Ph.D. in Information Technology Thesis Defense

July 18th, 2025 at 15:00 pm "Emilio Gatti" Conference Room – building 20

Giacomo CASSANO – XXXVII Cycle

Understanding Learning Engagement in Video-Based Learning: How to Monitor, Assess, and Enhance

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Abstract:

Video-Based Learning (VBL) is becoming an increasingly popular approach in education due to its flexibility and accessibility. It allows students to engage with learning materials at their own pace and from any location, making education more inclusive and adaptable. However, while VBL offers these significant advantages, it also presents challenges. On one side, the lack of real-time interaction can make it difficult for instructors to monitor their students' engagement; on the other, VBL often leads to passive consumption of content, making it harder for the students to stay motivated. This research explores how technology can address these challenges, helping to better monitor and enhance engagement in VBL through both pedagogical and technological innovations.

Firstly, it builds on the theoretical background of the research by conducting a systematic literature review that identifies key indicators and facilitators of engagement in VBL. Then, with the knowledge obtained, two systems are developed and validated: Evoli, a Video Annotation Tool (VAT) that collects self-reported feedback from students and video Learning Analytics (LA) to make the teacher aware of students' engagement during video learning, and SmartQuiz, a Large Language Model (LLM)-based framework designed to generate high-quality in-video Multiple Choice Questions (MCQs), recognized in the review as a key facilitator for engagement.

Evoli enhances instructor awareness by analyzing self-reported feedback and LA on student interactions with video content. A study demonstrated the tool's good usability and its perceived usefulness by students and instructors. A second study highlights how a VAT like Evoli can independently influence student engagement, showing a positive impact on the emotional and agentic dimensions. Finally, a study examined whether explicit feedback from students or video log data was a better predictor of performance, revealing that video interaction data is a more accurate predictor of achievement.

Recognizing the role of MCQs as a key facilitator of learning engagement in VBL, SmartQuiz tackles the time-consuming process of MCQ creation by utilizing LLMs to generate pedagogically sound questions aligned with best practices. Following the development of the system, an initial study assessed the quality of AI-generated MCQs, confirming their compliance with established guidelines. A subsequent study compared the impact of SmartQuiz-generated MCQs with those authored by instructors, revealing similar student learning outcomes. These findings suggest that AI

can generate high-quality MCQs, thereby reducing instructor workload without compromising quality.

This thesis demonstrates how, by utilizing annotation tools enhanced with MCQs, it is possible to create a VBL learning experience that not only increases instructor awareness but also enriches and enhances student engagement.

Future research will focus on extending Evoli's engagement framework to other educational media, such as slides and documents, enabling its use in both synchronous and asynchronous contexts. The SmartQuiz system will also be refined to handle longer videos, improve concept extraction, and incorporate visual elements to enhance question quality. Additionally, deploying Evoli in real-world settings will allow the collection of large-scale data on learner interaction and feedback, supporting further research in video-based and self-regulated learning.

PhD Committee

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