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Investigating the Impact of Training Program on Generative AI Applications in Improving University Teaching

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ABSTRACT: Recent innovations in artificial intelligence (AI) have had a profound impact on higher education, as they have on many other aspects of human existence. The current study aimed to investigate the impact of a training program on generative AI applications in enhancing lecturers' teaching capabilities in higher education in the Sultanate of Oman. The study adopted a mixed-methods approach, utilizing both quasi-experimental and qualitative methods. Data were collected through pre- and post-tests conducted on a sample of 31 lecturers from higher education institutions in the sultanate of Oman, and interviews were conducted with six participants in the training program. The results showed a significant positive impact of the program, with significant statistical differences in post-test measurements compared to pre-test measurements and high effect sizes. The interviews also revealed a consensus among participants on the significant impact of the training program on improving teaching capabilities using generative AI applications. The study suggested providing specialized training programs focusing on generative AI applications, implementing educational programs dedicated to generative AI, and strengthening international collaboration in this domain. Based on the findings, the study provided suggestions and recommendations to address the impact of the training program on the use of generative AI applications for developing teaching methods among Omani lectures and beyond.

Keywords: Generative AI, higher education, teaching skills, training.

I. INTRODUCTION

Amidst the dynamic realm of technology, the utilization of artificial intelligence (AI) in the field of education has garnered considerable interest in the recent era as an expanding array of educational organizations and institutions investigate the prospective advantages of AI-powered technologies [1, 2]. Among these technologies is generative artificial intelligence, which has surfaced as a potent instrument capable of revolutionizing diverse facets of human existence [3]. In education, for instance, generative AI has been gaining popularity due to its potential to enhance the learning experience [4]. Considering the current literature, several studies have shown that using AI in education can lead to significant improvements in learners' knowledge and teachers' experiences [5-7]. Meanwhile, research interest in using generative AI in education has surged. This interest has grown, particularly since ChatGPT launched in November 2022. ChatGPT's release brought generative AI to the public's attention and sparked greater interest in its potential impact on education. As a result of their ascent, educational technologists are increasingly interested in integrating AI technologies into teaching and learning [6, 8]. On the other hand, AI in higher education plays a vital role in assisting university lectures. It has the potential to help instructors oversee the entire class

rather than just individual students. Tutoring, grading, and virtual reality-based learning are significant applications of AI in the classroom that aim to enhance the learning and teaching experience through effective collaboration between AI and instructors [9, 10]. In addition, AI has the potential to enhance professors' teaching performance and create optimal learning environments for their students [11]. Through the analysis of comprehensive data sources and the generation of insights, AI can streamline the process of creating tailored learning paths. This can significantly reduce the time that professors would otherwise spend on manually studying and comparing data [12].

Based on these advantages of AI, the expected ideal situation would be involving generative AI into educational practices, significantly improving teaching and learning methods. However, in reality, we are still in the early stages of adopting these AI tools, and much of its potential are still not explored [13]. This is could be due to the lack of understanding how generative AI can be effectively improving teaching process, and less knowledge in its implementation [13, 14].

Besides, Upadhyay & Khandelwal [15] pointed out that the advantages of AI-based training help effectively to address the gaps in understanding and utilizing AI tools. The advantages encompass acquiring knowledge at one's own pace, which results in increased retention. AI expert systems have the capability to analyze the training, analyze the data on activities, identify any areas of weakness, and propose appropriate measures to address them. Featuring an extensive reservoir of curated and tagged content, AI systems have the capability to generate substantial variations of personalized and tailored content. Tailored content and examination queries. Automated translation of information into a variety of languages saves both time and money. An AI-powered system has the capability to evaluate a learner's alignment of learning with business by considering behavior, cognitive, and engagement preferences. Resulting in the fact that AI enables learning through iterative experimentation.

Continuing with this logical progression, the current study investigates the impact of training program on generative AI applications in developing teaching methods among university lecturers. Along with that, it also seeks to explore the lecturers' opinions on the impact of the training program on developing the lecturers' teaching methods. Furthermore, this study aims to gain recognition and acknowledgement for its significant contribution to the development of generative AI applications in Oman's teaching methods, given the lack of extensive research in this field and the goals outlined in Oman Vision 2040. These goals specifically recommend enhancing lectures' capabilities in AI applications and technology in general. The following questions were addressed in the study:

- What is the impact of training on generative AI applications in developing teaching methods among university lecturers?
- What are the lecturers' opinions on the impact of the training on developing teaching methods?

II. LITERATURE REVIEW

Generative AI has a promising future in education. AI-powered tools have the potential to revolutionize education and increase accessibility for all. Over the coming years, it is foreseeable that the educational tools propelled by AI will become more developed and efficient as AI technology advances. This development necessitates further investigation and exploration in relation to education across various educational domains.

In recent years, there has been a growing body of research on the applications of AI in education [16, 5, 13, 14, 17, 18]. Such studies have shown that AI can be effective in helping trainers, teachers, researchers, and learners in a variety of areas, including teaching, learning, writing, fluency, and so on. For instance, Ally [18] selected 34 educational technology professionals from six different nations and gathered data through interviews and written replies. The data was used to create a Competency Profile for the Digital Teacher (CPDT) 2030, which consists of nine general domains and 105 particular competencies. The required competencies were proficiency in virtual environments, digital literacy, the capacity to develop and modify digital learning materials, effective communication skills, personal adaptability, open-mindedness, and a willingness to learn and utilize assistive and multimedia technologies. Furthermore, Wang et al. [19] suggested that educators undergo professional development in order to improve their attitudes towards and intentions to employ AI technologies.

A further investigation was conducted by Kuleto et al. [20] to assess the extent of AI knowledge among teachers in Serbia, their proactive utilization of AI as an instructional aid, and their opinions regarding AI in relation to their expectations. The data analyses demonstrated a direct and positive relationship between teachers' exposure to AI in education (AIED) and their attitudes towards it. This, in turn, influenced their plans to include AI in their teaching practices.

These connections indicate that providing additional professional development opportunities for instructors, which enable them to actively use AI, may result in an increased inclination to incorporate AI into their regular teaching methods. According to Yang and Chen [21] the opinions and learning experiences of pre-service teachers during their training have an impact on their future classroom practices. This research included 26 prospective information technology educators in Taiwan and gathered data through questionnaires, interviews, and Chabot usage logs. During the trial, the participants had the option to learn using either the Learning Management System (LMS) or the Chabot. The examination of behavioral and interview data revealed that pre-service teachers used the Chatbots to organize their knowledge, search for information, and participate in conversations unrelated to the course topics. Yang and Chen [21] determined that pre-service teachers' interactions with Chatbots can impact their decision on which activities to incorporate or exclude from a learning management system (LMS).

In addition, Koka et al. [22] found that ProWritingAid and Grammarly are highly effective AI tools for foreign language lecturers, with over 80% agreeing, emphasizing the importance of lecturers' perceptions in evaluating writing content. In a South Korean setting, Yang's (2022) study on pre-service English teachers' perceptions of AI Chatbots suggests they can enhance teaching aids and improve EFL learners' confidence and motivation in speaking English.

In an Indonesian scenario, Sumakul et al.'s [23] study examines teachers' perceptions of AI's use in English as a Foreign Language (EFL) classrooms. Interviews with four Indonesian EFL teachers revealed positive perceptions of AI's potential to help teach and learn. Another study by Belda-Medina and Calvo-Ferrer [24] explored future teachers' knowledge, satisfaction, and perceptions of conversational AI integration in language learning, revealing positive results and gender-related differences in satisfaction. In the Hong Kong situation, Kohnke et al.'s [25] study examined English language instructors' attitudes towards AI tools, intentions, and institutional support, emphasizing the need for familiarity, confidence, challenges, and tailored support.

To put it generally, several studies have accentuated the significance of incorporating AI into the educational process like teaching and learning, particularly in language teaching and learning [26-30]. These studies have concluded that AI plays a crucial role in education, particularly in the field of English teaching and learning. Chen & Sun [26] stated that the field of English teaching and learning encompasses a wide range of activities that are intricate and influenced by multiple circumstances. These aspects include the proficiency levels of English teachers, the availability of educational resources and teaching tools, and even the varying interests and cognitive styles of students. Artificial intelligence has the ability to imitate and replicate human cognition, logic, and the articulation of ideas through focused computation and examination. Within the ever-changing realm of English education, artificial intelligence possesses the ability to uniquely enhance ways of teaching and studying the English language. Hence, the objectives of this study are formulated to:

- Investigate the impact of training on generative AI applications in developing teaching methods among university lecturers.
- Find out lecturers' opinions on the impact of the training on developing teaching methods.

III. METHOD

The study employed a mixed-methods approach, combining quasi-experimental and qualitative methods. The quasi-experimental approach aimed to test the effect of an independent variable on a dependent variable while controlling for other factors that might affect the dependent variables. The change in the dependent variable is attributed to the independent variable [31]. In the current study, the independent variable was training program, and the dependent variable was the impact of the AI based training program on university teaching. A pre-test was administered to the study sample, followed by a three-day training program totaling 15 training hours. After the training program, a post-test was administered to measure the impact of training

program on generative AI applications in developing teaching skills among lecturers. Additionally, the study used a qualitative approach by conducting individual interviews with a sample of participants to gain a deeper understanding of the training's impact and to gather their opinions and suggestions on its effectiveness.

1. STUDY SAMPLE

The current study sample consisted of 31 lecturers from universities and colleges in the Dhofar Governorate in the Sultanate of Oman, selected randomly. For the interviews, a sample of six participants from two universities in Dhofar—namely, the University of Technology and Applied Sciences-Salalah and Dhofar University—were chosen.

2. ETHICAL APPROVAL AND INFORMED CONSENT

Official authorization was obtained from the National Center for Statistics and Information, and formal approvals were obtained from the universities and colleges participating in the current study to allow for its implementation.

3. STUDY INSTRUMENTS

3.1 Test

The researchers developed a test to measure the impact of the training program before and after application. The researchers developed the test through a systematic process. Initially, the researchers reviewed the theoretical literature on generative AI to identify key concepts. Then, the researchers determined the main axes of the test and formulated relevant items to cover all aspects of the research. Nine experts in AI reviewed the test to evaluate its clarity and relevance to the intended objectives and content. Based on their feedback, the test was refined and finalized to include three main axes.

3.2 Interviews

Semi-structured individual interviews were conducted with the current study sample to collect data from training program participants and understand their perspectives on the study topic. According to Gray [32] interviews allow researchers to discover individuals' views on a specific issue, gather data on their attitudes, and evaluate their experiences and preferences that cannot be collected by other methods. The interview questions were prepared with four questions, and the interviews lasted between 20-30 minutes.

4. RELIABILITY AND VALIDITY

4.1 Test

The reliability of the test was verified by administering it to a sample of 41 university professors outside the original study sample. The internal consistency coefficient, Cronbach's alpha, was calculated for each domain of the scale. The reliability coefficients were 0.90 for the first domain, 0.93 for the second domain, and 0.98 for the third domain. These values indicate a high degree of reliability and internal consistency of the scale, making it suitable for the current study. Below table illustrates the reliability and validity.

Table 1. Reliability and validity of the test

Domains	Cronbach's alpha
First domain	0.90
Second domain	0.93
Third domain	0.98

4.2 Interviews

The reliability of the interview data was established by adopting Lincoln and Guba's [33] criteria for evaluating qualitative data, specifically credibility and conformability. For credibility, the internal validity of the data was ensured by thoroughly reading the interview transcripts multiple times, employing an external reviewer to verify the data, and including a diverse range of respondents from different universities and specializations. Conformability was achieved through an external audit, where external reviewers examined the data and procedures to ensure the validity of the findings.

IV. DATA ANALYSIS AND RESULTS

The statistical analysis was performed using SPSS (version 26.0). The methods used to answer the research questions included calculating means and standard deviations and conducting a paired sample t-test.

Thematic analysis by Braun and Clarke [34] was employed to identify recurring themes in the qualitative data. The steps included familiarizing with the data by transcribing audio recordings and reading them multiple times, creating initial codes, transforming codes into main themes, and identifying the primary themes in the study: expanding knowledge of generative AI applications, developing teaching and learning methods, providing immediate feedback, and improving time and effort management. These themes were reviewed for consistency and coherence before compiling the final report logically and cohesively.

1. QUANTITATIVE DATA ANALYSIS

First Research Question: What is the impact of training on generative AI applications in developing teaching methods among university lecturers, as measured by pre- and post-test results? To answer this question, a paired sample t-test was used to determine the significance of the differences between the pre- and post-test means. Table 2 presents these results:

Table 2. Paired Sample t-test Results for the Significance of Differences between Pre- and Post-Test Means

Measurement	N	Mean	Standard Deviation	Degrees of Freedom	t-value	Significance Level	Effect Size (η^2)
Post-test	31	2.98	0.97	30	6.98	0.000	0.62
Pre-test	31	4.38	0.67				

The above table shows significant differences at the 0.05 significance level between the pre- and post-test means, favoring the post-test application. This suggests the positive impact of training on generative AI applications in developing teaching methods. The effect size was calculated to be 0.62, which is considered high according to Cohen's [35] classification, indicating a high impact of the training program.

2. QUALITATIVE DATA ANALYSIS

Second Research Question: What are the participating lecturers' opinions on the impact of the training in developing the teaching process, as revealed by the qualitative interview results?

The results of the qualitative analysis were categorized into four key themes that illustrate the positive impact of the training program. These themes are as follows, and they were determined after the interviews were analyzed:

2.1 Expansion of Knowledge on Generative AI Applications:

The interview results indicated the tangible effectiveness of the program in expanding participants' knowledge of AI applications. One participant mentioned, "The program changed our view of AI from just a limited-use technical tool to a partner and assistant that can be utilized in many tasks". Another participant (Participant 6) said, "The program helped me discover enormous potentials of AI that I had never imagined". Another participant echoed this sentiment by saying, "The program completely changed our perception of AI, and I am excited to try all the applications in the coming days". Additionally, participants highlighted that their knowledge of AI applications was very limited before the program, restricted mainly to the ChatGPT

application. However, the program opened entirely new horizons for them, as they realized AI encompasses a wide range of diverse fields. Participant 3 expressed, "When the program was announced, I thought it would focus only on learning the ChatGPT application because I believed AI was limited to it. But I was surprised during the program by the presence of many diverse and wonderful applications; there are applications for images and videos, and others that help in scientific research and data analysis".

2.2 Improvement in Teaching and Learning Quality

Participants' responses confirmed the program's profound positive impact on improving teaching and learning methods, providing new tools and techniques to enhance education quality. For example, Participant 5 said, "When I started using generative AI to create educational content, I felt like I had a magic wand; I could prepare interactive lessons, educational videos, and even personalized tests for each student according to their needs. I noticed that students no longer felt bored and were eagerly waiting for the lessons". It can be said that generative AI contributed to making the learning experience exciting for students and increased their engagement and interest in educational materials.

2.3 Provision of Immediate Accurate Feedback

Participants were able to utilize AI applications to provide immediate evaluations and feedback on assignments and tests based on their responses, allowing students to know and correct their mistakes promptly. One participant highlighted the significant benefits of these applications, saying, "I used the Magic School application to grade assignments and provide instant feedback, and personally, it had a great impact on improving my students' performance; they could immediately identify and correct their mistakes, which significantly helped in raising their levels" (Participant 2). This quote clearly reflects the benefits of using AI to provide immediate feedback, making it easier for students to identify and correct their mistakes quickly, improving their understanding of educational materials and increasing motivation.

2.4 Time and Effort Management

Academics face significant challenges in managing time and effort during the educational process. Participants noted that the generative AI applications they learned during the training program significantly improved time and effort management in preparing educational materials and routine tasks. This allowed them more time to focus on creativity, innovation, and integrating future skills into learning, curricula, and student projects. Supporting this, Participant 1 said, "Thanks to AI, I have more time to interact with students and develop curricula. For example, we had an event for Math Day; previously, it would take days to prepare ideas and create posters, but using one of the applications I learned in the program, it helped students produce creative ideas in a short time". In summary, participants affirmed their benefit from the program not only in improving teaching methods and increasing students' engagement and interest in the study materials but also in providing accurate immediate feedback. This contributed to better time and effort management, giving them time for creativity and innovation and enhancing overall education quality.

V. DISCUSSION

This section discussed the results in relation to existing studies in the literature on generative AI, as well as its theoretical background. Furthermore, the current study's results confirm that the training program significantly enhances the use of generative AI applications, thereby enhancing the teaching process and enhancing the capabilities of lecturers. These results underscore the importance of integrating such training programs within higher education institutions in Oman to elevate the quality of education, update the educational system, and improve university outcomes. This finding aligns with the results of Kaplan-Rakowski et al. [17], which revealed positive perceptions among teachers towards generative AI; regardless of their teaching style, the more teachers used AI tools, the more positive their views became.

Previous studies [14, 13, 16] also support these results, demonstrating that generative AI offers numerous benefits for enhancing the learning process. These benefits include designing activities and educational videos, providing immediate feedback, preparing tests, improving time management, reducing effort, and

developing teaching plans and curricula. This result can also be attributed to the well-thought-out design of the program, which included the participation of prominent experts in the field of generative AI. Their presence helped deliver high-quality content based on the latest developments in the field, assisting participants in gaining comprehensive knowledge of the technologies.

Given all of the findings, this study reflects some important conclusions from previous studies on generative AI. It pertains to a study by Kuleto et al. [20], which confirmed a clear and favorable relationship between lecturers' exposure to AI in Education (AIED) and their views towards it. This subsequently impacted their ambition to incorporate AI into their teaching methods. These relationships imply that giving lecturers more chances for professional development programs that enable them to actively integrate AI may increase their motivation to do so in their everyday teaching practices. In a similar context, Yang and Chen [21] concluded that the perspectives and educational encounters of pre-service teachers throughout their training have a significant impacted their future instructional methods in the classroom.

VI. CONCLUSION

The current study was intended to investigate the impact of a training program on generative AI applications in improving the teaching skills of lecturers in higher education in the Sultanate of Oman. The study implemented a mixed-methods approach, incorporating both qualitative and quasi-experimental methods. The quantitative and qualitative results of the study demonstrated the clear impact of training program on generative AI applications in improving teaching methods and strategies among university lecturers. The results indicated significant statistical differences between pre- and post-training measurements with a high effect size. Similarly, the interview results showed that generative AI applications helped participants enhance their engagement with these technologies, improve teaching methods, provide better assessments, manage time more effectively, and reduce effort. Therefore, the study recommends developing specialized training programs in generative AI applications for lectures at Omani universities and beyond, where applicable. The lectures are encouraged to utilize generative AI applications to improve their teaching methods and techniques. Additionally, it suggests including courses on generative AI in academic curricula and strengthening international partnerships with universities and research institutions.

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Authors Contribution

All authors made an equal contribution to the development and planning of the study.

Conflict of Interest

The authors have no potential conflicts of interest or such divergences linked to this research study.

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