1 to 5 (1 = Low to 5 = High), rate how valuable the lecture videos were compared to the rest of the course content.

(vi) On a scale of 1 to 5 (1 = Low to 5 = High), rate the level of time commitment to watch lecture videos compared to an in-person course.

(vii) Can you describe how you watched the videos (note-taking, mobile viewing, location, setting, scheduling, etc.)?

(viii) What factors impacted your ability to watch the lectures to completion (video quality, delivery, style, distractions, length, content, number, etc.)?

(ix) What motivated you to revisit or skip a video?

(x) Did you use external resources (books, videos, tutoring, etc.) for this course?

(xi) Did the course activities (discussion boards, quizzes, assignments, projects) help keep you engaged?

Impact on Learning Outcomes

(x) Did you have opportunities to ask questions or get feedback when needed? On a scale of 1 to 5 (1 = Low to 5 = High), rate how valuable the instructor feedback was towards your learning.

(xi) Compared to other online learning experiences at Rowan, rate this course as far as content and instructor effectiveness in achieving the learning outcomes on a scale of 1 to 5 (1 = Low to 5 = High)?

(xii) Did you have multiple instructors for this course? If yes, how did this impact your learning?

(xiii) Did you encounter any technical difficulties? How did those impact your learning?

(xiv) On a scale of 1 to 5 (1 = Low to 5 = High), how do you perceive your overall learning experience in this course?

Future Recommendations

(xv) What specific improvements can you suggest?

(xvi) Is this course a good fit for online delivery?