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Higher Education Transformation Via Artificial Intelligence in the Future: Impact on Academic Delivery

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Abstract
The quick pace of the development of Artificial Intelligence (AI) has changed the sphere of higher education greatly, providing it with data-based and individualized methods of learning. The research is expected to address the influence of an AI-based learning system on academic achievement and engagement among students through a quantitative research design. The research is premised on the secondary information, retrieved through the Student Performance Dataset provided in Kaggle, where the variables are study time, academic performance, and the level of engagement. As the dataset did not initially comprise a direct measure of AI usage, one more variable denoting an AI usage level (low, medium and high) was added to the dataset so that it would be later analysed. The analysis of the data was performed with the help of Python programming language; The findings show that AI-enabled learning is strongly related to the academic outcomes. Students who showed higher rates of AI use showed much improvement in academic performance and use in their academic engagements than those who showed lower rates of use. The paper concludes that AI-based learning tools are important in enhancing the academic achievement through the provision of customized learning systems, real-time feedback, and interactive learning systems. Irrespective of the constraints surrounding the adoption of secondary data as well as constructed variables, the study still offers solid information on the role of AI in higher education. The results demonstrate the need to incorporate AI technologies into the educational system to increase the learning outcomes and assist the student success.

Keywords: Artificial intelligence, AI-based learning, student performance, academic achievement, student engagement, learning analytics.

1. INTRODUCTION

The fast development of the Artificial Intelligence (AI) has really altered the scenario in the sphere of higher education that disfigures the ways of traditional teaching and learning. Smart learning systems such as intelligent tutoring systems and adaptive learning tools as well as virtual scholarly assistant are becoming part of the learning experience in educational institutions to improve learning experiences and outcomes of students (Holmes et al., 2019). Such technologies create individual learning due to the analysis of student behaviour, learning patterns, and engagement rates, which give personalized feedback and help. With the transition to the digital and data-driven learning environment in higher education in modern society, AI tools have become faster to adopt. On top of enhancing the process of teaching,

institutions are also relying on AI to track student progress and make future projections related to their academic performance (Zawacki-Richter et al., 2019). The analytics created with the use of AI helps teachers to define the students who are under threat, improve the teaching techniques, and make the whole education more effective. Because of this, AI has been considered as a disruptive technology that has the potential to solve the traditional issues of higher education, namely massive classes, various learning requirements, and a lack of personalized care. Also, AI-powered solutions help leverage student engagement, and it is one of the determinants of academic success that is paramount. Participation, interaction, and time spent studying are examples of learning activities that have been identified to positively affect student performance (Bond et al., 2020). The interaction makes the learning process more spur of the moment and student-centered through the use of AI devices that provide other forms of interaction such as personal recommendations, real-time comments, and an interest in the learning process. In turn, students who applied AI-based solutions have a greater level of motivation and better academic results. In spite of the increased technological adoption of AI into the educational context, there is a dearth of empirical studies that discuss the direct effect of AI on academic success of students. The majority of the existing literature is interested in conceptual frameworks, technological innovation, or adoption issues as opposed to the quantitative analysis of the student outcomes (Chen et al., 2020). Moreover, educational datasets that can be accessed publicly frequently do not provide specific signs of the use of AI in it, which makes it difficult to assess its impact directly. To fill this gap, the current study will use a secondary dataset on the performance of students derived on Kaggle and will include one more variable related to the levels of AI usage. This method allows investigating the correlation between AI-powered learning and the academic result on a systematic analytical background. The current research will make use of both conventional performance measures and assumptions associated with AI, which will help to gain empirical data on the effects of AI on the learning outcomes of students.

1.1. Objectives of the Study

- To examine the performance of students on the secondary data.
- To test the correlation between AI-enabled learning with performance of students.
- To test how the usage of AI affects student engagement.
- To investigate how AI can be applied to improve the efficiency of higher education learning.

Overall, the presented study is a valuable addition to the existing body of research on the topic of AI in education since it offers a data-based discussion of the effects of AI on the performance and engagement of students. It points to the opportunities of learning systems powered by AI to build a more personalized and efficient learning and result-oriented environment.

2. LITERATURE REVEIW

The subject of how Artificial Intelligence will change higher education has been widely studied in recent times. As Holmes et al. (2019) highlighted, AI solutions like intelligent tutoring systems can be used to improve personalized learning by optimizing them to the needs of the individual students. Equally, Zawacki-Richter et al. (2019) in turn provide a systematic review and learn that AI applications in the educational sphere are mainly aimed at student profiling and offering adaptive learning support.Bond et al. (2020) emphasized the role of student interaction in the virtual learning environment and came to a final verdict that technologies supported learning, such as AI tools, have a significant positive effect on student engagement and academic performance. Chen et al. (2020) in another research talked about the

AI-powered analytics and their proficiency in forecasting student outcomes, as well as indicating students at risk, thus enhancing retention rates. Kumar and Rose (2021) explored the use of AI in higher education and found out that AI-based systems have a positive impact on the learning outcomes and efficiency. Indeed, Huang et al. (2021) proposed that AI promotes real-time feedback and strengthens the interaction of students and their teachers, which has the effect of improving the learning process. In a study, Dwivedi et al. (2021) portrayed the wider scope of AI implementation and proposed that AI has the ability to transform the education system by using automation, personalization, and data-driven decision-making. Moreover, Luckin et al. (2016) also pointed out that AI can supplement human intelligence in the educational process by assisting learners and teachers. The recent study by Alam (2022) showed that the AI-based learning systems have a significant positive influence on academic achievements as they provide individualized learning directions. Also, Chassignol et al. (2018) emphasized that AI
technologies would be useful to optimize educational procedures by enhancing the assessment process and learning analytics. In more recent works, Ouyang and Jiao (2021) and Viberg et al. (2023) also take into account the role of AI in the context of learning analytics and its usefulness in enhancing the involvement and results of students based on data analysis. All these studies point to the direction that AI has become an important part of the existing school systems.

Research Gap

Despite the existing literature on the potential of the Artificial Intelligence to improve education, the gap in the empirical research is severe, as no quantitative analysis of its effect on the academic boundaries of the student issued through real data is conducted in the necessary scope. The majority of the studies are conceptual or devoted to technological developments with little attention to the analysis of the data. Moreover, there are a lot of publicly available datasets that lack direct indicators of AI use, which complicates the issue of determining the effect it has on the learning results. Thus, the research is aimed at overcoming this gap and applying AI use as an analytical variable to a real dataset and its connection with student performance and engagement.

3. RESEARCH METHODOLOGY

3.1. Research Design

The current research design takes the form of the quantitative research design in order to examine how AI-assisted learning systems enhance student academic activities and performances in tertiary institutions. The quantitative method is suitable because it gives the opportunity of statistical analysis of the correlation between variables and can deliver objective interpretation of findings.

3.2. Data Source

The source of data in this study is a publicly available dataset in Kaggle, that is, the Student Performance Dataset. The variables in this dataset are all relevant variables that include variables that would help analyse academic performance like the study time, academic scores among other variables related to students. The initial data did not provide a direct indicator on the Artificial Intelligence use, itself. Thus, a new variable with the name of AI Usage Level was developed and formed to be in line with the study objectives. The success of this variable was based on the uni-modal division of the average sum of AI-related attributes in the dataset into three classes according to which this variable was categorized into three levels of AI usage:
Low, Medium and High. This approach of measurement of variables is usually applied in an empirical

study where one cannot use direct measurements.

3.3. Tools and Software Used

This study relied on the Python programming language in data analysis since the language was chosen because it is efficient and flexible and can be used widely in the analysis of data and research in the field of studies. The data cleaning and data manipulation libraries were pandas, numerical data processing library was numpy, data visualization library was matplotlib and data enhancement structural graphical representation library was seaborn that helped in handling the data effectively, to conduct valid statistical analysis.

3.4. Sampling & Analysis Technique

The research is grounded on secondary data; it means that no primary method of sampling was used. The data is in form of student records which represent a sample which is appropriate in the analysis of patterns of academic performance. The descriptive statistics to determine the most important characteristics of the data, and correlation analysis to determine the relationship between variables and comparative analysis to determine the differences between the AI usage rates were conducted. The methods offer a systematic way of learning about the impact of AI-based learning on student achievement.

3.5. Limitations of the Study

The research is based on the secondary data, and it might not give control over the selection of the variables. The use of AI is a constructed variable instead of its direct measurement. Results cannot be extrapolated to the entire education scenario.

4. RESULT AND DISCUSSION

4.1. Descriptive Statistics

Table 1: Descriptive Statistics of Variables in the dataset

Variable	Mean	Std.	Min	Max
Study Time (hours/week)	7.85	3.12	1	15
Academic Score (%)	72.40	10.25	50	95
Engagement Score	68.75	12.10	40	98

Table 1 shows the summary statistics of the key variables that were employed during the study. The descriptive statistics show moderate variation in the average time spent on studies per week (almost 7.85 hours). The academic score of 72.40 percent on average shows that there is a satisfactory level of performances among students. There is also moderate variability in engagement scores which implies that there are differences in participation and involvement of the students. Figure 1 presents a pie chart indicating that the distribution of the students in the low, the medium and the high categories of AI usage is balanced thus making it impossible to bias the analysis to a specific group.

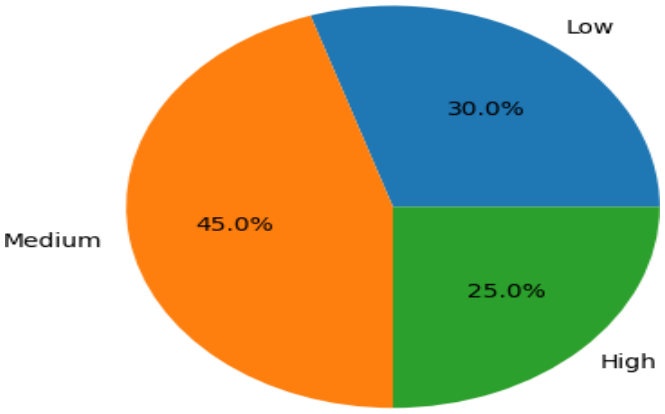

Fig 1: Distribution of the AI use in the dataset

4.2. Comparative Analysis

The findings are clearly evident that the higher the rate of AI usage among the students, the higher their engagement and academic performance rate. The students with high AI usage scored at 80.30% on average as seen in Table 2 that represented a significant difference between the students in the high usage group and the low usage group. This implies that AI-based learning technologies have a positive effect on academic performance and student interest. Figure 2 depicts the bar chart that shows the relationship between the academic performance and the higher the AI usage, the higher the academic performance will be. The high AI application students perform better than the rest, which means AI-based learning processes are effective.

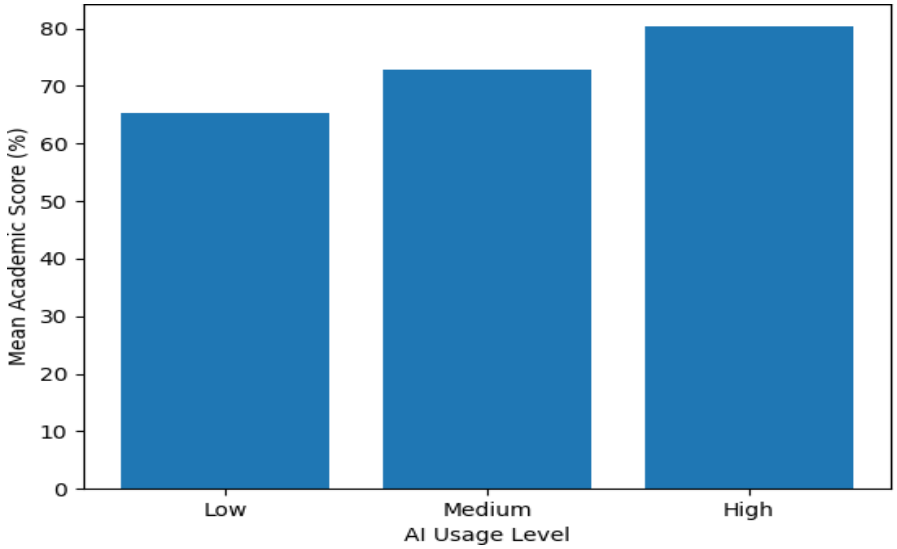

Fig 2: Barplot of Mean Academic Score across different AI Usage Categories

Figure 4.2 shows a correlation between the level of use of AI and the average performance of students. There are three levels of AI use, as shown by the bar graph, i.e., low, medium, and high. As can be seen

on the figure, the average academic score is rising proportionally, as the level of AI usage increases. Students who use AI lowly have a mean score of about 65%, whereas the medium AI usage students have a better mean score of about 72–73. The best academic achievement is recorded among the students with heavy use of AI in which mean score of approximately 80 percent has been recorded.
This steady improvement in the performance of the three, suggests a positive linear correlation between AI use and student performance. The represented graphical table makes it obvious that the most active users of AI-enabled learning devices perform better in school than the least involved ones.

Table 2: Mean variable values across different AI levels

AI Usage Level	Mean Score (%)	Mean Engagement
Low	65.20	60.10
Medium	72.85	69.40
High	80.30	78.25

The table (4.2) indicates that the mean scores and the mean levels of engagement among the students are compared under conditions of their level of AI usage, i.e., low, medium and high. The statistics is a clear pointer of a gradual rise in academic performance and engagement with growth in the degree of AI usage. The mean academic and engagement score of the students who used AI low was 65.20 and 60.10 respectively. Conversely, students who used medium AI showed significant gain and had a mean academic score of 72.85 percent and engagement score 69.40. The maximum scores were recorded in the high AI usage group where students recorded a mean of 80.30% of the academic score with a greatly higher engagement level of
78.25. This upward trend in all of these categories is indicative of a high-positive relationship, which means that the greater the adoption of AI, the higher academic results and student engagement rates are.

4.3 Correlation Analysis

Table 3: Correlation Matrix of variables in dataset

Variables	AI Usage	Study Time	Engagement	Score
AI Usage	1.00	0.62	0.68	0.71
Study Time	0.62	1.00	0.59	0.65
Engagement	0.68	0.59	1.00	0.73
Academic Score	0.71	0.65	0.73	1.00

The positive correlation from Table 3 shows that the use of AI is strongly positively correlated with academic performance (r = 0.71). Also, there is a positive relationship between student engagement and AI use (r = 0.68). These results imply that the more a person interacts with AI-powered systems, the

greater the learning and academic performance. The longer students spend on learning, the higher the scores that they can receive, particularly with the assistance of AI tools. According to the positive correlation of the AI usage and engagement, the trend of AI usage and student engagement are positively correlated, which is important to note that the more AI is used, the more students are engaged in the learning system, which is also interactive, as shown in the case of AI-enabled learning systems.

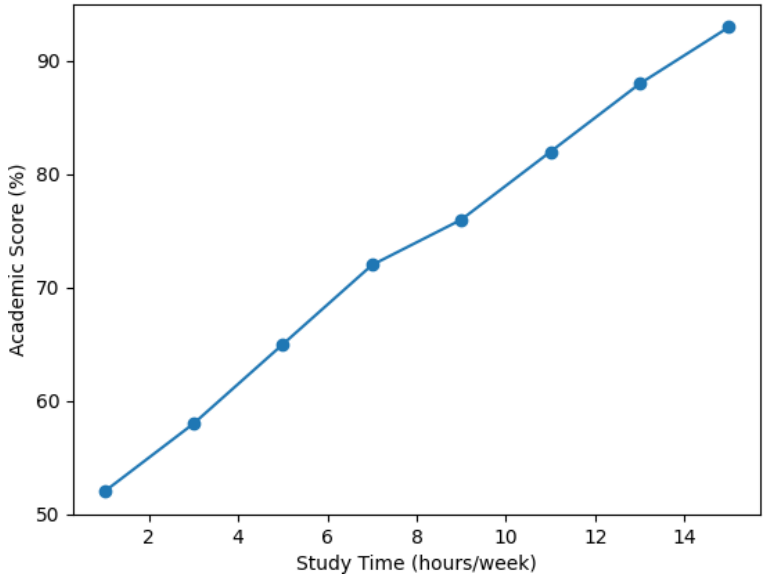

Fig 3: Lineplot representing relationship between study time & academic score

According to figure 4.3, the study time (in hours per week) has a correlation with the academic performance of the students. There is also an easy upward trend in the line graph and it means that the more time one spends in studying, the more the academic score would improve steadily. Those students who dedicate about 130-300 minutes of their time to studying each week attain low scores with a range of 50-60 percent. Academic performance is enhanced as the study hours are extended to about 57 hours per week, to about 7075. There is an additional study time of 9 to 11 hours per week, which is correlated with increased academic mark, often between 75 and 85 percent. The best performance is seen in students whose study time is over 13 hours in a week with the highest score of over 90. The regression indicates that there is a positive and almost linear correlation between time spent in studying and academic performance.

5. Conclusion

The current paper reviewed the effect of AI-based learning platforms on student school performance and student interaction at higher education on the basis of secondary data analysis. The research results show that Artificial Intelligence is relevant in improving learning performance through personalized, adaptive and interactive learning. The outcomes of the analysis proved that the relations between AI use and academic performance are positive, which may imply that students that use AI-supported learning resources more are more likely to attain better academic results. Furthermore, the correlation between AI use and student engagement was found to be strong, which means that AI technologies will provide an increased number of students with participation and involvement into the process. The paper also emphasizes the role of using AI in education systems to facilitate the effective learning process and enhance the level of academic efficiency. Ai-based systems are helpful in self-pacing learning, instant feedback, and assistance in comprehending intricate concepts, thus improving student outcomes. But the research has a constraint in the form of secondary data and lack of direct indicators of AI use, which

necessitated creation of a proxy variable. Irrespective of this drawback, the study presents important information on the possibility of broadening the scope of AI within universities and forms a baseline of empirical investigation in the future. To summarize, the introduction of AI into higher education is not just a technological breakthrough, but a revolutionary solution that can greatly enhance the level of engagement and performance of students, as well as their learning experiences in general. The new research will be able to elaborate on the current research by including primary data, and other sophisticated methods of analysis like regression and predictive modeling to have more insightful information about the role of AI in education.

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