Research from the Office of RIDIL

The Use of Artificial Intelligence to Manage Student Learning in Higher Education

This white paper provides a summary of a section of the work from:

Crompton, H., & Burke, D. (2023). Artificial Intelligence in Higher Education: The State of the field. *International Journal of Educational Technology in Higher Education, 20*(22). https://doi.org/10.1186/s41239-023-00392-8

Research Authors Bios

Dr. Helen Crompton is a Professor of Instructional Technology in the Department of STEM and Professional Studies, and the Executive Director of the Research Institute for Digital Innovation in Learning at ODUGlobal at ODU. Dr. Diane Burke is a Senior Research Associate at the Research Institute for Digital Innovation in Learning at ODUGlobal at ODU.

Overview

There has been a rise in the capabilities and the use of artificial intelligence (AI) in higher education since 2016. AI is being used to conduct tasks and provide new types of information for higher education instructors, students, and administrators. One of those tasks is the use of AI for managing student learning. AI can provide affordances for both administrators and instructors to access information and data analysis that can facilitate decision-making in the management of successful student learning.

Purpose of the Research

The purpose of this research was to conduct a systematic review to examine extant publications on how AI has been used in higher education teaching and learning from 2016-2022. The main question of this study was: What are the applications of AI in higher education? One of the applications that was revealed is how AI is being used for managing student learning in higher education. This white paper reports on those findings.

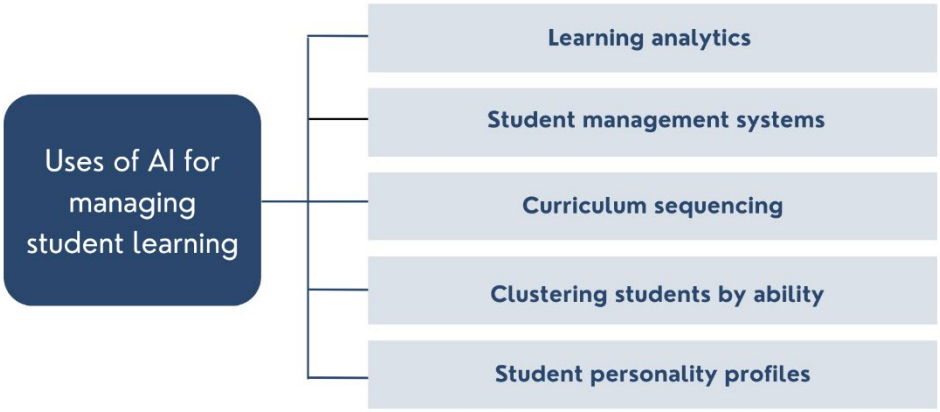
Method

A PRISMA systematic review methodology was used to determine the articles that would be included in this systematic review. Then a grounded coding approach revealed the trends in the use of AI in higher education. One of those trends was in the use of AI to manage student learning.

Findings and Discussion

Managing student learning was investigated in 19 of the 138 original studies focused on the use of AI in higher education. There were several ways in which AI facilitated the management of student learning, see Figure 1. These include the use of learning analytics, using big data to create and support student management systems, curriculum sequencing, teaching adjustments, clustering students by ability, and student personality profiling.

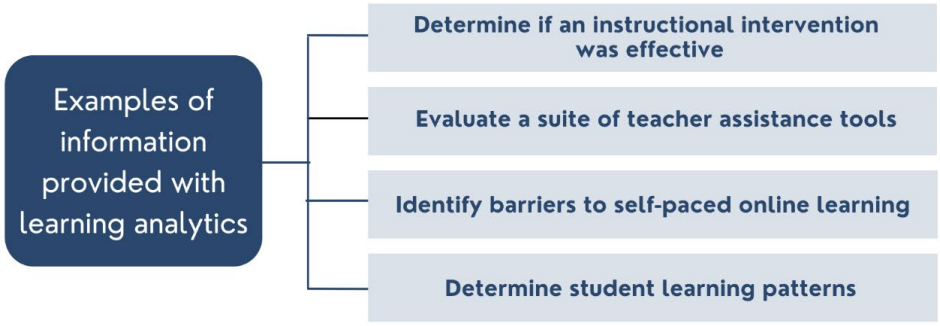
Figure 1. Uses of AI for managing student learning



Uses of AI and learning analytics

The most frequent use of AI in managing student behavior was in learning analytics. Learning analytics was an a priori term often found in studies that described "the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs" (Long & Siemens, 2011, p. 34). The studies investigated were across grades and subject areas and provided administrators and instructors with different types of information to guide their work. Kuromiya et al., (2020) in an undergraduate physics class evaluated the effectiveness of instructional intervention using a database integrated into learning analytics dashboards with actual learning context.

Figure 2. Information Provided with Learning Analytics

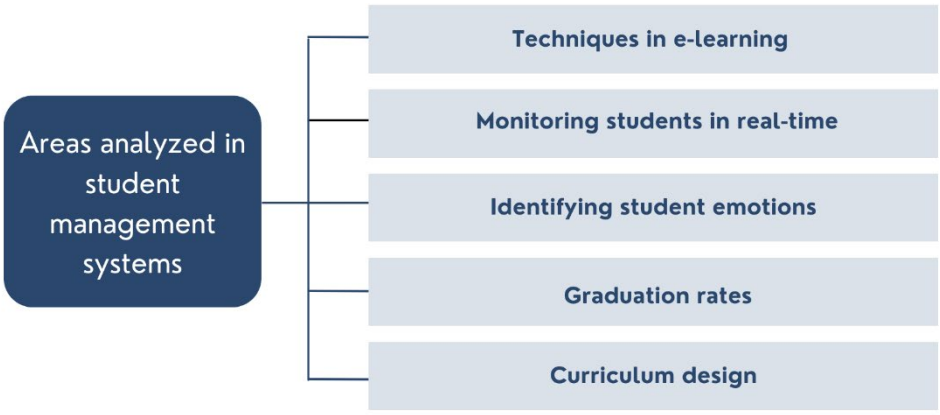


Uses of AI and student management systems

The second most frequent use of AI in managing student learning was using big data to support student learning through the development of student management systems. The ability to look across and within large data sets to create student management systems is a valuable affordance of AI in higher education. An effective student management system requires data from a multitude of sources. The studies in this systematic review investigated a variety of data sources. A study by Teng et al., (2023) used a data-driven decision-making model based on artificial intelligence. Student data, graduation rate, and curriculum

design were analyzed for administrative decision-making. They determined that AI-supported learning management systems can attain precise outcomes and enable informed decision-making.

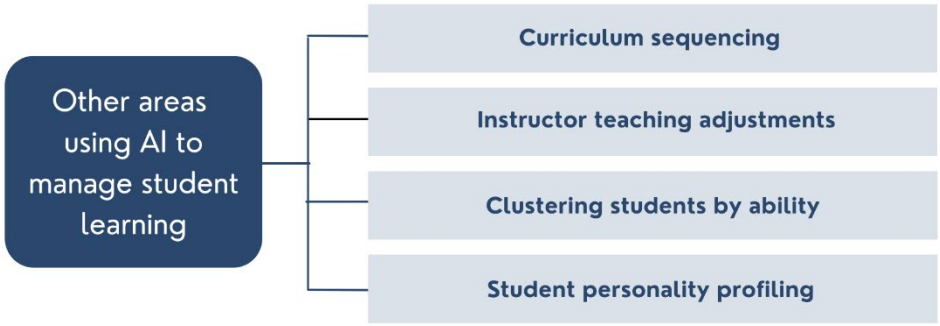
Figure 3. Areas analyzed in student management systems



Uses of AI in other areas

This systematic review revealed other areas using AI for managing student learning that are noteworthy, see Figure 4. One of those areas is curriculum sequencing. Meani et al., (2018) used AI-facilitated curriculum sequencing to find an optimal path for learners to provide personalized learning paths using individual profiles of the learners. Another study (Omheni, et al. 2017) used AI to investigate the possibility of personality recognition based on digital annotations. The results can provide a step forward for indirectly assessing a learners' personality in an on-line learning environment.

Figure 4. Other Areas for Managing Student Learning



Conclusion

This systematic review of the state of the field regarding the use of AI in higher education from 2016-2022 revealed a variety of ways in which AI was used for managing student learning. Some of these included learning analytics, student management systems, curriculum sequencing, teaching adjustments, clustering of students, and personality profiling. As the use of AI in higher education continues to become more sophisticated and more accessible, the need to continue to identify ways in which it can be used to manage student learning and success becomes more critical.

References

Kuromiya, H., Majumdar, R., & Ogata, H. (2020). Fostering Evidence-Based Education with Learning Analytics: Capturing Teaching-Learning Cases from Log Data. *Journal of Educational Technology & Society, 23*(4).

Long, P., & Siemens, G. (2011). Penetrating the fog: Analytics in learning and education. *Educause Review, 46*(5), 31-40.

Menai MEB, Alhunitah H, Al-Salman H. (2018) Swarm intelligence to solve the curriculum sequencing problem. *Computer Applications in Engineering Education,*. 26:1393–1404. https://doi.org/10.1002/cae.22046

Omheni, N., Kalboussi, A., Mazhoud, O. *et al.* Computing of Learner's Personality Traits Based on Digital Annotations. *Int J Artif Intell Educ* **27**, 241–267 (2017). https://doi-org.proxy.lib.odu.edu/10.1007/s40593-016-0124-x

Teng, Y., Zhang, J., & Sun, T. (2023). Data-driven decision-making model based on artificial intelligence in higher education system of colleges and universities. *Expert Systems*, 40(4), e12820.https://doi.org/10.1111/exsy.1282014 of 14TENGET AL.