PERSONALISED LEARNING WITH AI: IMPLICATIONS FOR IGNATIAN PEDAGOGY

FX. Risang Baskara[1,2]

[1] English Letters Department, Universitas Sanata Dharma, Yogyakarta
[2] Faculty of Business, Design, and Arts, Swinburne University of Technology, Sarawak Campus

Corresponding author: risangbaskara@usd.ac.id

Article Info	Abstract
	Artificial intelligence (AI) has the potential to transform education by enabling personalized learning experiences, fostering collaboration and communication, and cultivating critical thinking and problem-solving skills. However, ethical issues such as privacy, bias, and the impact of technology on values and beliefs must be considered. This paper explores the implications of integrating AI into education from the perspective of Ignatian pedagogy, a Jesuit-inspired educational approach rooted in certain principles and values. Drawing on a comprehensive review of existing literature on AI in education and Ignatian pedagogy, this paper investigates how AI can support the goals of Ignatian pedagogy while addressing ethical concerns. The paper presents examples of AI use in educational settings, highlighting the potential benefits and ethical challenges. Notably, there is a gap in research on how AI aligns with the values and goals of different educational approaches, including Ignatian pedagogy. To address this gap, this paper examines the potential of AI to support Ignatian pedagogy and identifies critical ethical considerations that should be addressed. Our findings suggest that AI has the potential to support Ignatian
	pedagogy, but such integration requires thoughtful consideration of ethical issues. Further research is needed to evaluate the potential of AI to support Ignatian pedagogy and other educational approaches while addressing ethical concerns such as privacy, bias, and the impact of technology on values and beliefs.

INTRODUCTION

Integrating artificial intelligence (AI) into education can revolutionize the way we teach and learn (Jaiswal & Arun, 2021). With the power to provide personalized learning experiences, facilitate collaboration and communication, and support the development of critical thinking and problem-solving skills, AI can transform education in significant ways (Kim et al., 2022). At the same time, the use of AI in education raises critical ethical considerations, such as privacy, bias, and the potential impact of technology on values and beliefs (Holmes et al., 2022).

Integrating artificial intelligence (AI) into education can revolutionize how we teach and learn (Yang & Bai, 2020). One of the main benefits of AI in education is its ability to provide personalized learning experiences (Akgun & Greenhow, 2022). AI can create customized learning paths that adapt to each student's unique needs and interests by using algorithms and machine learning techniques to analyze students' performance data (Troussas et al., 2020). This can help ensure that students receive the support and guidance they need to succeed and can foster a sense of agency and ownership over their learning process.

Another potential benefit of AI in education is its ability to facilitate collaboration and communication (Pedro et al., 2019). AI technologies, such as virtual reality and online collaboration tools, can create immersive and interactive learning environments that allow students to work together and learn from each other (Ng, 2022). This can help foster a sense of community and belonging within the classroom and support the development of personal relationships between students and teachers.

AI technologies, such as simulations and games, can support the development of critical thinking and problem-solving skills (Spector & Ma, 2019). These technologies create immersive and interactive learning experiences that challenge students to think critically and apply their knowledge to real-world problems (Almeida & Simoes, 2019). This can be particularly helpful in preparing students for success in the 21st century.

While the use of AI in education has the potential to transform education in significant ways, it is essential to recognize that it also raises important ethical considerations (Holmes et al., 2022). These include concerns about privacy, bias, and the potential impact of technology on values and beliefs. It is essential to address these ethical considerations to ensure that AI is used fairly, transparently, and accountable, supporting educational goals.

AI has the potential to impact education significantly, but it is essential to consider whether it aligns with the values and goals of different educational approaches (Popenici & Kerr, 2017). Ignatian pedagogy, grounded in the Jesuit tradition's principles and values, emphasizes the importance of fostering critical thinking and problem-solving skills, promoting collaborative learning and personal relationships, and supporting the formation of students' spiritual and moral values (Mencuccini, 2021). By examining how AI can support Ignatian pedagogy and the ethical considerations involved in using AI in education, we can better understand AI's role in the future of education. This can help us use AI in ways consistent with the values and

goals of Ignatian pedagogy, promoting the development of critical thinking, collaboration, and personal relationships in the learning process.

Ignatian pedagogy is a form of education grounded in the Jesuit tradition's principles and values (Mesa, 2017; Mountin & Nowacek, 2012). It emphasizes the importance of fostering critical thinking and problem-solving skills, promoting collaborative learning and personal relationships, and supporting the formation of students' spiritual and moral values (Mummadi, 2021; Pousson & Myers, 2018; Reilly, 2017). These goals are central to the Jesuit educational philosophy and are seen as key to helping students develop their full potential as human beings.

Ignatian pedagogy offers a valuable framework for examining the relationship between AI and education. By examining how AI can support Ignatian pedagogy and the ethical considerations involved in using AI in education, we can gain a deeper understanding of AI's role in the future of education.

Given the potential of AI to support the goals of Ignatian pedagogy, it is essential to consider how AI can be used to enhance the teaching and learning process in ways consistent with the values and goals of Ignatian pedagogy. This includes examining the potential of AI to create personalized learning experiences that adapt to each student's unique needs and interests, facilitate collaboration and communication, and support the development of critical thinking and problem-solving skills.

It is essential to consider the ethical implications of using AI in education and ensure that it is used fairly, transparently, and accountably (Holmes et al., 2022). To ensure the ethical use of AI in education, it is necessary to establish guidelines and provide training to educators on its ethical use. It is also essential to engage in ongoing discussions about the role of AI in education. By addressing these ethical considerations and using AI responsibly in education, we can better understand its potential to support the goals of Ignatian pedagogy and its role in the future of education.

In this paper, this study will examine the relationship between Ignatian pedagogy and AI in education, focusing on the potential of AI to support the goals of Ignatian pedagogy and the ethical considerations that need to be considered when using AI in education. By doing so, this study aims to provide a comprehensive and nuanced understanding of AI's role in education and how it can support the development of critical thinking, collaboration, and personal relationships in the learning process.

OVERVIEW OF IGNATIAN PEDAGOGY

Ignatian pedagogy's core is the belief that education should be a transformative experience that helps students develop their full potential (Go & Atienza, 2019). To this end, Ignatian pedagogy focuses on four key goals. The first goal is to foster critical thinking and problem-solving skills. Ignatian pedagogy encourages students to think critically and approach problems with curiosity and open-mindedness. This involves providing students with

opportunities to engage in activities that challenge them to think creatively and to apply their knowledge and skills to real-world problems.

Ignatian pedagogy fosters critical thinking and problem-solving skills (Connor, 2014). Encouraging critical thinking and curiosity in students involves opportunities to engage in activities that challenge them to think creatively and apply their knowledge and skills to real-world problems (Nelson & Crow, 2014). This helps students to approach problems with an open-minded and curious attitude.

The second goal is to promote collaborative learning and personal relationships. Ignatian pedagogy emphasizes the importance of collaborative learning and the development of personal relationships in the learning process (Reilly, 2017). This involves creating opportunities for students to work together and learn from each other and promoting the development of personal relationships between students and teachers.

Another critical goal of Ignatian pedagogy is promoting collaborative learning and personal relationships (Niyigena et al., 2018). It involves creating opportunities for students to work together and learn from each other and promoting the development of personal relationships between students and teachers. Collaborative learning can be a powerful way to engage students and help them develop higher-order thinking skills such as analysis, synthesis, and evaluation (Alharbi et al., 2022).

The next goal is to support the formation of students' spiritual and moral values (Leighter & Smythe, 2019). Ignatian pedagogy strongly emphasizes helping students develop their spiritual and moral values. This involves providing students with opportunities to reflect on their values and beliefs and engaging in activities supporting the development of virtues such as compassion, empathy, and justice (Dewi, 2019).

Another goal is to provide personalized learning experiences. Ignatian pedagogy emphasizes the importance of providing personalized learning experiences considering each student's unique needs and interests (Pousson & Myers, 2018). Ignatian pedagogy aims to provide personalized learning experiences that cater to each student's unique needs and learning styles (Pennington et al., 2013). This involves adapting the teaching methods and learning material to fit the individual needs of each student. By considering each student's specific needs and interests, personalized learning experiences can help students receive the support and guidance they need to succeed and feel a sense of ownership over their learning process.

OVERVIEW OF AI IN EDUCATION

Artificial intelligence (AI) refers to developing and using computer systems and algorithms to perform tasks that typically require human intelligence, such as learning, problem-solving, and decision-making (Tien, 2017). In education, AI can be used in various ways to support the teaching and learning process. Some potential uses of AI in education include adaptive learning, simulations and games, virtual reality, and online collaboration tools (Alam, 2022; Marienko et al., 2020; Osadchyi et al., 2020).

Adaptive learning systems use algorithms and machine learning techniques to analyze students' performance data and adjust the content and pace of the learning material accordingly (Johnson & Samora, 2016). The goal of adaptive learning is to provide students with customized learning experiences that are tailored to their individual needs and learning styles and that allow them to progress at their own pace (Cavanagh et al., 2020). This allows students to progress at their own pace and receive customized support based on their strengths and areas for improvement.

To provide personalized learning experiences, adaptive learning systems typically use a combination of algorithms and machine learning techniques to analyze students' performance data and adjust the content and pace of the learning material accordingly (Cavanagh et al., 2020). This may involve adjusting the difficulty level of the learning material based on students' strengths and areas for improvement or providing students with additional support and guidance in areas where they are struggling.

One of the main benefits of adaptive learning is that it allows students to progress at their own pace and receive customized support based on their strengths and areas for improvement (Jagadeesan & Subbiah, 2020). This can help ensure that students receive the support and guidance they need to succeed and can foster a sense of agency and ownership over their learning process.

AI can create immersive and interactive learning experiences, such as simulations and games, that challenge students to think critically and apply their knowledge and skills to real-world problems (Ahmad et al., 2019). These learning experiences are particularly effective at engaging students and helping them develop higher-order thinking skills such as analysis, synthesis, and evaluation.

To create simulations and games, AI technologies can generate virtual environments and characters that students can interact with (Pan et al., 2021). These virtual environments can simulate real-world scenarios, such as historical events, scientific phenomena, or business situations. They can allow students to apply their knowledge and skills to these scenarios.

Virtual reality (VR) is an AI technology that can create immersive and interactive learning environments (Geng & Wu, 2021). VR technologies use computer-generated simulations of real or imaginary environments to create an immersive and interactive learning experience for students (Meccawy, 2022).

AI technologies, such as virtual reality, can create immersive and interactive learning environments that allow students to engage with course material more engagingly and interactively (Champion & Foka, 2020). This can be particularly effective at engaging students and helping them to develop higher-order thinking skills, and it can also be an enjoyable and rewarding learning experience for students. By immersing students in virtual environments, VR can help to create a more immersive and interactive learning experience, which can be particularly effective at engaging students and helping them to retain knowledge and skills (Phakamach et al., 2022).

VR can be used in various ways in education, simulating real-world scenarios, visualizing abstract concepts, or providing interactive demonstrations of complex processes (Kamińska et al., 2019). For example, VR can simulate historical events, scientific phenomena, or business situations and provide students with opportunities to apply their knowledge and skills to these scenarios.

THE POTENTIAL OF AI TO SUPPORT IGNATIAN PEDAGOGY

There are several ways in which artificial intelligence (AI) could be used to support the goals of Ignatian pedagogy, such as fostering critical thinking and problem-solving skills, promoting collaborative learning and personal relationships, and providing personalized learning experiences. Some possible examples include fostering critical thinking and problem-solving skills, promoting collaborative learning and personal relationships, and providing personalized learning experiences.

AI technologies, such as simulations and games, can provide immersive and interactive learning experiences that challenge students to think critically and solve complex problems. For example, an AI-powered biology game could allow students to analyze and interpret data, make predictions, and develop solutions to real-world problems. These learning experiences can support Ignatian pedagogy by encouraging students to think creatively and critically and providing opportunities to apply what they have learned to real-world scenarios.

Another way in which AI can support Ignatian pedagogy is by promoting collaborative learning and personal relationships. AI technologies such as virtual reality and online collaboration tools can allow students to work together and learn from each other. This can include group projects, peer review sessions, or online forums where students can discuss course material and share their insights and experiences. Collaborative learning experiences like these can foster a sense of community and connection among students and provide a supportive and welcoming environment for learning (Brindley et al., 2009). This can be particularly important in the context of Ignatian pedagogy, which emphasizes the importance of personal relationships and the development of a sense of community.

Finally, AI can also support Ignatian pedagogy by providing personalized learning experiences. Adaptive learning systems, which use algorithms and machine learning techniques to analyze students' performance data and adjust the content and pace of the learning material accordingly, can be used to create personalized learning paths that cater to the unique needs and interests of each student. Personalized learning can help ensure that each student receives the support and guidance they need to succeed and can foster a sense of agency and ownership over the learning process (Archambault et al., 2022). By providing students with a tailored learning experience that meets their individual needs and interests, AI can help to support the goals of Ignatian pedagogy.

Collaborative learning and personal relationships are two essential components of effective education. AI technologies offer several ways to promote both in the classroom. For instance,

virtual reality and online collaboration tools create immersive and interactive learning environments that enable students to work together and learn from each other (Tlili et al., 2022). These technologies provide a platform for group projects, peer review sessions, or online forums where students can discuss course material and share their insights and experiences. Such approaches encourage students to collaborate, fostering personal relationships and promoting a sense of community.

AI can also be used to support the development of personal relationships within the classroom. Personalized AI-powered tutors or personal assistants can offer students guidance, support, and feedback (Pedro et al., 2019). These technologies help students to develop a sense of belonging and trust within the classroom, which is crucial to effective learning (Seo et al., 2021). By providing personalized support and guidance, AI can foster connections between students and teachers, contributing to the overall success of the learning experience.

Spiritual and moral values are another critical aspect of practical education. AI technologies provide several immersive and interactive learning experiences that challenge students to think critically about their values and beliefs (Mystakidis, 2021). For example, virtual reality and simulations can provide environments where students consider the impact of their actions on others. These experiences can help students develop empathy and compassion, promoting spiritual and moral values.

AI can also support the development of spiritual and moral values through personalized support and guidance. Personalized AI-powered tutors or personal assistants can offer students feedback and support tailored to their needs (Pokrivčáková, 2019). These technologies foster connections and trust between students and teachers, which is essential in promoting the development of spiritual and moral values.

Personalized learning experiences are a crucial component of effective education. Adaptive learning systems, powered by algorithms and machine learning techniques, provide personalized learning experiences for individual students (Oxman et al., 2014). These systems analyze student performance data and adjust the content and pace of the learning material accordingly. In doing so, they can help ensure that students receive the support and guidance they need to succeed (Joseph-Richard et al., 2021).

Personalized feedback and support, provided by AI-powered tutors or personal assistants, is another way to support personalized learning experiences (Nazari et al., 2021). These technologies can foster a sense of belonging and trust between students and teachers, crucial factors in personalized learning experiences (Chounta et al., 2022). By enabling personalized learning experiences, AI can help achieve the goals of Ignatian pedagogy, which aims to develop students' critical thinking, problem-solving, and moral and spiritual capacities through collaborative learning, personal relationships, and personalized learning experiences.

AI simulations and games can give students a dynamic and interactive learning experience that engages their critical thinking and problem-solving skills (Lampropoulos et al., 2019). These learning experiences can efficiently teach complex or abstract concepts, allowing students to explore and experiment in a virtual environment. For example, an AI-powered

physics simulation could allow students to manipulate virtual objects and observe the effects of different forces, helping them to gain a deeper understanding of the underlying principles (Tlili et al., 2022). Similarly, an AI-powered economics game could allow students to make decisions and see the consequences of those choices in a simulated market environment. By providing students with a chance to engage with course material in a hands-on and interactive way, AI simulations and games can help to make learning more engaging and meaningful.

AI technologies such as virtual reality and online collaboration tools can provide students with various opportunities to work together and learn from each other. For example, virtual reality technology could allow students to participate in collaborative projects or simulations that involve working in a virtual environment with their peers (Winkelmann et al., 2020). This could include designing a virtual city or conducting a virtual science experiment. Online collaboration tools, such as video conferencing software or online forums, can also provide students with opportunities to work together and learn from each other (Libre, 2021). For instance, students could use these tools to work on group projects, conduct peer review sessions, or participate in online discussions about course material. Collaborative learning experiences like these can support Ignatian pedagogy by fostering a sense of community and connection among students and providing opportunities for them to learn from and with each other.

Adaptive learning systems can create personalized learning paths that cater to each student's unique needs and interests, providing a tailored learning experience (Shemshack & Spector, 2021). For example, an adaptive learning system might track students' progress through a course, analyzing their performance on assessments and identifying areas where they struggle. Based on this data, the system could then adjust the content and pace of the course material to meet the student's needs better, providing additional support or resources as needed. By providing students with a personalized learning experience that adapts to their unique needs and interests, adaptive learning systems can help ensure that each student receives the support and guidance they need to succeed. Additionally, personalized learning can foster a sense of agency and ownership over the learning process, as students have more control over the content and pace of their studies.

In addition to these examples, AI can also be used to support the goal of promoting personal relationships in Ignatian pedagogy. For instance, AI-powered chatbots or virtual assistants can facilitate communication between students and teachers, allowing for more frequent and personalized interactions (Kuhail et al., 2022). This can help create a sense of community and connection among students and provide a supportive and welcoming environment for learning. Furthermore, AI can be used to support the Ignatian emphasis on the integration of faith and learning. For example, AI-powered recommendation systems could suggest readings or other resources related to Ignatian spirituality or connect students with others interested in similar topics. This can help to create a more holistic learning experience that integrates spiritual and intellectual growth.

All in all, AI has the potential to support and enhance the goals of Ignatian pedagogy in a variety of ways. By fostering critical thinking and problem-solving skills, promoting collaborative learning and personal relationships, and providing personalized learning experiences, AI can help students develop the skills and values central to Ignatian education.

One potential challenge in using AI to support Ignatian pedagogy is ensuring the technology is used ethically and responsibly. This may involve protecting students' privacy, ensuring that the AI systems are free from bias, and being transparent about the technology's use. By addressing these issues, it may be possible to harness the power of AI to support the goals of Ignatian education while also upholding the values and principles of the Ignatian tradition.

ETHICAL CONSIDERATIONS

When using artificial intelligence (AI) in education, several ethical considerations must be considered. Some key ethical issues include privacy, bias, and impact on values and beliefs.

AI in education often involves collecting and analyzing a wide range of personal data about students, including test scores, grades, and other performance metrics (Tanveer et al., 2020). This data can be used to track students' progress, identify areas of weakness, and provide personalized support and resources. However, collecting and analyzing personal data also raises significant concerns about privacy and the potential for students' data to be accessed or used in ways they do not consent to (Price & Cohen, 2019). Several potential risks are associated with using AI in education, including the possibility that students' data could be shared with third parties without their knowledge or consent or that it could be used to make decisions about students' educational opportunities or career paths (Rubel & Jones, 2016).

To address concerns about collecting and using personal data in education, it is essential to have clear and transparent policies that protect students' privacy and give them control over their data (Holmes et al., 2022). This may involve requiring explicit consent before collecting or using students' data and being transparent about its use. By taking these steps, we can mitigate the risks associated with using AI in education and ensure that it is used ethically and responsibly.

AI algorithms can be biased if they are trained on data that is not representative of the population or designed in ways that discriminate against certain groups of people (Mehrabi et al., 2019). This can lead to unfair outcomes or inequities in education, as AI systems that are biased may make decisions or recommendations that are unfair or unjust (Holstein & Doroudi, 2021). For example, an AI system trained on data not representative of a diverse student population may be less accurate or practical for students from underrepresented groups, leading to inequities in educational outcomes. Similarly, an AI system designed to discriminate against certain groups of people may produce biased results that disproportionately affect those groups.

Ensuring AI systems are designed and implemented to minimize bias and promote fairness and equity in education (Nguyen et al., 2022). This may involve ensuring that the data used to train AI algorithms is diverse and representative of the population and carefully designing and testing AI systems to ensure that they do not discriminate against certain groups. By taking steps to minimize bias in AI systems, it may be possible to ensure that they are used ethically and responsibly and to promote fairness and equity in education.

The use of AI in education can raise questions about the potential impact of technology on students' values and beliefs. As AI systems become more prevalent in educational settings, they may influence students' understanding of what is normal or acceptable (Kim et al., 2020). They may shape students' expectations about learning and interacting with others. For example, AI-powered personal assistants or tutors may provide students with information or guidance that shapes their understanding of specific topics or issues (Ravshanbek, 2022). These systems may also influence students' expectations about learning and interacting with others, as they may model certain behaviors or ways of thinking.

There is a risk that AI systems may reinforce existing biases or stereotypes or may present a narrow or biased perspective on specific issues (Kordzadeh & Ghasemaghaei, 2022). It is essential to consider the potential impact of AI on students' values and beliefs and design and use these systems to promote fairness, diversity, and critical thinking. This could involve providing students with opportunities to explore different perspectives and sources of information and encouraging them to think critically about the information they receive from AI and other sources. By being proactive and thoughtful in using AI in education, we can reduce potential risks and maximize the benefits of this technology.

In addition, it is crucial to consider AI's potential impact on social justice and equity in education. It is essential to ensure that AI is not used to perpetuate or exacerbate existing inequalities or disadvantage certain groups of students. This may involve examining the potential for bias in AI systems and taking steps to mitigate it, as well as considering the potential consequences of AI for access to education and the distribution of resources. By considering these ethical considerations, it may be possible to use AI ethically and responsibly, promoting fairness and equity in education.

All in all, the use of AI in education raises a range of ethical considerations that need to be carefully considered and addressed to ensure that AI is used in fair, transparent, and responsible ways that support the goals of education.

CONCLUSION

Integrating artificial intelligence (AI) in education holds tremendous potential for revolutionizing how we teach and learn. AI can offer personalized learning experiences, facilitate collaboration and communication, and promote the development of critical thinking and problem-solving skills. However, ethical concerns, such as privacy, bias, and the impact of technology on values and beliefs, must be addressed when using AI in education.

Ignatian pedagogy is an educational approach grounded in Jesuit principles and values that prioritizes critical thinking and problem-solving skills, collaborative learning and personal relationships, and the formation of students' spiritual and moral values. By exploring the potential of AI to support these goals while considering ethical considerations, we can develop a deeper understanding of AI's role in the future of education.

The relationship between Ignatian pedagogy and AI has far-reaching implications for the future of education. By leveraging AI to support the objectives of Ignatian pedagogy, we can create immersive and interactive learning experiences that foster critical thinking and problem-solving skills, promote collaborative learning and personal relationships, and provide personalized learning experiences. However, it is essential to ensure that AI use is fair, transparent, and accountable, considering the ethical considerations that arise when using AI in education.

To fully realize the potential of AI in education, further research is needed. Future research can explore how AI aligns with other educational approaches and goals beyond Ignatian pedagogy. Additionally, future research can investigate how to address ethical concerns, such as privacy, bias, and the impact of technology on values and beliefs when using AI in education. By addressing these questions, researchers can develop strategies that enable AI to support educational goals and help students reach their full potential.

REFERENCES

Ahmad, M. K., Adnan, A. H. M., Azamri, N. M., Idris, K. B., Norafand, N. N., & Ishak, N. I. (2019). Education 4.0 technologies for English language teaching and learning in the Malaysian context. *Proceedings of the International Invention, Innovative & Creative (InIIC) Conference, Series*, *2*(2019), 6–16.

Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics*, *2*(3), 431–440. https://doi.org/10.1007/s43681-021-00096-7

Alam, A. (2022). Employing adaptive learning and intelligent tutoring robots for virtual classrooms and smart campuses: Reforming education in the age of artificial intelligence. In *Advanced Computing and Intelligent Technologies: Proceedings of ICACIT 2022* (pp. 395-406). Singapore: Springer Nature Singapore.

Alharbi, S. M., Elfeky, A. I., & Ahmed, E. S. (2022). The effect of e-collaborative learning environment on the development of critical thinking and higher order thinking skills. *Journal of Positive School Psychology*, 6848-6854.

Almeida, F., & Simoes, J. (2019). The role of serious games, gamification, and industry 4.0 tools in the education 4.0 paradigm. *Contemporary Educational Technology*, *10*(2), 120–136. https://doi.org/10.30935/cet.554469

Archambault, L., Leary, H., & Rice, K. (2022). Pillars of online pedagogy: A framework for teaching in online learning environments. *Educational Psychologist*, *57*(3), 178–191. https://doi.org/10.1080/00461520.2022.2051513

Brindley, J. E., Blaschke, L. M., & Walti, C. (2009). Creating effective collaborative learning groups in an online environment. *International Review of Research in Open and Distributed Learning*, *10*(3). https://doi.org/10.19173/irrodl.v10i3.675

Cavanagh, T., Chen, B., Lahcen, R. A. M., & Paradiso, J. R. (2020). Constructing a design framework and pedagogical approach for adaptive learning in higher education: A practitioner's perspective. *International Review of Research in Open and Distributed Learning*, *21*(1), 173–197. https://doi.org/10.19173/irrodl.v21i1.4557

Champion, E., & Foka, A. (2020). Art history, heritage games, and virtual reality. In *The Routledge Companion to Digital Humanities and Art History* (pp. 238–253). Routledge.

Chounta, I.-A., Bardone, E., Raudsep, A., & Pedaste, M. (2022). Exploring teachers' perceptions of Artificial Intelligence as a tool to support their practice in Estonian K-12 education. *International Journal of Artificial Intelligence in Education*, *32*(3), 725–755. https://doi.org/10.1007/s40593-021-00243-5

Connor, K. R. (2014). Accompanying the student: The Ignatian pedagogical paradigm and prior learning. *Journal of Adult Theological Education, 11*(1), 3-17. https://doi.org/10.1080/17432415.2014.896127.

Dai, C.-P., & Ke, F. (2022). Educational applications of artificial intelligence in simulation-based learning: A systematic mapping review. *Computers and Education: Artificial Intelligence*, 100087. https://doi.org/10.1016/j.caeai.2022.100087

Dewi, N. (2019). Cognition, conscience, and creativity: Multimedia-based literature teaching for pre-service teachers in Indonesia. *3L: Southeast Asian Journal of English Language Studies*, *25*(2).

Geng, J., & Wu, X. (2021). Application of virtual reality technology in university education. *2021 2nd International Conference on Artificial Intelligence and Education (ICAIE)*, 472–475. https://doi.org/10.1109/ICAIE52409.2021.9432821

Go, Johnny C, S. J., & Atienza, R. J. (2019). *Learning by Refraction: A Practitioner's Guide to 21st Century Ignatian Pedagogy*. Ateneo de Manila University Press.

Johnson, D., & Samora, D. (2016). The potential transformation of higher education through computer-based adaptive learning systems. *Global Education Journal*, *2016*(1).

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. T., Cukurova, M., & Bittencourt, I. I. (2022). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education*, *32*(3), 504–526. https://doi.org/10.1007/s40593-021-00239-1

Holstein, K., & Doroudi, S. (2021). Equity and artificial intelligence in education: Will" AIEd" Amplify or Alleviate Inequities in Education?. *arXiv preprint arXiv:2104.12920.*

Jagadeesan, S., & Subbiah, J. (2020). RETRACTED ARTICLE: Real-time personalization and recommendation in Adaptive Learning Management System. *Journal of ambient intelligence and humanized computing*, *11*(11), 4731-4741.

Jaiswal, A., & Arun, C. J. (2021). Potential of artificial intelligence for transformation of the education system in India. *International Journal of Education and Development using*

Information and Communication Technology, *17*(1), 142-158. https://doi.org/10.20898/ijict.v17i1.1935

Joseph-Richard, P., Uhomoibhi, J., & Jaffrey, A. (2021). Predictive learning analytics and the creation of emotionally adaptive learning environments in higher education institutions: A study of students' affect responses. *The International Journal of Information and Learning Technology*, *38*(3), 104-121. https://doi.org/10.1108/IJILT-05-2020-0077

Kamińska, D., Sapiński, T., Wiak, S., Tikk, T., Haamer, R. E., Avots, E., Helmi, A., Ozcinar, C., & Anbarjafari, G. (2019). Virtual reality and its applications in education: Survey. *Information*, *10*(10), 318. https://doi.org/10.3390/info10100318

Kim, J., Lee, H., & Cho, Y. H. (2022). Learning design to support student-AI collaboration: Perspectives of leading teachers for AI in education. *Education and Information Technologies*, 1–36. https://doi.org/10.1007/s10639-022-10706-w

Kim, J., Merrill, K., Xu, K., & Sellnow, D. D. (2020). My teacher is a machine: Understanding students' perceptions of AI teaching assistants in online education. *International Journal of Human–Computer Interaction*, *36*(20), 1902–1911. https://doi.org/10.1080/10447318.2020.1801227

Kordzadeh, N., & Ghasemaghaei, M. (2022). Algorithmic bias: Review, synthesis, and future research directions. *European Journal of Information Systems*, *31*(3), 388–409. https://doi.org/10.1080/0960085X.2021.1927212

Kuhail, M. A., Alturki, N., Alramlawi, S., & Alhejori, K. (2022). Interacting with educational chatbots: A systematic review. *Education and Information Technologies*, 1–46. https://doi.org/10.1007/s10639-022-10710-8

Lampropoulos, G., Anastasiadis, T., Siakas, K., & In, L. E. (2019, April). Digital Game-based Learning in Education: Significance of Motivating, Engaging and Interactive Learning Environments. In *24th International Conference on Software Process Improvement-Research into Education and Training (INSPIRE 2019)* (pp. 117-127).

Leighter, J. L., & Smythe, K. R. (2019). Ignatian pedagogy for sustainability: An overview. *Jesuit Higher Educafion: A Journal*, *8*(1), 3–11. https://doi.org/10.15368/jhe.2019v8n1.1

Libre, N. A. (2021). A Discussion Platform for Enhancing Students Interaction in the Online Education. *Journal of Online Engineering Education*, *12*(2), 07-12. https://www.jee.org/index.php/jee/article/view/385/285

Marienko, M., Nosenko, Y., & Shyshkina, M. (2020). Personalisation of learning using adaptive technologies and augmented reality. *ArXiv Preprint ArXiv:2011.05802*.

Meccawy, M. (2022). Creating an Immersive XR Learning Experience: A Roadmap for Educators. *Electronics*, *11*(21), 3547. https://www.mdpi.com/2079-9292/11/21/3547

Mehrabia, N., Morstatter, F., Saxena, N., Lerman, K., & Galstyan, A. (2021). A survey on bias and fairness in machine learning. *ACM Computing Surveys, 54*(6), 1-35. https://dl.acm.org/doi/10.1145/3475685

Mencuccini, M. C. (2021). *Cultivating the Practice of Ignatian Pedagogy in Faculty at Jesuit Universities* (Doctoral dissertation, Creighton University).

Mesa, J. (2017). *Ignatian Pedagogy: Classic and Contemporary Texts on Jesuit Education From St. Ignatius to Today*. Loyola Press.

Mountin, S., & Nowacek, R. (2012). Reflection in action: A signature Ignatian pedagogy for the 21st century. *International Journal of Ignatian Spirituality, 1*(1), 28-41.

Mummadi, L. S. R. (2021). *The Ignatian Pedagogical Paradigm as a Critical Theoretical Framework to Enhance Teachers' Professional Identity in Diverse Context* (Doctoral dissertation, University of San Francisco).

Mystakidis, S. (2021). Motivation enhancement methods for community building in extended reality. In *Augmented and Mixed Reality for Communities* (pp. 265–282). CRC Press.

Nazari, N., Shabbir, M. S., & Setiawan, R. (2021). Application of Artificial Intelligence powered digital writing assistant in higher education: *Randomised controlled trial. Heliyon, 7*(5), e07014. https://doi.org/10.1016/j.heliyon.2021.e07014

Nelson, L. P., & Crow, M. L. (2014). Do active-learning strategies improve students' critical thinking?. *Higher Education Studies*, *4*(2), 77–90. https://doi.org/10.5539/hes.v4n2p77

Ng, D. T. K. (2022). What is the metaverse? Definitions, technologies and the community of inquiry. *Australasian Journal of Educational Technology*, *38*(4), 190–205. https://doi.org/10.14742/ajet.7945

Nguyen, A., Ngo, H. N., Hong, Y., Dang, B., & Nguyen, B.-P. T. (2022). Ethical principles for artificial intelligence in education. *Education and Information Technologies*, 1–21. https://link.springer.com/article/10.1007/s10639-022-10775-2

Niyigena, C., Ateka, F., & Machyo, C. (2018). Ignatian pedagogical paradigm: How teachers' consideration of students' context contributes to holistic education in private secondary schools in Kigali City, Rwanda. *International Journal of Innovative Research and Development, 7*(6), 332–341. https://doi.org/10.24940/ijird/2018/v7/i6/JUN18079

Osadchyi, V., Chemerys, H., Osadcha, K., Kruhlyk, V. S., Koniukhov, S., & Kiv, A. (2020). Conceptual model of learning based on the combined capabilities of augmented and virtual reality technologies with adaptive learning systems. *CEUR Workshop Proceedings*, *2731*, 328–340. https://ceur-ws.org/Vol-2731/paper-27.pdf

Oxman, S., Wong, W., & Innovations, D. (2014). White paper: Adaptive learning systems. *Integrated Education Solutions*, 6–7. https://www.academia.edu/9521221/White_Paper_Adaptive_Learning_Systems

Pan, Z., Sun, Y., Yao, Z. W., & Li, M. (2021). Application of virtual reality in English teaching. *2021 3rd World Symposium on Artificial Intelligence (WSAI)*, 64–71. https://doi.org/10.1109/WSAI52453.2021.9415263

Pedro, F., Subosa, M., Rivas, A., & Valverde, P. (2019). Artificial intelligence in education: Challenges and opportunities for sustainable development. *Proceedings of the 2019*

IEEE Global Engineering Education Conference (EDUCON), 1447-1451. https://doi.org/10.1109/EDUCON.2019.8725022

Peng, H., Ma, S., & Spector, J. M. (2019). Personalized adaptive learning: An emerging pedagogical approach enabled by a smart learning environment. *Smart Learning Environments*, *6*(1), 1–14. https://doi.org/10.1186/s40561-019-0089-y

Pennington, K., Crewell, J., Snedden, T., Mulhall, M., & Ellison, N. (2013). Ignatian pedagogy: Transforming nursing education. *Jesuit Higher Education*, *2*(1), 34–40. https://doi.org/10.1017/jhe.2013.1

Phakamach, P., Senarith, P., & Wachirawongpaisarn, S. (2022). The Metaverse in education: The future of immersive teaching & learning. *RICE Journal of Creative Entrepreneurship and Management*, *3*(2), 75-88. https://doi.org/10.33172/rjcem.2022.2.75-88

Pokrivčáková, S. (2019). Preparing teachers for the application of AI-powered technologies in foreign language education. *Journal of Language and Cultural Education*. https://doi.org/10.2478/jolace-2019-0025

Popenici, S. A., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, *12*(1), 1–13. https://doi.org/10.1186/s41039-017-0062-8

Pousson, J. M., & Myers, K. A. (2018). Ignatian Pedagogy as a frame for Universal Design in college: Meeting learning needs of Generation Z. *Education sciences*, *8*(4), 193.

Price, W. N., & Cohen, I. G. (2019). Privacy in the age of medical big data. *Nature Medicine*, *25*(1), 37–43. https://doi.org/10.1038/s41591-018-0272-7

Ravshanbek, Z. (2022). Use of artificial intelligence technologies in the educational process. *Web of Scientist: International Scientific Research Journal*, *3*(10), 764–770. https://doi.org/10.31435/rsglobal_wos/32022022/7802

Reilly, A. H. (2017). Using Ignatian pedagogy to support faculty-student mentoring. *Jesuit Higher Education*, *6*(2), 97–107. https://doi.org/10.15368/jhe.2017v6n2.7

Rubel, A., & Jones, K. M. (2016). Student privacy in learning analytics: An information ethics perspective. *The Information Society*, *32*(2), 143–159. https://doi.org/10.1080/01972243.2016.1130502

Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. *International Journal of Educational Technology in Higher Education*, *18*(1), 1–23. https://doi.org/10.1186/s41239-021-00292-9

Shemshack, A., & Spector, J. M. (2021). A comprehensive analysis of personalized learning components. *Journal of Computers in Education*, *8*(4), 485–503. https://doi.org/10.1007/s40692-021-00230-4

Spector, J. M., & Ma, S. (2019). Inquiry and critical thinking skills for the next generation: From artificial intelligence back to human intelligence. *Smart Learning Environments*, *6*(1), 1–11. https://doi.org/10.1186/s40561-019-0088-z

Tanveer, M., Hassan, S., & Bhaumik, A. (2020). Academic policy regarding sustainability and artificial intelligence (AI). *Sustainability*, *12*(22), 9435. https://doi.org/10.3390/su12229435

Tien, J. M. (2017). Internet of things, real-time decision-making, and artificial intelligence. *Annals of Data Science*, *4*(2), 149–178. https://doi.org/10.1007/s40745-017-0112-5

Tlili, A., Huang, R., Shehata, B., Liu, D., Zhao, J., Metwally, A. H. S., ... & Burgos, D. (2022). Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis. *Smart Learning Environments*, *9*(1), 1-31. https://doi.org/10.1186/s40561-021-00185-1

Troussas, C., Krouska, A., & Virvou, M. (2020). Using a multi-module model for learning analytics to predict learners' cognitive states and provide tailored learning pathways and assessments. In *Machine Learning Paradigms* (pp. 9–22). Springer.

Winkelmann, K., Keeney-Kennicutt, W., Fowler, D., Lazo Macik, M., Perez Guarda, P., & Joan Ahlborn, C. (2020). Learning gains and attitudes of students performing chemistry experiments in an immersive virtual world. *Interactive Learning Environments*, *28*(5), 620–634. https://doi.org/10.1080/10494820.2019.1683738

Yang, S., & Bai, H. (2020). The integration design of artificial intelligence and normal students' education. *Journal of Physics: Conference Series*, *1453*(1), 012090. https://doi.org/10.1088/1742-6596/1453/1/012090