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Exploring the Role of Artificial Intelligence on Educational Dynamics: Evaluating its Impact on Pedagogical Practices and Student Learning Outcomes

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ABSTRACT: Artificial intelligence has emerged is an emerging technology in the current era with far reaching implications on every economic sector. AI is transforming how human interacts with machine and automate day to day actions which were traditionally performed by humans. The current study primary aim was to investigate the scope of AI application in academic settings from instructional and pedagogical perspective. The sim of the study was investigating factors influencing pedagogical beliefs of teachers to implement AI in mainstream education system of Oman. The review of literature suggests role of AI in terms of profiling & prediction, tutoring, accessing student performance, grading & evaluation and personalization of learning experience which influences learning outcomes amongst students using mediating role of pedagogical beliefs of teachers. Using these variables from the literature, five hypotheses were analyzed using quantitative research methods. Primary data was gathered from the sample of n=250 using an instrument which measured variables on a Likert Scale from one to five. Five hypotheses were tested using SPSS where Hayes process Macros was used to test the direct and indirect effect. Findings shows that a Profiling and prediction, Assessing Student Performance and grading and evaluation capabilities aided by AI has indirect effect on learning outcomes amongst students whereas tutoring and personalization capability aided by AI has direct effect on learning outcomes amongst students. Findings poses significant managerial and practical implications for policy makers in Oman to implement AI in the mainstream education system of Oman.

Keywords: Artificial Intelligence, Pedagogical Practices, Student Learning Outcomes, Intelligent Tutoring System

I. INTRODUCTION

Artificial Intelligence (AI) is a flourishing technological realm that can alter each aspect of social interactions. AI has outperformed humans in every domain whether its police investigation, treating patients with cancers, developing autonomous vehicles and reducing the risk of air collusions. In context of education, AI has transformed the teaching and learning dynamics [1]. In many developing nations, AI has automated activities like grading, tutoring, student feedback and student support. According to Malik et al [2] AI is increasingly becoming a part of our daily lives and work; many countries are initiating a roll out plan for AI integration into mainstream education system. Karsenti [3] states that AI has the capability to significantly contribute towards student learning outcomes, pedagogical practice, curriculum and campus environment to transform educational landscape.

AI can be described as the association of intelligence with machines, which can represent human intelligence and make decisions by mimicking human capabilities of learning, problem-solving, and reasoning along with inter- and intra-personal intelligence, mathematical and linguistic capabilities. AI has revolutionized how people learn and teach, from student engagement to adapting new teaching styles, allowing students to grasp curriculum more accurately [4].

Hinojo-Lucena et al. [5] claim that schools are increasingly transforming with artificial intelligence (AI) technology integration from primary to higher education level. These AI-based systems can assist teachers by analyzing individual learning patterns and tailoring education content as per preferences to maximize student learning outcomes. Kasepalu et al. [6] state that AI can enhance inclusivity, efficiency and effectiveness of pedagogical practices by providing teachers with insights, support, and tools to meet the diverse needs of their

students. Traditional classroom-based learning environment creates many cognitive challenges for teachers, whereas teachers are continuously implementing pedagogical actions to overcome the challenges associated with curriculum delivery and design. AI based systems complemented by the teacher's strength can provide more effective in helping students and fostering integrated learning environment.

Kraishan [7] states that the Ministry of Higher Education in the Sultanate of Oman is well aware of these recent developments in AI and wants to transform its education system by making substantial interventions in students' learning process through implementing of artificial intelligence (AI) based systems in classrooms. Integrating artificial intelligence (AI) applications and intelligent education systems has become a modern necessity that requires combined effort to make it a critical element in Education. Most of the teaching methods and strategies depend upon discussion, dialogue, and recitation, which has become useless and does not enhance the learner's passion towards learning [4]. Artificial Intelligence (AI) is currently used in applications and programs based on AI metrics about its use in the educational field in the Sultanate of Oman. Shortly, significant expansion will be observed in the education sector as AI systems will serve as an essential tool for school administration to mitigate the challenges associated with teachers' pedagogical practices and promote student learning outcomes amongst students.

The study provides insight on how artificial intelligence (AI) can be integrated into the education system to enhance pedagogical practices and improve student learning outcomes, particularly in the Sultanate of Oman. While AI has demonstrated its potential to revolutionize teaching and learning dynamics globally, the specific challenge lies in adapting these advancements to traditional educational systems, such as those in Oman, where current teaching methods may not be effective in fostering student engagement and learning. The research aims to explore how AI can mitigate these challenges and contribute to the transformation of the educational landscape. The findings possess significant implication for Oman to integrate AI into education to improve student engagement, personalized learning, and teaching efficiency. These advancements could modernize traditional teaching methods, making them more relevant and effective. In Oman, AI adoption could bridge gaps in current pedagogical practices and drive substantial improvements in student outcomes. Overall, AI could revolutionize the educational landscape by making learning more adaptable and efficient.

1. ROLE OF AI IN INFLUENCING LEARNING OUTCOMES (LO'S)

Harris & Clayton [8] defines student learning outcome as a "statement of what a learner knows, understands and is able to do after completion of learning". AI enables machine to stimulate human cognitive process and provide real time assistance in problem solving and learning within cognitive, affective, and psychomotor domain. Gronlund and Brookhart [9] state that learning outcome is where the "learner should know, be able to do, and value as a result of integrating skills, learned attitude and integrating knowledge throughout the course". Learning outcomes comprised of assessments, learning activities, and learning outcomes are interdependent. In a nutshell, the learning outcome is what the learner expects after the learning process, assessment is how to determine the level of learner's achievement, and learning activities are how the learner will learn. The outcome-based model originated in the 1980s in the U.S.A. The model has been adopted in higher education institutions since increased accountability to the learners and learning bodies by the institutions and instructors [10]. Boubker [11] investigated the role of AI tool Chat GPT large language model on student learning outcomes. Findings shows that that output quality, perceived usefulness, Chat GPT use and student satisfaction with Chat GPT significantly influence learning outcomes amongst students. Mei Chou et al. [12] investigated the role of AI technology application on student learning effectiveness. Findings shows that ICT self-efficacy directly influence effectiveness of AI technology application amongst students whereas human computer interaction has indirect effect on effectiveness of AI technology application amongst students. Alkhawaldeh and Khasawneh [13] conducted study on application of AI-empowered Game-based Learning (GBL) as a gamification strategy to enhance the proficiency of translation abilities. Findings showed that GBL positively contributed towards learning outcome by promoting engagement and motivation among translation learners, ensuring enhancement in translation competencies, language proficiency, and cultural comprehension. Kraishan [7] conducted study to investigate the role of AI in influencing LO's amongst eight grade students in Oman. Findings shows influential role of AI in the performance level of science learning with moderate improvement witnessed in the teacher's performance and significant improvement in education strategies. In a nutshell, AI is a valuable learning technology in higher education that can help learners achieve positive learning outcomes and enable teachers to formulate better teaching practices.

2. ROLE OF AI IN INFLUENCING PEDAGOGICAL PRACTICES

Weng et al [14] findings show that integrating of artificial intelligence (AI) and computational thinking results in integration of disciplinary knowledge. However, teachers' pedagogical beliefs play an essential role in influencing the role of integrating AI or any technological innovation in education (Cabero-Almenara et al. [15]). Pedagogical belief refers to the ideas hold by teachers regarding teachings and personal convictions about overall education process. This belief significantly influences how teachers approach instructions, design learning curriculum, interact with students and access student progress. Cabero-Almenara et al. [15] findings shows that teachers with constructivist beliefs are more likely to adapt AI as part of their pedagogical teaching practices rather than teachers with transmissive orientations. Hence, findings conclude that Pedagogical Practices mediates the relationship between AI application and achieving LO using technology.

Richter et al. [16] findings show four areas of application of AI in education which includes assessment and evaluation, adaptive and personalization, intelligent tutoring systems, and profiling and prediction.

2.1 Profiling and Prediction role of AI in Education

AI technologies can help in profiling and prediction in higher Education, including dropout and retention, academic achievement, admission decisions, and course scheduling. The most commonly used AI algorithms, profiling, and prediction were mixed regarding knowledge elicitation methods, ad adaptive systems, and personalization [17].The AI applications are learner models or profiles that allow prediction, e.g., the likelihood of a student being admitted to a program or dropping out of a course. Modelling, prediction, and classification are critical components of educational data mining. In Education, the profiling and prediction were classified into three main subcategories: drop-out and retention, student models and academic achievement, admission decision, and course scheduling [18]. Cesar and Mamaril, [19] conducted study to investigate the impact of AI based predictive algorithm i.e. instance-based, statistical and Bayesian networks to predict selection of ideal collegiate course for a student. Findings shows that all these three AI based algorithm successfully predicted ideal collegiate course using historical data on high school grades and admission records. Ramirez-Montoyaa et al. [20] conducted study to investigate the role of AI in predicting student GPA which shows that AI based machine learning modeling successfully predicting GPA using knowledge acquisition, class participation, and summative performance. Hence, these previous literatures provide rationale for the development of hypothesis to explore the role of AI in profiling and prediction in educational context.

Hypothesis 1: Profiling and prediction capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.

2.2 Tutoring role of AI in Education

AI tutoring is a computer-based program that is not only responsible for acting as a human tutor but also personalizes the instructions based on the progress and background of each learner. Its evolution began with computer-assisted instruction, ranging through various e-learning systems. It progressed from earner adaptive systems to ITS, highlighting a smooth cognitive interaction of machine and man [21]. The Intelligent Tutoring System (ITS) can be an effective tool for enhancing student earning. Al-Shanfari et al. [22] investigated the impact of ITS on the Omani higher education system. Subsequently, it has examined the perception of Omani university instructors about readiness, challenges, and awareness concerning their integration of ITS. The findings show that students have positive outlook towards ITS effectiveness in enhancing LO's amongst students. Mohammad &Lamia [23] implemented a flipped classroom using an intelligent tutoring system in the learning process. The findings indicate that an intelligent tutoring system was helpful to students in dealing with problems in the course out

Hypothesis 2: Intelligent tutoring capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.

2.3 Assessing Student Performance role of AI in Education

Assessment can be defined as all activities that students and teachers undertake to receive information to alter teaching and learning. Assessment is inevitable for teaching and learning activities in school and mediates the interaction between students and teachers [24]. Star & McDonald [25] highlighted the successful pedagogy for students through academic culture. The critical elements of pedagogy were proactive and added extensive scaffolding, formative and developmental assessment, and constructive alignment for student learning. The increase in student passing rates, and a decrease in academic misconduct, improved students' retention and outcome. Pal [26] findings shows that AI revolutionized assessment practices. Hooda et al., [27] findings shows

that AI based models which includes I-FCN, ANN, XG Boost, SVM, Random Forest, and Decision Trees are most commonly used performance metrics to evaluate student performance. Richardson and Clesham, [28] findings show that AI tools were effective to assesses oral, aural, reading and written skills amongst A-level students in high stake exams. The evidence on assessment role of student performance provides rationale for the development of hypothesis.

Hypothesis 3: Assessing Student Performance aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.

2.4 Grading and Evaluation role of AI in Education

Grading is a method of evaluation for student performance. It is performed through marks, letter grades, percentages, and more. Grades are given on activities related to tests, projects, assignments, and other activities. Grading is to allot the grades; evaluation is about assessing those grades [29] . Grading activity is a systematic approach using assessment model which can be automated using AI. Gnanaprakasam and Lourdusamy, [30] findings shows that AI plays an essential role in reducing grading backlog amongst teachers by giving instant feedback, learning incentives, scalability, and important notes however there are challenges associated with potential biases, fairness, and ethics in using AI tools for grading. Ahmad et al., [31] findings shows that AI enhances effectiveness of instructor by assisting them in grading and assessment activities. Sekeroglu et al. [32] conducted study on four AI based algorithm in classification of student performance. Findings shows that ML based algorithm have significant impact on grading and evaluation of student. These literatures serve as a rationale for the development of below hypothesis.

Hypothesis 4: Grading and evaluation capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.

2.5 Personalization role of AI in Education

Instructional approaches are customized to individual learners in personalized learning. Personalized learning is what you do, not how to do it. It is feasible to bring personalized learning to scale utilizing the affordances of adaptive learning technologies. Computer technology has significantly affected higher education pedagogy due to the changing educational landscape[33] . Peng et al. [34] introduced a new learning method: personalized adaptive learning. Two main pillars have been analyzed: adaptive learning and personalized learning. Its core elements were personal development, individual performance, individual characteristics, and adaptive adjustment. The core concept is technology-empowered pedagogy, which can adjust teaching strategies adaptively to learners' differences and changes, real-time monitoring, personal development, and individual performance. Arsovic and Stefanovic's [35] investigated the adaptive e-learning model that enables intelligent decision-making and personalized learning experiences. It consists of an adaptation module, an expert system for data analysis and decision-making, a student model, a database of educational methods, and a repository of learning objects. The design model provides adaptivity through a learning management system and considers students' characteristics, assessing a structure based on student's needs and performance. Singh and Alshammari [36] findings show that digital technology-enabled personalized and adaptive learning can improve evaluation methods, increase professionalism, bridge the gender divide, and streamline curriculum. The literature provides rationale for the development of below hypothesis.

Hypothesis 5: Personalization capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.

The objective of this study is to investigate factors influencing pedagogical beliefs of teachers to implement AI in mainstream education system of Oman. The study aims to achieve following research objectives

- To investigate the moderating effect of pedagogical beliefs on the relationship between AI applications in education and student learning outcomes.
- To explore the impact of AI's profiling and prediction capabilities on the pedagogical beliefs of teachers regarding AI implementation in Oman's education system.
- To assess how AI's intelligent tutoring capabilities, affect the pedagogical beliefs of teachers towards AI integration in Oman's education system.
- To examine the influence of AI's student performance assessment capabilities on teachers' pedagogical beliefs about AI implementation in Oman's education system.

- To determine the influence of AI's grading and evaluation capabilities on teachers' pedagogical beliefs about AI implementation in Oman's education system.
- To investigate how AI's personalization capabilities, impact the pedagogical beliefs of teachers regarding AI integration in Oman's education system.

Therefore, the purpose of this study was to develop a blueprint for teachers to understand the evolving role of AI in teaching domain and expand practical knowledge and skills in planning deployment of AI based system into Oman mainstream education system by changing pedagogical beliefs of teachers and administrators. In terms of the purpose of the study, the following research questions are considered:

- How do pedagogical beliefs influence the effectiveness of AI applications in achieving high learning outcomes among students?
- To what extent do AI's profiling and prediction capabilities influence the pedagogical beliefs of teachers in Oman regarding the integration of AI into mainstream education?
- How does AI's intelligent tutoring capability impact teachers' pedagogical beliefs concern the adoption of AI in mainstream education in Oman?
- What is the effect of AI-driven student performance assessment on teachers' pedagogical beliefs regarding the use of AI in Oman's mainstream education?
- How do AI's grading and evaluation capabilities affect the pedagogical beliefs of teachers regarding the implementation of AI in Oman's mainstream education system?

II. MATERIALS AND METHODS

1. RESEARCH DESIGN

The study employs mono method by using quantitative research to explore this phenomenon through a data collection, execution of statistical analysis, using computational or mathematical techniques [37] . Using descriptive research design a cross-sectional approach where primary data has been gathered from teachers in Oman [38]. The study uses positivism as a research philosophy which emphasizes on the explanation, prediction and control of a phenomenon being observed by applying the methods of scientific testing. This study uses deductive approach as the goal is to test the proposed research hypothesis from general principles to specific observations.

Based on the research problems and study purpose, the authors have followed a systematic research framework (Figure 1)

2. DATA COLLECTION

Using purposive sampling strategy primary data was gathered from the college teachers of three departments consisting of math, English and science in Masqat, Oman. English, mathematics and science. The survey consists of three parts: demographic information, questions about AI in Education, and pedagogical practices with students' learning outcomes. The respondents consist of 250 teachers of K-10 (first two years of high school) to K-12 (final two years of high school) and university classes from various colleges and higher education institutions in Muscat City, Oman. Questionnaires comprises of 14 different items were adapted from previous studies of (Ikhlas & Dela Rosa, [38]; Singh et al., [39]; Baidoo-Anu et al., [40] and Monteiro et al., [41] Following table shows the instrumentation of items used in the development of the questionnaire along with the Cronbach alpha score which suggests that all the items exhibit high internal consistency in measuring what it intends to measure. The questionnaire items were designed on a Likert scale of 1 to 5 where 1 is Strongly Disagree and 05 is Strongly Agree. The below table shows that all items exhibited strong reliability with the value of α>0.7 which is the lenient cut off value to measure the internal consistency in items to measure what it intends to measure on the scale of 1 to 5.

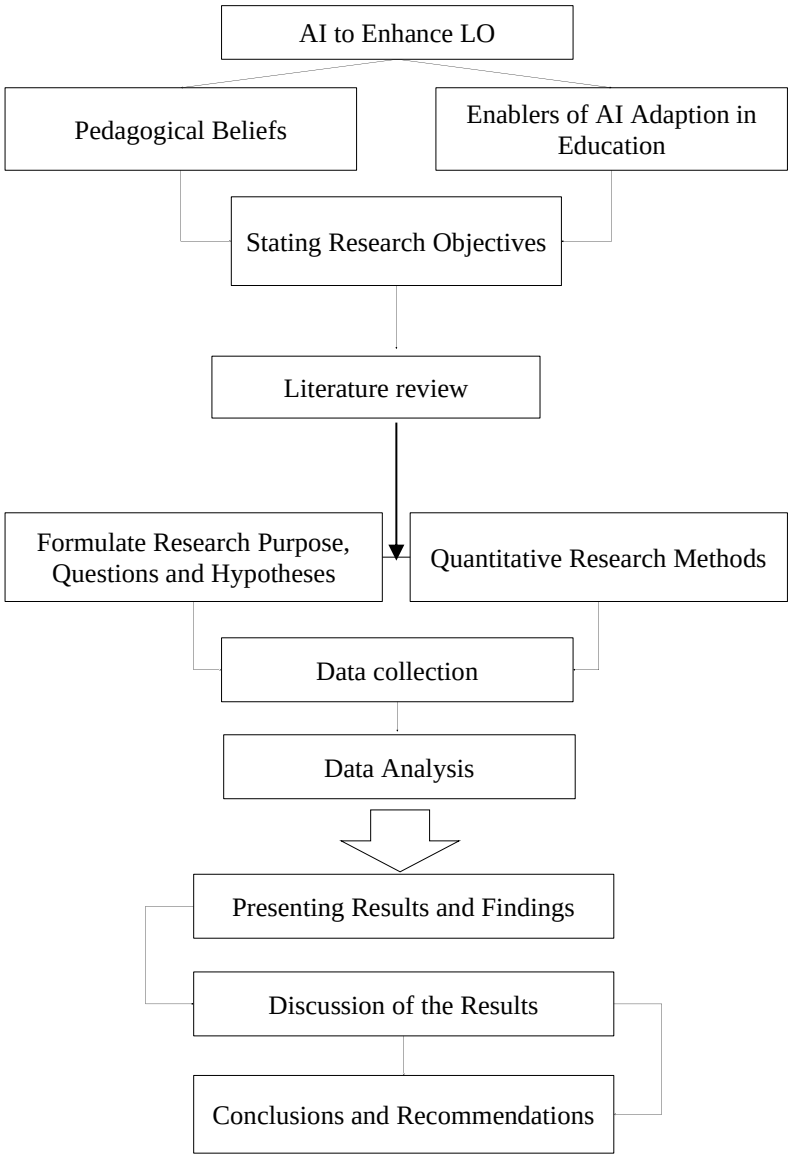

FIGURE 1. Research framework

Table 1. Instrumentation used for data collection

Code	Items for Measurement of Instrument	Alpha Score
PP1	AI-based profiling tools accurately predict student performance and help identify areas where additional support is needed.	0.77
PP2	It is important for educators to be involved in the development and oversight of AI systems used for student profiling and prediction.	0.79
TR1	AI-driven Intelligent Tutoring Systems can effectively support personalized instruction for students.	0.81
TR2	The use of AI-based Intelligent Tutoring Systems enhances the ability of teachers to address individual student learning needs.	0.83
SA1	AI-based assessment tools enhance the ability of teachers to evaluate student performance across diverse learning styles and abilities.	0.77
SA2	AI-based tools such as tools offered by Turn it in effectively monitor and evaluate student assignments, coursework, and projects.	0.71
GE1	AI-based tools assist in providing accurate and consistent grading of student assignments, coursework, and projects.	0.69

GE2	AI-driven evaluation systems reduce the time required for grading while maintaining high standards of fairness and objectivity.	0.74
PL1	AI-generated student profiles can help tailor personalized learning experiences for individual students.	0.81
PL2s	AI-driven adaptive learning systems help students progress at their own pace, enhancing their overall learning experience.	0.71
PGP1	AI integration in education has positively influenced my beliefs about the potential of technology to enhance teaching and learning.	0.85
PGP2	AI-driven tools have changed my views on the role of teachers, making me more open to incorporating technology into my teaching practices.	0.79
LO1	The use of AI tools in the classroom leads to improved learning outcomes for students.	0.84
LO2	AI-driven personalized learning experiences enhance students' understanding and retention of course material.	0.88
	OVERALL RELIABILITY OF INSTRUMENT	0.91

[1] Source: Compiled from Cronbach alpha tests results from SPSS

Following where the inclusion criteria was used for shortlisting samples for the data collection.

- All genders, male and female teachers.
- Currently working as an instructor, tutor, associate professor in public or private schools, colleges and universities.
- Must be serving in Oman based institute for at least one year.

3. DATA ANALYSIS

Data gathered from questionnaires were coded into SPSS and testing using descriptive and inferential statistics. Cronbach alpha test was used to test the reliability and internal consistency of items used in the instrument. Correlation was used to test the linear association between variables. Regression was used to test the significance level and Hayes process macros for mediation was used to test the direct and indirect effect of variables.

III. RESULTS

The questionnaires were coded into SPSS and analyzed for descriptive statistics to understand the demographic profile of respondents. The below table shows the demographic profile of respondents. Majority of the respondents i.e. 78% were Omani teachers. Majority of the respondents who participated in the survey were from the age group of 31 to 40 years old i.e. 45% of the respondents. Majority of respondents who participated in the survey were teaching high school K-12 standard. Majority of the respondents i.e. 42% had teaching experience of more than 11 years.

Table 2. Demographic Profile of Respondents

Demographic Profile of Respondents	Frequency	Percentage
Nationality		
Omani	215	78.75%
Non-Omani	46	16.85%
Age Group		
31 to 40 Years	125	45.79%
41 to 50 Years	108	39.56%
Others	34	14.65%
Teaching Background		
High School (K-10)	63	23.08%
High School (K-12)	128	46.89%
Post Graduate	61	22.34%
Undergraduate	11	4.03%

Working Experience in Oman		
1 to 3 years	5	1.83%
3 to 5 years	10	3.66%
5 to 7 years	16	5.86%
7 to 9 years	19	6.96%
9 to 11 years	94	34.43%
Less than 1 year	3	1.10%
more than 11 years	117	42.86%

[1] Source: Compiled from Descriptive Statistics from SPSS

Hayes process macros was used to analyze the moderating role of pedagogical beliefs of teachers with the factors driving application of AI in educational context. Findings shows that role of AI to conduct profiling and prediction has no statistically significant impact on pedagogical beliefs of teachers in Oman with the value of p=0.51>0.05 which is significant level of interval. However, direct and indirect effect was tested using Hayes process Macros which shows that profiling and prediction has indirect effect to achieve learning outcome with the P value 0.00<0.05. Moreover, the table below shows that there is no '0' between LLCI and ULCI, which indicate that profiling and prediction has indirect effect on learning outcome by influencing pedagogical beliefs of teachers.

Table 3. Direct and Indirect Effect (Profiling and Prediction Role of AI)

Outcome Variable	Model	Coeff	T	P	LLCI	ULCI
Learning Outcomes	Constant	1.7	6.0	.00	1.2	2.3
	PPR	.59	10.2	.00	.48	.71
	PP (D.E)	-.04	-0.9	.35	-.15	.05
	PP (I.E)	.02			-.06	.12
Model Summary: R-Sq.=.28, F=52.95, P= .00						

Findings shows that role of AI to conduct tutoring using intelligent tutoring AI based system has no statistically significant impact on pedagogical beliefs of teachers in Oman with the value of p=0.07>0.05 which is significant level of interval. However, direct and indirect effect was tested using Hayes process Macros which shows that conducting tutoring using intelligent tutoring has indirect effect to achieve learning outcome with the P value 0.00<0.05. Moreover, the table below shows that there is no '0' between LLCI and ULCI, which indicate that profiling and prediction has indirect effect on learning outcome by influencing pedagogical beliefs of teachers.

Table 4. Direct and Indirect Effect (Tutoring Role of AI)

Outcome Variable	Model	Coeff	T	P	LLCI	ULCI
Learning Outcomes	Constant	1.4	6.4	.00	1.03	1.93
	PPR	.46	6.3	.00	.32	.61
	SA (D.E)	.14	2.6	.00	.03	.24
	SA (I.E)	.21			.08	.36
Model Summary: R-Sq.=.55, F=57.2, P= .00						

Findings shows that role of AI to conduct student assessment has statistically significant impact on pedagogical beliefs of teachers in Oman with the value of p=0.00<0.05 which is significant level of interval with the beta value of β=0.45. However, direct and indirect effect was tested using Hayes process Macros which shows that conducting student assessment using AI has both direct and indirect effect to achieve learning outcome with the P value 0.00<0.05. Moreover, the table below shows that there is no '0' between LLCI and ULCI, which indicate that student assessment has indirect effect on learning outcome by influencing pedagogical beliefs of teachers.

Table 5. Direct and Indirect Effect (Student Assessment Role of AI)

Outcome Variable	Model	Coeff	T	P	LLCI	ULCI
Learning Outcomes	Constant	1.54	5.4	.00	.98	2.09
	TR	.59	10.1	.00	.47	.70
	TR (D.E)	.02	.40	.68	-.08	.12
	TR (I.E)	.06			-.03	.17
Model Summary: R-Sq.=.53, F=52.4, P= .00						

Findings shows that role of AI to conduct grading and evaluation of students has statistically significant impact on pedagogical beliefs of teachers in Oman with the value of p=0.00<0.5 which is significant level of interval with the beta value of β=0.35. However, direct and indirect effect was tested using Hayes process Macros which shows that conducting grading and evaluation using AI has both no direct but indirect effect to achieve learning outcome with the P value 0.00<0.05. Moreover, the table below shows that there is no '0' between LLCI and ULCI, which indicate that grading and evaluation has indirect effect on learning outcome by influencing pedagogical beliefs of teachers.

Table 6. Direct and Indirect Effect (Grading and Evaluation Role of AI)

Outcome Variable	Model	Coeff	T	P	LLCI	ULCI
Learning Outcomes	Constant	1.6	6.0	.00	1.13	2.22
	PPR	.60	9.8	.00	.48	.72
	GE (D.E)	-.03	-.4	.63	-.16	.10
	GE (I.E)	.21			.07	.36
Model Summary: R-Sq.=.28, F=52.5, P= .00						

Findings shows that role of AI to conduct to promote personalization in learning has statistically significant impact on pedagogical beliefs of teachers in Oman with the value of p=0.00<0.05 which is significant level of interval with the beta value of β=0.2. However, direct and indirect effect was tested using Hayes process Macros which shows that conducting personalization of learning using AI has direct effect to achieve learning outcome with the P value 0.06<0.05. Moreover, the table below shows that there is no '0' between LLCI and ULCI, which indicate that personalization has indirect effect on learning outcome by influencing pedagogical beliefs of teachers.

Table 7. Direct and Indirect Effect (Personalization Role of AI)

Outcome Variable	Model	Coeff	T	P	LLCI	ULCI
Learning Outcomes	Constant	4.2	2.9	.00	1.4	7.0
	PPR	.56	9.3	.00	.44	.68
	PL (D.E)	-.80	-1.8	.06	-1.6	.05
	PL (I.E)	-1.17			-1.80	-.63
Model Summary: R-Sq.=.54, F=54.7, P= .00						

IV. DISCUSSION

Table 8. Hypothesis Testing

Hypothesis	P-Value	Direct Effect	Interpretation
Profiling and prediction capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.	0.51>0.5	.35>0.05	Partially Accepted with Indirect Effect
Intelligent tutoring capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream	0.00<0.05	.00<0.05	Accepted

education system of Oman to promote learning outcomes amongst students.			
Assessing Student Performance aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.	0.00<0.05	.68>.05	Partially Accepted with Indirect Effect
Grading and evaluation capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.	0.00<0.05	.63>0.05	Partially Accepted with Indirect Effect
Personalization capability aided by AI significantly influence pedagogical beliefs of teachers to implement AI in mainstream education system of Oman to promote learning outcomes amongst students.	0.00<0.05	.06<0.05	Accepted

Findings validates previous study conducted by (Chu et al., [17]; Krishna et al. [19]; Cesar and Mamaril, [20]; Ramirez-Montoyaa et al. [21]) as our findings validates that AI plays a partial role in enhance learning outcomes as findings shows that H1 is partially accepted with indirect relationship between profiling and predictive role of AI in administrating academia. Alternate hypothesis for H2 is accepted as our findings suggests significant role of AI in tutoring. Findings validates previous studies conducted by (Ahuja & Sille, [22] ; Al-Shanfari et al. [23]; Lamia, [24]). Alternate hypothesis for H3 is partially accepted as our findings shows there is no direct but indirect effect of role of AI in evaluating student assessment validating previous studies conducted by (Tekyiwa & Sekyi, [25] ; Pal [27]; Hooda et al. [28] and Richardson and Chesham, [29]. Alternate hypothesis for H4 has been accepted as our findings shows indirect effect of AI on grading and evaluation of student performance which indirectly contributes towards enhancing learning outcomes amongst students validating previous studies conducted by (Kumar,[30] Gnanaprakasam and Lourd Samy, [31] and Ahmad et al. [32]) Alternate hypothesis for H5 has been accepted, our findings suggests Personalization capability aided by AI significantly has direct effect on pedagogical belief of teachers to implement AI in Oman to promote learning outcomes amongst students validating previous studies conducted by (Taylor et al. [34] ; Arsovic and Stefanovic's [36] and Singh and Alshammari [37]

V. CONCLUSION

The findings provide valuable insights into the role of artificial intelligence in education and its related stakeholders. AI technology can enhance the teachers' pedagogical practices, which in turn helps improve student learning outcomes. Profiling & prediction, intelligent tutoring systems, grading & evaluation, and adaptive systems do not directly impact student learning outcomes but have an indirect influence through AI in pedagogical practices. It clearly emphasizes the significance of artificial intelligence in pedagogical practices to improve student learning outcomes. Education institutions also need to build artificial intelligence in the student assessment mechanism, which directly helps enhance student learning outcomes. Applying AI in various disciplines is recommended to identify their effectiveness and make personalized learning recommendations across disciplines. Additionally, the researcher may consider professional training for learners through chatbots and identify the influence of various training strategies on their learning outcomes.

The current study collected data from college teachers, and some of them needed to become more familiar with AI, which limits our insights regarding the role of AI in teachers' pedagogical practices. The chosen sample size from Masqat does not represents the whole population. The current study has also yet to include chatbots and virtual assistants in the framework, which limits our findings.

The current study was conducted within the domain of college teachers to investigate the role of AI in assessing pedagogical practices and learning outcomes. The current research still needs to be investigated due to untapped areas and little research evidence. Future researchers can also conduct research using the same framework on university teachers, as AI is primarily used in higher education institutions. The research and development can also be introduced in the framework while conducting research in higher education institutions. In future research, individual AI tools can be used to assess its role in pedagogical practices other than intelligent tutoring systems and others.

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Author contribution

Sarah Abou Karroum: Conducted all parts of the research, including the literature, data collection, data analysis and manuscript writing. Dr. Nour-Eldin M. Elsheikh, Supervised the research, provided guidance on the methodology structure, and conducted a thorough review and verification of the entire work.

Conflict of Interest

I declare no potential conflicts of interest or affiliations that could have influenced the outcomes of this research study.

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