Improving Accessibility of Education for Students with Disabilities in Virtual Learning Environments with Artificial Intelligence

Erik Đuranec

Faculty of Organization and Informatics

Student at Organization of business systems

Pavlinska ulica 2, 42 000 Varaždin

`eduranec@foi.hr`

Abstract. *This research discusses the possibilities of artificial intelligence in the adaption of virtual learning environments (and their educational content) for students with disabilities based on existing studies. Virtual learning environments (VLE), at the moment, offer very limited adaptation for students who have been diagnosed with some form of physical or cognitive disability. Such students require a learning environment that is purposefully designed for them. Furthermore, they might need extra assistance and the dedication of tutors or professors to successfully adopt new knowledge. Virtual learning environments offer more freedom in the use of advanced artificial intelligence techniques to increase or enable the inclusion of students with disabilities. More precisely, AI-based tools and methods can be used to analyze data with the intent to build a model that adapts content delivery to the student. Through this approach, AI based tools have the potential to increase the accessibility of educational content in virtual learning environments based on data they collect through students' interaction with the system in real time. All this is with respect to specific characteristics of an individual, such as academic performance, style of learning, and whether the student has a disability or not. Different approaches and relevant scientific work will be collected, compared, and discussed in this research, based on the given subject. The proposition of a framework for designing VLEs with AI in mind is given based on previous research. The framework consists of a high-level approach with a respect to crucial elements such as UX, Monitoring, Analysis, and Reporting System which represents a fundamental ground for the function of an AI system. Furthermore, AI is in charge of creating and evaluating the success of the created Student model which represents a student including academic performance, model of disability, and others. The tutor model represents a way system creates an adapted approach toward learning success and preferences of an individual student with included adaptive granularity and adaptive learning units. Also, a questionnaire was conducted for the evaluation of accessibility and satisfaction of students with the current VLEs. The purpose of the conducted research was to find out the current satisfaction of the students with the existing functionalities of VLEs, as well as the need for more intelligent functionalities powered by AI and students' opinions on the improvement of their academic success through smart functionalities. The research was conducted on a set of 62 respondents of which 10 were students with disabilities and three respondents were not comfortable with sharing this information. Students agreed that some form of intelligent tutor would be a useful addition to the existing VLEs. From research, the need for improved adaptability and accessibility of current VLEs is also visible, especially for the subset of students with some form of disability. Finally, most respondents agreed that smart functionalities powered by AI could improve their academic performance.*

Keywords. Artificial intelligence, accessibility, education, virtual learning environments

Acknowledgments

References

Cuesta, D.J., Ramos, A.C., & Pavlich-Mariscal, J.A. (2012). Adaptation and disability aspects in a virtual learning environment. Rev. Avances en Sistemas Informática, 9, 6-14.ISO/IEC

25010:Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - System and software quality models. (2011).

F. Berding, E. Riebenbauer, S. Stütz, H. Jahncke, A. Slopinski, i K. Rebmann (2022). Performance and Configuration of Artificial Intelligence in Educational Settings. Introducing a New Reliability Concept Based on Content Analysis. Front. Educ., vol. 7, 2022, doi:10.3389/feduc.2022.818365.

Krouska, A., Troussas, C., Giannakas, F., Sgouropoulou, C., & Voyiatzis, I. (2021). Enhancing the Effectiveness of Intelligent Tutoring Systems Using Adaptation and Cognitive Diagnosis Modeling. NiDS.

Shukor, Nurbiha. (2014). A Predictive Model to Evaluate Students' Cognitive Engagement in Online Learning. Procedia - Social and Behavioral Sciences. 116. 4844-4853. 10.1016/j.sbspro.2014.01.1036.

Schmitz-Hübsch, A., Stasch, S. M., Becker, R., Fuchs, S., & Wirzberger, M. (2022). Affective Response Categories-Toward Personalized Reactions in Affect-Adaptive Tutoring Systems. Frontiers in artificial intelligence, 5, 873056. https://doi.org/10.3389/frai.2022.873056

Mayer, R. E. (2009). Multimedia Learning (Second Edi.). New York: Cambridge University Press.

Troussas, Christos & Krouska, Akrivi & Virvou, Maria. (2021). A multilayer inference engine for individualized tutoring model: adapting learning material and its granularity. Neural Computing and Applications. 10.1007/s00521-021-05740-1.

Vladisauskas, M., Belloli, L., Fernández Slezak, D., & Goldin, A. P. (2022). A Machine Learning Approach to Personalize Computerized Cognitive Training Interventions. Frontiers in artificial intelligence, 5, 788605. https://doi.org/10.3389/frai.2022.788605

Weitekamp, Daniel & Harpstead, Erik & Koedinger, Kenneth. (2020). An Interaction Design for Machine Teaching to Develop AI Tutors. 1-11. 10.1145/3313831.3376226.

Tato, A., & Nkambou, R. (2022). Infusing Expert Knowledge Into a Deep Neural Network Using Attention Mechanism for Personalized Learning Environments. Frontiers in artificial intelligence, 5, 921476. https://doi.org/10.3389/frai.2022.921476

Armando, M., Ochs, M., & Régner, I. (2022). The Impact of Pedagogical Agents' Gender on Academic Learning: A Systematic Review. Frontiers in artificial intelligence, 5, 862997. https://doi.org/10.3389/frai.2022.862997

Hibbi, Fatima-Zohra & Otman, Abdoun & Khatir, Haimoudi. (2020). Integrating an Intelligent Tutoring System into an Adaptive E-Learning Process. 10.1007/978-3-030-35202-8_8.