EALL:7475
Research Objective Part 2
James Brewer
12 March 2925

What are the instructional constraints, research challenges, design, and student progress manifested thus far?

Based upon my research objectives, and those expressed in the exemplar study (Demartini, et al., 2024), I identified three primary challenges to the use of Artificial Intelligence (AI) as the foundation for an Intelligent Tutoring System (ITS), particularly as a tool for enhancing virtual learning experiences.

1) Sophistication of the AI to perceive teaching opportunities, cognitive impairments, and learning patterns across student cohorts to trigger curriculum refinement as well as interventions for students experiencing emotional or psychological difficulties. While this study provided ample evidence for the benefits of using educational data mining and learning analytics (EDM/LA), it was limited to correlating the overall student performance to a single variable (Python coding competence). However other studies using similar EDM/LA tooling were able to demonstrate flexibility in lesson delivery as well as human-like responsiveness to learner emotions using facial recognition technology coupled with neural networking (Shoaib, et al., 2023).

2) Depth of analysis to understand nature of obstacles in learning (i.e., lesson plan, pacing, etc.) and recommending remediations. A study by Mohanan & Gupta (2017) described a solution based upon a cubic emotional model (CEM) to train a neural network to

recognize eight categories of student emotion, leveraging a facial expression recognition system (FERS) developed by Masum & Ishizuka (2005). The neural network was capable of refining both lesson delivery (through hints, scaffolding, and providing analogous examples) as well as human-like emotional responses to each student based upon their cognitive and emotional profiles (Mohanan & Gupta, p. 6). The exemplar study scratched the surface of emotional recognition and support, but lacking a visual analysis module, could not adequately support the cohorts.

3) Security and personal privacy issues involved in obtaining past academic and emotional experiences from learners, and safely and correctly cataloging them in the learning model. With the increasing use of Emotional AI in the classroom, the level of technology enables learning to "sense, learn about, and interact with human emotional life" (McStay, 2020). This new capability has given rise to concerns about the use of AI in education (Gouseti, et al., 2024). Some of the challenges include a lack of awareness by both students and teachers of the ethics of using AI, deep concerns of faculty and administrators on the ethical risks of AI, and lack of training for teachers in the ethical use of AI (Gouseti, et al., p. 9).

What strategies you will take to address existing challenges to support students in meeting the learning goals you specified?

1) The exemplar study sought to further its progression by increasing the breadth and depth of data collection (i.e., past class attendance, knowledge, skills, competencies, and

emotional behaviors) as well as sharpening data quality standards to facilitate more rigorous data mining approaches, and supporting increased data granularities (Demartini, et al., p. 23). This would support evaluation of behavioral emotional dynamics, perhaps amplifying the finding that "inadequate coding skills significantly contribute to low performance" (ibid., p. 24).

2) Augmenting the sophistication of the adaptive learning model to incorporate emotional recognition is another future objective of the exemplar study, particularly since the researchers observed the significance of recognizing and responding to adverse emotions in a constructivist learning environment (ibid., p. 12). Adopting facial recognition technologies, coupled with analytics of tactile behavior (i.e., mouse click speed, keyboard accuracy) and the speed of responses (or conversely, of the hesitation between responses) could create more meaningful information yielding more timely decisions in instructional design and deployment.
3) The researchers recognized the essential need for data security and personal privacy for the students, teachers, and other stakeholders (ibid., p. 4). A holistic approach toward conditioning the learning models to adhere to rules protecting data and privacy is part of the future direction of the exemplar research program (ibid., p. 23). Other research suggests additional strategies for addressing such challenges, including re-dedicating the research program toward "a constructivist pedagogy to increase student's ethical awareness of AI", reformulating AI literacy courses to emphasize ethical awareness, and the development of "pre-service and in-service CPD courses that focus on ethics and AI" (Gouseti, et al., p. 11-12).

In the rapidly developing disciplines of Intelligent Tutoring Systems and Educational AI, the overwhelming focus from all the research I reviewed was the betterment of the educational experience for the students, particularly for remote and virtual learners. The view that these initiatives should come from within an academic setting, disinterested in the profit motive, was a high priority for each of the research teams. The major challenge, in my opinion, is to balance the tremendously rapid growth of ITS and EAI capabilities, with the enforcement and governance of essential security and privacy considerations. This will result in both novel solutions, against the risk of failures that are potentially harmful to students and teachers alike. By invoked rule-based protections directly into the learning engines, and buttressing these with human governance, much of the risk can be mitigated (OECD, 2023).

References

Demartini, C. G., Sciascia, L., Bosso, A., & Manuri, F. (2024). Artificial intelligence bringing improvements to adaptive learning in education: A case study. *Sustainability*, *16*(3), 1347. https://doi.org/10.3390/su16031347

Gouseti, A., James, F., Fallin, L., & Burden, K. (2024). The ethics of using AI in K-12 education: a systematic literature review. *Technology Pedagogy and Education*, 1–22. https://doi.org/10.1080/1475939x.2024.2428601

Masum, S., and Ishizuka, M., "An affective role model of software agent for effective agent-based e-learning by interplaying between emotions and learning," Procs. of WEBIST, Miami, USA, 2005, pp. 449-456.

McStay, A. (2020). Emotional AI, soft biometrics and the surveillance of emotional life: An unusual consensus on privacy. *Big Data & Society*, *7*(1), 2053951720904386. https://doi.org/10.1177/2053951720904386

Mohanan, R, Stringfellow, C., & Gupta, D. (2017). An emotionally intelligent tutoring system. *2017 Computing Conference*. https://doi.org/10.1109/sai.2017.8252228

OECD Digital Education Outlook 2023. (2023). In *Digital education outlook*. Organization for Economic Cooperation and Development. https://doi.org/10.1787/c74f03de-en

Shoaib, M., Shah, B., Hussain, T., Yang, B., Ullah, A., Khan, J., & Ali, F. (2023). A deep learning-assisted visual attention mechanism for anomaly detection in videos. *Multimedia Tools and Applications*., Article 0123456789. https://doi.org/10.1007/ s11042-023-17770-z

Shoaib, M., Shah, B., EI-Sappagh