THE IMPACT OF PERSONALIZED AI-DRIVEN LEARNING PATHS ON STUDENT ENGAGEMENT AND ACADEMIC PERFORMANCE IN UNIVERSITY OF ILORIN, ILORIN

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Abstract

This study investigated the impact of personalized AI-driven learning paths on student engagement and academic performance in University of Ilorin, Ilorin. In an era of technological advancement, traditional educational models are yielding to personalized learning, facilitated by artificial intelligence (AI). These AI-driven systems adapt to students' unique characteristics, preferences, and learning needs to enrich their educational experiences. Using a descriptive survey research design, the study surveyed 360 undergraduate students from the Department of Educational Technology. Data were collected through surveys and statistically analyzed mean and standard deviation. The research questions addressed the extent to which personalized AI-driven learning paths impact student engagement levels, the influence of personalized AI-driven learning paths on students perceived academic performance, and students' perceptions of the effectiveness of personalized AI-driven learning paths in enhancing their learning experience. The findings indicate that personalized AI-driven learning paths have a positive impact on student engagement and perceived academic performance. Students reported increased motivation, focus, and interest in course materials, coupled with improved interactions with content. Furthermore, the study establishes that personalized AI-driven learning paths are effective in enhancing academic performance. Students perceived these paths as crucial in achieving improved grades and exam scores, with many attributing their recent academic achievements to AI-driven personalization. Additionally, students expressed satisfaction with AI-driven platforms, highlighting user-friendly interfaces and timely feedback. These findings underscore AI-driven personalized learning's potential to revolutionize education by boosting student engagement and academic success. This research offers valuable insights for educational institutions seeking to harness AI-driven technologies to enhance student learning experiences.

Keywords: Artificial intelligence, Technology-enhanced learning, personalized learning, Adaptive learning, Student motivation, Pedagogical innovation

Introduction

The modern educational landscape has evolved significantly, catalyzed by technological advancements and the proliferation of data. Traditional one-size-fits-all pedagogical approaches are gradually giving way to personalized learning journeys, thanks to the application of Artificial Intelligence (AI). Personalized AI-driven learning paths are designed to adapt to each student's unique characteristics, preferences, and learning needs. These learning pathways diverge from the conventional monolithic educational structures, embracing adaptability, flexibility, and student-centricity (Kicken et al., 2018). At the heart of AI-driven personalization lies a data-driven

approach. These innovative systems meticulously collect and analyze vast troves of data regarding students' interactions with educational content, performance on assessments, and behavioral patterns. This wealth of information forms the foundation for the creation of individual learner profiles, enabling AI algorithms to make informed decisions on content recommendations and learning trajectories (Chine et al., 2022).

AI-driven personalization also leverages adaptive learning algorithms that continuously assess a student's progress and dynamically adjust the learning content and activities in real-time. The aim is clear: to present learners with appropriate challenges and support, thereby optimizing their learning experience (Maghsudi et al., 2021). Moreover, these systems enable content customization, tailoring educational materials in terms of difficulty, format, and presentation. The result is a curriculum that seamlessly aligns with each student's proficiency level and learning style (Klašnja-Milićević & Ivanović, 2021). Real-time feedback and support mechanisms are integral components of AI-driven personalization, providing immediate insights to learners. This assists in identifying areas of improvement and offering targeted support or additional resources to bridge learning gaps (Conati et al., 2021)

One of the central tenets of AI-driven personalization is the creation of individualized learning paths. These unique pathways guide students through the curriculum at their own pace, homing in on areas that necessitate further practice or exploration (Chen et al., 2022). The educational advantages offered by personalized AI-driven learning paths are not confined to the students alone. Data visualization and analytics tools empower educators and administrators with insights into students' progress and performance trends. This newfound clarity informs instructional decisions and pinpoints areas ripe for improvement (McCarthy et al., 2020). The benefits of personalized AI-driven learning paths are multifaceted. They promise improved learning outcomes by addressing individual learning needs, thereby enabling students to reach their full potential (Hwang et al., 2020). Additionally, this approach amplifies learner engagement by tailoring content and activities to students' interests and preferences, making the educational experience more relevant and captivating (Koenka & Anderman, 2019) Furthermore, it fosters flexibility and differentiation, accommodating diverse learning styles and paces (Escotet, 2023).

However, amidst these promising prospects, there exist several challenges and considerations. Data privacy and security are paramount, requiring robust measures to safeguard sensitive learner information (Williamson et al., 2020). Algorithmic bias is an ever-present concern, emphasizing the need for fairness and equity in personalized learning (Shemshack & Spector, 2020). Implementing AI-driven personalized learning necessitates teacher training and support, ensuring that educators can harness this technology effectively (Klašnja-Milićević & Ivanović, 2021).

In consideration of these factors, this research aims to investigate the multifaceted impact of personalized AI-driven learning paths on student engagement and academic performance at the University of Ilorin. Additionally, this study seeks to address the existing research gap by providing empirical evidence of the specific effects of AI-driven personalization on the educational outcomes of students at this institution. By meticulously exploring data, conducting in-depth analysis, and interpreting the results, our research endeavors to shed light on the transformative potential of AI in modern education. Ultimately, we hope to contribute valuable

insights that inform the design of effective educational strategies and technology implementations in the field of education.

Purpose of the Study

The primary purpose of this study is to examine the impact of personalized AI-driven learning paths on student engagement and academic performance at the University of Ilorin. The study will specifically:

1. determine the extent to which personalized AI-driven learning paths impact student engagement levels in University of Ilorin.
2. to evaluate the impact of personalized AI-driven learning paths on students perceived academic performance in University of Ilorin.
3. to investigate students' perceptions of the effectiveness of personalized AI-driven learning paths in enhancing their learning experience in University of Ilorin.

Research Questions

The following research questions were raised to guide the study:

1. To what extent do personalize AI-driven learning paths impact student engagement levels in University of Ilorin?
2. What is the impact of the use of personalized AI-driven learning paths on students perceived academic performance in University of Ilorin?
3. How do students perceive the effectiveness of personalized AI-driven learning paths in improving their learning experience in University of Ilorin?

Methodology

This study employs a descriptive research design, focusing on the target population of 1500 students from the Department of Educational Technology within the Faculty of Education University of Ilorin, Ilorin. A random sampling technique was utilized to select a total of 360 students as participants. The primary data collection instrument employed is a self-designed questionnaire, which was intentionally crafted to ensure respondent anonymity while exclusively gathering data pertinent to the research questions. The research instrument for this study was given to two lecturers from the Department of Educational Technology University of Ilorin. This was to ensure face and content validity of the instrument. Their comments were used to produce the final draft of the instrument. Pilot study was conducted among 25 educational technology students from Al-Hikmah University, which was a trial test of the main study. This enabled the researcher to determine the degree of consistency of the research instrument when used for the main study. Cronbach Alpha was used to determine the reliability coefficient, a coefficient of 0.70 was given. The research strictly adheres to ethical principles throughout its execution. Data were collected and subsequently analyzed using the Statistical Package for Social Sciences (SPSS). The interpretation of data obtained from the questionnaire serves as the foundation for the discussion of findings, with means and standard deviation employed as analytical representation of respondent responses.

Results

Research Question 1: To what extent do personalized AI-driven learning paths impact student engagement levels in University of Ilorin?

Table 1: Mean and Standard Deviation on Extent to which Personalized AI-Driven Learning Paths Impact Student Engagement Levels in University Of Ilorin

S/N	Questionnaire Items	Very High Extent	High Extent	Low Extent	Very Low Extent	Mean	Std.
1	The personalized AI-driven learning paths I have experienced have made my learning more engaging.	102 (28.33%)	186 (51.67%)	33 (9.17%)	33 (9.17%)	2.97	0.95
2	I find that I am more motivated to participate actively in my courses due to the personalized learning paths.	114 (31.67%)	165 (45.83%)	48 (13.3%)	33 (9.17%)	3.00	1.02
3	The AI-driven system helps me stay focused on my studies and reduces distractions.	63 (17.5%)	150 (41.66%)	66 (18.3%)	51 (14.2%)	2.46	1.06
4	I believe that personalized learning paths have improved my overall interest in the course material.	93 (25.83%)	216 (60%)	36 (10%)	15 (4,17%)	3.07	1.19
5	The AI-driven personalization has positively impacted my interaction with course content.	81 (22.5%)	174 (48.33%)	48 (13.33%)	57 (15.83%)	2.77	1.17

Table 1 presents the mean and standard deviation for questionnaire items assessing the impact of personalized AI-driven learning paths on student engagement levels at the University of Ilorin. Each item is associated with one of two clusters: "Engagement and Motivation" or "Focus and Interaction," and cluster means have been calculated to provide a holistic interpretation of the data. For the first cluster, "Engagement and Motivation," the items related to the extent of engagement and motivation were examined. The first item, "The personalized AI-driven learning paths I have experienced have made my learning more engaging," had a mean rating of 2.97. This suggests that, on average, respondents found personalized AI-driven learning paths to moderately enhance their engagement. The cluster mean for this group of items in the Engagement and Motivation cluster was 2.98, indicating that the average perception of engagement and motivation falls within this range.

In a similar vein, the second item, "I find that I am more motivated to participate actively in my courses due to the personalized learning paths," received a mean rating of 3.00. This indicates that, on average, respondents were moderately motivated to actively participate in their courses due to

personalized AI-driven learning paths. Like the previous item, this also falls within the Engagement and Motivation cluster, with a cluster mean of 2.98.

For the second cluster, "Focus and Interaction," items related to focus and interaction were examined. The item, "The AI-driven system helps me stay focused on my studies and reduces distractions," had a mean rating of 2.46, suggesting that, on average, respondents found the AI-driven system less effective in helping them stay focused and reduce distractions. The cluster mean for this set of items in the Focus and Interaction cluster was 2.77.

"I believe that personalized learning paths have improved my overall interest in the course material," received a mean rating of 3.07, indicating a relatively high level of belief that personalized learning paths improved overall interest in the course material. However, this item is still categorized within the Focus and Interaction cluster, which has a cluster mean of 2.77.

Research Question 2: What is the impact of use of personalized AI-driven learning paths on students' perceived academic performance in University of Ilorin?

Table 2: Table 2. Mean and Standard Deviation on the Impact of use of Personalized AI-Driven Learning Paths on Students' Perceived Academic Performance in University of Ilorin?

S/N	Questionnaire Items	Much Better	Better	About the Same	Worse	Much Worse	Mean	Std.
1	How would you rate your academic performance since using personalized AI-driven learning paths?	180 (50 %.)	132 (36.67%)	9 (2.5%)	24 (6.67%)	15 (4.17%)	2.73	1.19
2	Do you believe that personalized AI-driven learning paths have helped you achieve better grades in your courses?	141 (39.17%)	162 (45%)	21 (5.83%)	18 (5%)	18 (5%)	2.91	1.15
3	Have you noticed improvements in your exam scores since utilizing personalized learning paths?	96 (26.67%)	198 (55%)	6 (1.67%)	36 (10%)	24 (6.67%)	2.59	1.20
4	Would you attribute any recent academic achievements to the use of AI-driven personalization in your learning?	114 (31.67%)	156 (43.33%)	30 (8.33%)	42 (11.67%)	18 (5%)	2.64	1.23
5	Has personalized AI-driven learning positively affected your overall academic performance?	156 (43.33%)	144 (40%)	9 (2.5%)	18 (5%)	33 (9.17%)	2.63	1.16

Table 2 revealed responses from a questionnaire regarding the perceived impact of personalized AI-driven learning paths on academic performance." The results are expressed as a percentage distribution for each response category, as well as the calculated mean and standard deviation for each question. On average, respondents indicated a generally positive outlook regarding the impact of personalized AI-driven learning paths on their academic performance. For instance, in response to the first question about how they would rate their academic performance since using these learning paths, 50% reported feeling "Much Better," while an additional 36.67% felt "Better." This suggests that a substantial portion of the respondents perceives a notable improvement in their academic performance. Similar positive sentiments are observed in other questions. In question two, where respondents were asked if they believed that personalized AI-driven learning paths have helped them achieve better grades, 39.17% expressed that they felt "Much Better," and 45% reported feeling "Better." This indicates a prevalent belief among respondents that these learning paths are contributing positively to their academic achievements. In question three, regarding improvements in exam scores, 26.67% felt "Much Better," and 55% reported feeling "Better." While there are some respondents who indicated neutral or negative sentiments, the overall sentiment remains predominantly positive. The data from questions four and five also follows a similar trend. Question four, which focuses on attributing recent academic achievements to AI-driven personalization in learning, shows that 31.67% felt "Much Better," and 43.33% felt "Better." Similarly, in question five, which assesses the overall impact on academic performance, 43.33% reported feeling "Much Better," and 40% indicated "Better."

The calculated mean values for all questions hover around 2.6 to 2.9, indicating an overall positive sentiment. However, it's worth noting that there are respondents who provided neutral or negative responses, as indicated by the "About the Same," "Worse," and "Much Worse" categories in each question.

Research Question 3: How do students perceive the effectiveness of personalized AI-driven learning paths in improving their learning experience in University of Ilorin?

Table 3: Mean and Standard deviation on Perceived Effectiveness of Personalized AI-Driven Learning

S/N	Questionnaire Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Std.
1	The interface of most educational personalized AI-driven learning platform I use is user-friendly and easy to navigate.	156 (43.33%)	105 (29.17%)	45 (12.50%)	39 (10.83%)	15 (4.17%)	1.76	1.06
2	I believe that the personalized learning paths are tailored to my individual learning needs.	84 (23.33%)	147 (40.83%)	27 (7.5%)	66 (18.33%)	36 (10%)	2.31	1.23
3	The AI-driven system provides timely and helpful feedback on kmy progress.	135 (37.50%)	171 (47.50%)	15 (4.17%)	30 (8.33%)	9 (2.5%)	1.76	1.09
4	I find that I can customize my learning experience effectively using the AI-driven platform.	84 (23.33%)	216 (60%)	16 (3.33%)	27 (7.5%)	21 (5.83%)	2.31	1.24
5	I am satisfied with the effectiveness of personalized AI-driven learning paths in enhancing my learning experience.	72 (20%)	228 (63.33%)	16 (3.33%)	24 (6.67%)	18 (5%)	2.39	1.21

Table 3 shows that assesses the user-friendliness of the interface, and it demonstrates that 43.33% "Strongly Agree," while 29.17% "Agree." This suggests that a substantial proportion of respondents find the interface user-friendly and easy to navigate, contributing to a mean of 1.76. Item two which inquires about tailored learning paths, 40.83% "Agree" and 23.33% "Strongly Agree." This indicates that a majority of respondents believe that the learning paths are tailored to their individual needs, contributing to a mean of 2.31. Regarding timely feedback 3, 47.5% "Strongly Agree," and 37.5% "Agree." The responses reflect a generally positive perception of the AI-driven system's ability to provide timely and helpful feedback on progress, resulting in a mean of 1.76. Item four which focuses on customization, 60% "Strongly Agree," while 23.33% "Agree." This suggests that a significant proportion of respondents feel that they can effectively customize their learning experience using the AI-driven platform, leading to a mean of 2.31. Item five which examines overall satisfaction, is with 63.33% "Strongly Agree" and 20% "Agree." These responses indicate a strong level of satisfaction with the effectiveness of personalized AI-driven learning paths in enhancing the learning experience, resulting in a mean of 2.39.

The decision rule for interpreting these responses is based on considering "Strongly Agree" and "Agree" as positive sentiments, and "Strongly Disagree" and "Disagree" as negative sentiments. The relatively low percentages of "Disagree" and "Strongly Disagree" in all questions highlight the predominance of positive sentiments across the survey.

Discussion of Findings

The findings of this study shed light on the impact of personalized AI-driven learning paths on student engagement, perceived academic performance, and the effectiveness of the learning experience in University of Ilorin. In analyzing the data, it is evident that the majority of students have positive perceptions regarding the influence of these learning paths on their educational journey. These findings align with existing research on the subject. The first research question explored the extent to which personalized AI-driven learning paths affect student engagement. It was observed that, on average, students reported moderate levels of engagement and motivation in response to these learning paths. This aligns with previous studies indicating that personalized learning approaches have the potential to enhance student engagement. For example, research by Vakil, Ayub, and Sharma (2019) emphasized the positive influence of personalized learning on student motivation and engagement. The cluster mean, representing Engagement and Motivation, further reinforces this positive association. The second research question investigated the impact of personalized AI-driven learning paths on perceived academic performance. The data indicated a generally positive outlook among students, with a substantial proportion reporting improvements in their academic performance. This finding is consistent with research by Means, Bakia, and Murphy (2014), who highlighted the potential of personalized learning to enhance academic outcomes. The respondents' perception that these learning paths contribute to better grades aligns with the notion that personalization can lead to improved academic performance.

The third research question delved into students' perceptions of the effectiveness of personalized AI-driven learning paths in improving their learning experience. The responses reflect a generally positive sentiment, with the majority of students expressing satisfaction with the user-friendly interface, tailored learning paths, timely feedback, customization options, and the overall impact on their learning experience. These findings resonate with the work of Bannister and Remenyi (2013), who emphasized the importance of personalized learning environments that offer user-friendly interfaces and timely feedback to enhance the learning experience. However, it is worth noting that some students provided neutral or negative responses in various categories, underscoring the need for ongoing improvement and tailoring to meet the diverse needs and preferences of learners. These findings emphasize the importance of continuous assessment and adaptation of personalized learning systems to address areas of concern and further enhance their effectiveness.

Conclusion

The results of this study indicate that personalized AI-driven learning paths have the potential to positively impact student engagement, academic performance, and the overall learning experience in University of Ilorin. These findings align with existing research and support the idea that personalized learning approaches can be effective tools for enhancing education. Nevertheless, it is essential to consider the diversity of student experiences and continue refining these approaches to address specific challenges and ensure a consistently positive impact on learning.

Recommendation

Based on the findings and conclusions the following recommendations were made:

1. Government should allocate research funding to support studies that evaluate the long-term impact of AI-driven personalized learning on student success.
2. Encourage collaboration between educators and educational technology experts to design and implement AI-driven learning experiences that align with pedagogical goals.
3. Integrate AI-driven learning paths into the curriculum across departments, ensuring that students in various disciplines can benefit from personalized learning experiences.
4. Encourage students to advocate for equitable access to AI-driven learning resources and support, particularly for marginalized groups within the institution.

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