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From E-learning to AI Integration: Assessing Effectiveness and Challenges at Sultan Qaboos University

Abdelzahir Abdelmaboud

a.elnour@squ.edu.om

Sultan Qaboos University

Majid Al Busafi

Sultan Qaboos University

Abdelrahman Elhag

Sultan Qaboos University

Maimoona Al Abri

Sultan Qaboos University

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Abstract

Within the backdrop of fast-paced advancements in digital technologies, e-learning has become an integral part of higher education, specifically in projects such as Oman Vision 2040. This research aims to explore the adoption, acceptance, readiness, and issues regarding e-learning technologies in Sultan Qaboos University (SQU), specifically focusing on AI-based applications among both lecturers and undergraduate students. Employing a quantitative research paradigm, this research used a case study design in which questionnaires were distributed to 435 students and 48 lecturers.

The findings show that the usage of e-learning tools is moderate, as indicated by mean scores of 3.03 among students and 3.12 among faculty members. Despite the willingness among students to use AI, as indicated by a mean of 3.39, its implementation is a significant challenge, as indicated by a mean score of 3.41 among the respondents. The faculty members are satisfied with the e-learning process, but the mean score of 2.90 indicates that the lack of training opportunities is a problem. The findings also show that there are no significant differences among genders in digital engagement ($p < .05$).

The conclusion reiterates that although e-learning is embedded in SQU, the development of teaching is lagging. This shift from access to effectiveness emphasizes the need for faculty development programs on AI teaching practices and digital literacy skills for students. This is critical to ensure that technology is fully integrated into teaching practices.

1.0 Introduction

1.1 Background

Higher Education represents an important sector within the Oman context as a way of developing high-quality and innovative human resource (Awashreh, 2025). Over the past 20 years, a comprehensive sector of higher education institutions has been developed in the Sultanate of Oman (Bhandari & Mohite, 2024). However, the sector continues to face increasing pressure in the need to enhance the quality of higher education, as well as address the issue of relevance in terms of meeting the national development requirements.

Digitalization stands as one of the pillars of the paradigm shift in postsecondary institutions and remains largely emphasized in the education reform in Oman, and most specifically in the implementation of information and communication technology tools in teaching and learning programs (Bhandari & Mohite, 2024; Tripathi, 2024). Blended learning and online programs of education have become one of the major components in this paradigm shift, partly because of the impact of the coronavirus pandemic, which accelerated the incorporation and implementation of online and blended learning strategies in postsecondary institutions in Oman (Achahbar & Khoumssi, 2023). Learning Management Systems, such as Moodle (Moodle, 2010) and Blackboard (Bradford et al., 2007) , have

become widespread in developing course materials, tests, and learning activities, and synchronous systems, for instance, virtual classrooms, have become part of the teaching systems.

E learning is broadly considered the use of technology to enhance learning experiences, and it includes a variety of systems from standard Learning Management Systems (LMSs) to Artificial Intelligence (AI)-based applications. The potential for flexibility, accessibility, learner engagement and pedagogical innovation that e-learning can offer has been acknowledged worldwide. Instead of just copying traditional instruction into digital forms, good e-learning innovates pedagogy away from teacher-oriented presentation to learner-centered activity, exploration and sharing (Al-Qahtani & Higgins, 2013).

In Oman the significance of e-learning as a strategic activity can easily be read in Oman Vision 2040, which promotes digitalization, innovation and knowledge-based economy (Al Zuheimi, 2025). Higher education laboratories are instead required to use digital technologies so that they can prepare future students for the Fourth Industry Revolution in this national context. As a result, universities have spent significant resources on digital infrastructure and online platforms, as well as teaching technologies to bring teaching and learning into the modern age.

Sultan Qaboos University, being a leading state university in the country, has been at the forefront in supporting and embracing e-learning (Al Maamari et al., 2025). Learning management systems, e-assessment tools, e-libraries, and e-classrooms have been institutionalized within the university colleges. More recently, the Oman digital environment has been supplemented with the introduction of AI-driven tools like ChatGPT and Gemini, opening doors for intelligent learning and paving the way for a myriad of questions related to academic integrity and ethics (Al Matari et al., 2023). The institutions of higher learning in Oman have embraced digital transformation as envisioned within Oman Vision 2040. As a case study, Sultan Qaboos University in Oman initially concentrated on developing Massive-Online-Open-Courses (MOOCs) and cloud technology for group learning were among the pioneers in describing Oman's digital framework in Sultan Qaboos University by incorporating Smart Learning Management Systems, which make effective use of responsive learning materials and tracking capabilities (Al-Khanjari & Al-Kindi, 2018). However, mirroring these opportunities, the sudden deployment of AI has brought with it pressing questions in relation to academic integrity, ethical use, digital literacy and pedagogical efficacy in higher education (Al Salmi et al., 2024).

1.2 Problem Statement

Many educational technologies are being adopted and there are significant investments in digital infrastructure, however, there is little empirical data to show whether these technologies have improved how higher education operates in Oman. Research in the Gulf region has mainly focused on Learning Management Systems (LMS), technology adoption and design and acceptance models. There is a dearth of information regarding their influence on pedagogy, the effectiveness of e-learning as a learning method, and the experiences of staff and students with e-learning (Ali et al., 2018). While e-learning is

utilized extensively at Sultan Qaboos University, the extent to which e-learning has been successfully integrated or has enhanced or merely digitized traditional methods of instruction is debated (Al Maamari et al., 2025).

The available evidence supports the notion of a structural divide in the context of e-learning. Although there has generally been an increase in accessibility to technology for learners, issues that affect students and instructors will continue to exist. While many learners are now described as "digital natives" and interact with technology on a daily basis, many of these learners still struggle to effectively use many advanced types of technology for deep academic learning because of a lack of digital literacy and suitable devices (Alenezi et al., 2023; Mhlongo et al., 2023).

Conversely, several instructors have identified that there is a “training gap” resulting from instructors not having enough training or professional development on how to successfully participate in the integration of their software into e-learning and AI tools, which has resulted in little or no impact with the use of software in those classrooms (Ali et al., 2018). In addition, numerous e-learning efforts have also faced challenges related to infrastructure, specifically with regard to unreliable internet connections or systems, which has created barriers for the success of e-learning initiatives in e-learning environments (Al Maamari et al., 2025). Whereas, to link institutional planning efforts and funding to the needs, preparedness, and experiences of learners and instructors, it is imperative that institutional administrators conduct an in-depth and thorough analysis of all the above-mentioned inter-related elements (Al Shizawi, 2025).

1.3 Significance of Study

This study is valuable at numerous levels**:**

- **On a national level**: The Evaluation of E-Learning Maturity at Sultan Qaboos University as it provides Empirical Evidence in supporting the Digital Education Goals of Oman as documented in its Vision 2040 and how SQU positioned itself in its strategy of Technology Access to Technology Integration in Delivering courses more Effectively.
- **On an Institutional level**, the Findings will provide SQU Leadership with detailed Evidence on Technical, Pedagogical, and Cultural Bottlenecks, which will allow Leadership to make informed decisions on Resource Distribution and make more specific Investments into E-Learning Technology and Pedagogy.
- **Regionally**, this Research will also increase the body of literature on E-Learning and Artificial Intelligence Integration in Higher Education in the Gulf Countries and provides an Empirical Case Study from a Non-Western Context, which fills a significant gap in ongoing efforts to Research Integration.

1.4 Research Objectives

This study aims to address the identified knowledge gaps through the following objectives:

1. To determine the frequency and extent of e-learning usage across the various colleges at Sultan Qaboos University.

2. To explore the perceptions of faculty and students regarding their use of e-learning and how they believe it contributes to their learning outcomes and student connectedness.

3. To identify what are the technology-based, pedagogic-based and culturally based barriers to effectively employing e-learning, and to determine how these barriers may be mitigated.

4. To identify if faculty and students are prepared to use cutting-edge technologies, most notably artificial intelligence, in their teaching and learning activities.

2.0 Literature Review

2.2 E-Learning in Higher Education

E-learning is quickly becoming an essential part of higher education systems globally because of improvements in technology, an increasing variety of learners in higher education, and the necessity to provide learning models that meet varied needs with flexibility and scale. Higher education environments utilize a diverse array of e-learning tools and practices, including but not limited to LMSs, virtual classrooms, mobile applications for learning, digital materials and resource repositories, and augmented support through educational technologies based on AI (Benkhalfallah et al., 2024; Brada & Dahmani, 2024).

The literature also emphasizes that there is consistent support for a positive impact of E-learning on accessibility for learners, autonomy of learners in their own learning processes, the ability of instructional staff to be efficient in their instructional processes, and the engagement of learners because of the integration of E-learning into instructional practice (Encarnacion et al., 2021; Petretto et al., 2021). Nevertheless, there are many factors beyond simply having technology available that impact how effective e-learning will be specifically the outcome of e-learning will depend on how well the course meets certain criteria (i.e., pedagogical design, instructor competency and pedagogical preparation, student support, and readiness to learn), as demonstrated in studies performed on a variety of post-secondary settings in which students tend to use e-learning tools such as LMS and video conferencing (Alqahtani & Rajkhan, 2020; Naveed et al., 2020).

However, many students do not fully utilize the more advanced options available in e-learning. Many courses offered by these institutions seem to have only progressed to the point of providing necessary administration and content but have yet to create an impact on enhancing teaching and learning through

e-learning platforms. A strategy in institutions arises as a major topic. Although studies conducted in Serbia do not relate particularly to the Arab region, they have a connection in showing how institutions heavily invest in hardware technology without considering leadership planning, faculty, and other important aspects in learning online (Kuleto et al., 2021).

2.3 E-Learning Adoption and Usage Patterns

Research has thoroughly investigated the extent of adoption and frequency of use of e-learning tools among both instructors and learners. All of the studies reviewed have exhibited a strong reliance by instructors and learners on their institutionally provided LMS platforms and the factors supporting this include their mandated use, course structure standardization, and exam participation (El Marsafawy et al., 2022). Virtual meeting platforms, such as Zoom and Microsoft Teams, have become additional core components of the instructional delivery process under the present pandemic conditions of COVID-19 (Grynyshyna et al., 2023).

Emerging technology adoption such as AI based tools, learning analytic systems, and e-content creation tools) shows a moderate and inconsistent pattern of growth in e-learning technology use among academics, departments, and across disciplines (Pathiala, 2024). Recent studies indicate that, although there has been a notable increase in the awareness of AI-based tools since 2023, as a result of growing interest in using AI technologies within the educational environment, the pedagogical integration of such tools into instructional practices remain minimally practiced, primarily due to perceived concerns regarding academic dishonesty, inadequate training, and/or uncertainty related to the instructional value of AI tools (Fošner, 2024; Zhai, 2022). The variance that exists between the significant use of foundational e-learning technologies with the moderate growth of the use of more advanced e-learning technologies continues to follow trends common in both the Gulf and non-Gulf regions of the world (Sadiki & Saleh, 2022).

2.4 Best Pedagogical Practices in E-Learning

Sound pedagogical practice is an essential component of the successful implementation of e-Learning; for e-Learning to be implemented effectively, instructors must do more than simply adopt tools. According to the body of research regarding e-Learning, many best practices can support creating a successful online learning environment. Examples of those best practices are: increasing learner engagement through multiple avenues, providing timely formative assessment and feedback, developing personalized learning pathways for each individual learner based on their needs, facilitating interactions (both synchronous and asynchronous) between learners, and providing empirical data through the use of Learning Analytics to inform instructional decisions (Bruggeman et al., 2021).

Even though these best practices have emerged widely in literature, it has been observed that most empirical studies have indicated a growing but low adoption level of these best practices by instructors

in e-Learning. This is true for data-driven and instructional practices in e-Learning, and it has been observed that instructors place a relatively heavier emphasis on activities within the realm of engaging students, such as interactive discussions and multimedia, and not on data-driven instruction and practices such as Learning Analytics and feedback systems within e-Learning platforms (Dritsas & Trigka, 2025). This points to a pedagogy divide, whereby despite their acknowledgment of the relevance of engaging students in e-Learning, the instructors seem to be lacking in training on the use of the technical capabilities of the e-Learning platform (Theelen & van Breukelen, 2022).

2.5 Instructors' Attitudes and Views on E-Learning

Besides the effects of faculty members' beliefs, their attitudes towards e-learning will remain important in shaping their future adoption and integration of e-learning technology in teaching practices. Based on the Technology Acceptance Model (TAM), instructed by Davis (1989, an educator's intention and attitude towards using electronic tools in teaching and learning practices can be influenced in a significant way by their perception of the benefits and ease of use of e-learning technology (Garcia et al., 2024). The literature shows a general pattern clearly indicating that faculty members perceive the potential benefits of e-learning technology in enhancing communication, flexibility, and teaching effectiveness.

In general, there is not necessarily an indication of the level of pedagogical implementation that will result from the use of e-learning technology. Numerous studies have documented the disparity between e-learning faculty's positive beliefs about e-learning technologies and their limited use of higher-order instructional practices (i.e., practices that incorporate AI and analytics) within their instructional practice (Ali et al., 2018; Bruggeman et al., 2021). These studies suggest that some of the most significant barriers to the development of innovative e-learning practices include concerns related to academic rigor, assessment integrity, and workload. As a result, many instructors have approached the development and implementation of innovative e-learning practices with a great deal of caution or with limited levels of implementation.

2.6 Students' Perceptions, Readiness, and Digital Literacy

Students' perceptions about e-learning along with their readiness for it are also equally important in assessing e-learning's effectiveness. Although many modern-day students have been described as digital natives, recent studies have shown that just because these same students frequently use technology does not mean they have high levels of digital or academic literacy or even proficiency when it comes to applying it in a meaningful manner (Ayyildiz et al., 2021). Therefore, although many students are highly skilled in using a variety of digital devices on a day-to-day basis, they struggle to develop meaningful e-learning technology experiences which are critical for critically analyzing concepts and solving academic problems.

However, paradox exists for students to use AI tools given the number of studies that have taken place recently (Scherpereel, 2024). On the one hand, AI has been employed by students to find information and produce content to help with learning and research. On the other hand, the number of students experiencing difficulties in applying AI tools to the learning environment to produce the intended results without relying on training on the usage of the guidelines and a lack of confidence regarding the ethical implementation of AI technologies (Zhai, 2022). The above highlights the need for students to receive the requisite support in implementing the usage of AI technologies from the superficial applications of AI to the more engaging tasks for better results.

2.7 Challenges and Barriers to Effective E-Learning

According to literature, there are a few factors working against the efficient implementation of e-learning in the higher education sector. These include a lack of support for professional development, lack of technical support, lack of constant internet access, and a fragmented digital environment (Ali et al., 2018). Studies have found resistance to technology-delivered teaching strategies is a less pressing issue compared to infrastructure and skills, mainly in an institution where technology is already integrated into the daily activities of the academic community.

In addition, the research conducted recently indicates that there are also differences within the academic community regarding discipline concerning e-learning use and readiness. Students and instructors in STEM and applied disciplines have reported being more active users and feeling more prepared to use e-learning tools when compared to their counterparts in the humanities and education disciplines. These differences result in different demands placed on the curriculum, assessment methods, and levels of exposure to digital technology (Zhai, 2022). Consequently, these results illustrate the existence of a "second-level digital divide," where there is equal access to technology but there are significant differences in competencies and pedagogical approach.

2.8 Research Challenge

Previous research into e-learning and its related topics including of adoption of e-learning; perceptions regarding e-learning; and challenges associated with e-learning, however, there are still several gaps in the literature (Ahmad et al., 2023; Baig et al., 2022) .

The first Challenge in the literature relates to the fact that no integrated studies were conducted using both instructor's and student's perspectives in one single study on the same institution's e-learning model.

The second Challenge in the literature is that there is limited empirical evidence regarding higher education in the Gulf Region (including Oman) with respect to AI readiness, mode of teaching and difference by discipline (Fadlelmula & Qadhi, 2024).

The third Challenge relates to the lack of published research that focuses more on using the technology for an institution's students and teacher's best practices for using that technology than on the alignment between their use of the technology, their beliefs regarding the technology, and their readiness to learn through using it (Thunberg & Arnell, 2022).

This study attempts to fill in some of these research gaps by looking at how both instructors and students use e-learning, how they teach using this technology, what are their beliefs regarding it, and when do they believe they are ready to learn using it, at Sultan Qaboos University. This will give researchers, administrators, policy makers, and educators a more complete view of the ways in which digital/AI-based learning will be implemented in Oman higher education and how to use those implementations to enable a more equitable dissemination of technology in higher education.

3.0 Methodology

3.2 Research Design

This study adopted a quantitative, cross-sectional survey design to assess the level of use of e-learning (learning via electronic means), perceptions of e-learning, readiness for e-learning, and challenges to use both e-learning and AI applications by instructors and undergraduate students at SQU. The quantitative approach was chosen because it is appropriate for measuring behaviors, attitudes and the relationships between multiple variables using large sample sizes. The quantitative approach also facilitates statistical inferences and comparisons for different demographics, such as gender and academic year and college (Weyant, 2022).

A cross-sectional design allows the researcher to collect all data at a single point in time, giving a "snapshot" of the current e-learning practices, and experiences of instructors and undergraduate students in the institutional context. A cross-sectional survey is commonly used to assess e-learning adoption levels and individuals' perceptions of and readiness to adopt e-learning in a rapidly changing environment (Ali et al., 2018).

3.3 Research Context

The research was conducted at Sultan Qaboos University (SQU), the premier public university in Oman. SQU hosts several separate colleges of Sciences, Health Sciences, Engineering, Humanities, and Social Sciences. SQU has formally established e-learning as a part of its operations through the implementation of the LMS, virtual classrooms, and digital academic services, representing a viable location for exploring the entwinement of AI Technologies and e-Learning in higher education.

3.4 Population and Sampling

The study targeted two distinct populations:

1. **Undergraduate students (N = 435)**: enrolled across various colleges at SQU.

2. **Instructors (N = 48)**: teaching undergraduate courses during the study period.

The sampling plan used for this research was a **non-probability convenience** sampling plan because of participant accessibility issues, and because participation was voluntary. Non-probability convenience sampling plans have often been used in the field of higher education research where the researcher attempts to get a variety of views across many disciplines, not to generalize the research findings to all populations with statistical accuracy. A total of **435** responses from students were collected and included all academic level types throughout multiple colleges within SQU. The full instructor responses were collected simultaneously with the student responses and were based on a similar instrument that reflected the instructor's teaching responsibilities and pedagogy.

3.5 Research Instruments

Two structured surveys were developed and distributed to collect data from a sample of students and instructors using an online format. The instruments created from the extensive bibliographic review of existing literature on e-learning and technology acceptance (Ali et al., 2018).

3.5.1 Student Questionnaire

The surveys created for each population used multiple domains measured using a **five-point Likert scale** ranging from (1) Strongly Disagree to (5) Strongly Agree with adaptations for frequency of use and challenge severity where applicable.

The domains included in the student survey include:

- E-learning Usage Frequency
- Perceptions of E-learning Effectiveness
- Training and Readiness
- Challenges Faced

The domains included in the instructor survey include:

- E-learning Usage Frequency
- Best Practices in E-learning Implementation
- Teachers' beliefs
- Challenges Faced

3.6 Validity and Reliability

3.6.1 Content Validity

Through expert review and by aligning to existing constructs of the Technology Acceptance Model (TAM) and to validated Instrumentation's used in E-Learning research, content validity was established. The items for the survey were reviewed for clarity, relevance and contextual appropriateness with regards to the Omani Higher Education System, and revisions were made as necessary.

3.6.2 Reliability Analysis

Reliability was assessed using Cronbach's Alpha to evaluate internal consistency across questionnaire domains. Cronbach's Alpha values of 0.70 or above are generally considered acceptable for social science research, although slightly lower values may be acceptable for exploratory domains or scales measuring diverse behaviors (Taber, 2018).

As shown in Table 1, the reliability analysis demonstrated acceptable to excellent internal consistency across domains, with the overall instrument achieving a high Cronbach's Alpha coefficient, indicating strong reliability of the collected data students, α = 0.839; faculty, α = 0.881.

Table 1
Reliability Statistics (Cronbach's Alpha)

Domain	Items	Cronbach's alpha (Students)	Cronbach's alpha (Faculty)	Reliability Level
Usage Frequency	6	0.524	0.805	Moderate/High
Perceptions	7	0.749	-	High
Best Practices	6	-	0.806	High
Training and Readiness	4	0.652	-	High
Teachers' Beliefs	15	-	0.837	High
Challenges Faced	7/5	0.759	0.566	High/Moderate
Total	**24/32**	**0.839**	**0.881**	**High**

Note. Cronbach's Alpha values above 0.70 are generally considered acceptable. Student and faculty instruments were analyzed separately to ensure context-specific validity.

3.7 Data Collection Procedure

The questionnaires were distributed online using an online survey tool. The survey has been distributed using a university-based e-mail system to all students and lecturers in all colleges within Sultan Qaboos University. The survey is voluntary, and all respondents are made aware of the survey's purposes. The survey was designed in a manner that ensured it was completed within a fixed period, and reminder emails were also sent throughout this period in a bid to improve response rates. Incentives were also not provided in the survey, which could otherwise influence respondents' answers.

3.8 Ethical Considerations

The ethical standards were followed in this research. The research was completely voluntary, and anonymity was ensured, with no identifiable data being collected regarding the subjects. Prior consent was obtained from all subjects participating in the research, with the complete data only being used in this research. The completed research fully complied with the ethical standards set by Sultan Qaboos University in relation to any kind of research in the social sciences.

3.9 Data Analysis Techniques

Data was analyzed by use of Statistical Package for Social Sciences (SPSS), and the following types of analyses were conducted:

- Descriptive statistics (means, standard deviations, frequencies) regarding the use patterns, perceptions, best practices, training & readiness, and challenges.
- Reliability analysis through Cronbach's Alpha.
- Independent samples t-tests to investigate any differences according to gender.
- One-way ANOVA to compare differences for academic year and college.
- Pearson correlation analysis was conducted to identify the relationship between patterns of use, perceptions, best practices, training and readiness, and challenge for use. Statistical significance was determined at 0.05 significance levels as per research norms in education.

4.0 Results

4.1 Participant Demographics

The total number of undergraduate students from different colleges in Sultan Qaboos University was 435, and they were chosen based on a broad range of academic years and disciplines. The students were from all major colleges, with a higher percentage from their third and fourth years, reflecting a greater familiarity with the available e-learning platforms in their universities. Moreover, the study gathered responses from 48 instructors in different colleges of the university. The instructors include lecturers, associate professors, assistant professors, and professors who have different levels of teaching experience. This ensures that the study gets a wide range of perspectives. Demographic variables such as gender, age, academic year, college affiliation, academic rank, and teaching experience were considered to enable comparisons with regards to the usage, perception, readiness, and challenges in e-learning.

4.2 Frequency of E-Learning Usage

4.2.1 Student Usage Patterns

Using descriptive statistics, student respondents reported an extensive use of e-learning tools that were institutionally sponsored, specifically LMSs and virtual classrooms. Both LMSs and virtual classrooms were reported as being the primary use for accessing course materials, submitting assignments, and

participating in synchronous class sessions. However, the use of AI-based tools was significantly lower in the students surveyed. Students also reported varying levels of use of mobile learning tools (used for less than half of all their e-learning activity). All the forms of e-learning tools used by students indicate that e-learning is now an integral part of the academic process and more frequently applies to institutionally sanctioned models as opposed to emergent technologies. The frequency of e-learning tool usage among students shown in Fig. 1.

4.2.2 Instructor Usage Patterns

It appears that the instructors used the same approach, heavily relying on their LMS and Virtual Classrooms for the management and delivery of academic content, course communication and assessment. In contrast, many instructors used AI applications much more cautiously and carefully. Most instructors were exploring ways to integrate AI tools into their teaching rather than integrating them systematically. Overall, instructors regularly engage with the core e-learning tools but are still in the early stages of their adoption of advanced technologies. Figure 2 shows instructors' frequency of e-learning and AI tool usage.

4.3 Perceptions of E-Learning Effectiveness

4.3.1 Student Perceptions

Based on the overall weighted average (M = 3.28, SD = 0.596), students perceive e-learning to be moderately effective. Many respondents rated their perceptions positively regarding the practical benefits e-learning platforms provide and have favourite areas such as the easiest to way to get course materials and the support provided for their learning. The scores received for the following two items were the highest; “The tool helps me learn better” (M = 3.55, SD = 0.926) and “Easy access to materials” (M = 3.54, SD = 0.929). These data show that students feel e-learning is beneficial in terms of their organization of their work and the availability of resources.

In addition to providing positive perceptions of the benefits of e-learning, the students also reported having moderate levels of agreement on the following items: motivation (M = 3.26), use of e-learning tools by instructors (M = 3.24), and ease of communication with instructors (M = 3.23). Participants also indicated a moderate level of confidence in their ability to participate in virtual classrooms (M = 3.19). The item that received the lowest mean score was associated with the statement, "Online learning is as effective as face-to-face learning" (M = 2.94, SD = 1.013). This indicates that, although students have a largely optimistic attitude towards online learning, they are not very confident in the ability of online learning to totally duplicate conventional learning.

4.3.2 Instructor Perceptions and Application of E-Learning Best Practices

The outcome of this study shows that there is a moderate level of engagement on the part of the instructors who implemented e-learning best practices, given the weighted mean (M) value of 3.23 (SD =

0.804). Instructors rated the most highly valued e-learning best practice as “Enhancing Student Engagement” (M = 3.81; SD = 1.142), indicating instructors consider maintaining student engagement as a high priority, while moderate levels of implementation were indicated for other instructional practices such as Personalized Learning, Collaborative Learning, Multimedia, and Formative Assessment & Feedback. Therefore, instructors utilize various instructional strategies when implementing e-learning, though the use of these strategies typically is at a moderate level.

The lowest mean (M) score for e-learning best practices was reported for “Learning Analytics” (M = 2.58, SD = 1.145), indicating little use of data-driven solutions to monitor student performance or to assist instructors in making decisions related to their instructional practices. Overall, the findings indicate that, when implementing e-learning best practices, instructors tend to utilize practices that support student engagement and content delivery to a greater extent than they do the use of practices that require the use of higher end analytical solutions or practice automated feedback tools.

4.4 Training and Readiness

4.4.1 Student Readiness

The average response of students to the question of how well-prepared they felt to use technology for learning with an electronic medium was a moderate level of score with a weighted mean of M = 3.39 (SD = 0.671). The statement that received the most agreement from students was, "I know how to use D.P.S." It received the highest score; however, many students appear to believe that they can use computer software related to A.I. In addition to this, a moderate level of awareness was reported by students regarding the institutional e-learning platforms, i.e., "I know how to use the S.Q.U. platforms," M = 3.46, SD = 0.903.

In contrast to the above-stated mean levels of agreement and moderate mean scores, the responses related to the items regarding the provision of formal training to students returned much lower mean levels. Specifically, the mean level associated with the statement "I received enough training," M = 3.14, SD = 0.858, was the lowest mean score received. While the statement "I would benefit from more training" returned to a moderately-high mean score, M = 3.36, SD = 0.977. Therefore, the data indicates that although students generally believe they are capable of using digital and A.I. technology to assist them in learning, their opinions regarding institutional training adequacy continue to reflect only a moderate level of satisfaction with the training they have received.

4.4.2 Instructor Readiness

The responses of instructors showed similar characteristics to that of students. While they were generally familiar with the e-learning tools available in their institutions, they were moderately prepared when it came to more advanced educational usage of such tools, especially when they involved AI-powered apps.

4.4.3 Faculty Beliefs Regarding the Impact of E-Learning

A scale comprising 15 items measured by faculty members' belief in e-learning, with negatively worded items scored in reverse fashion, so that a higher score reflects a positive belief. Faculty members' overall level of positive belief in e-learning is high, with a weighted mean of M = 3.69, and a standard deviation of 0.614.

The highest level of agreement was observed in relation to the items: “E-learning is a tool for instruction and learning for every subject matter” (M = 4.17, SD = 1.018); and “E-learning tools are easy to use” (M = 3.96, SD = 0.988). A high level of agreement was also observed in relation to items associated with enhancements in communication, teaching effectiveness, empowerment of learners, and effective use of class time with a score of more than 3.70. For statements that communicated concerns or doubts, a moderate level of agreement was found for “E-learning is useful only for administration” (M = 3.13, SD = 1.378) and “E-learning makes things too easy for students” (M = 2.73, SD = 1.233). These scores suggest that, despite positive perceptions about e-learning, some concerns exist about its effect on academic content.

4.5 Challenges and Barriers to Effective E-Learning

All students and instructors reported a wide range of barriers or challenges to the effective application of e-learning technologies at Sultan Qaboos University. Each group had similar average weighted total means for the level of challenge experienced by students and instructors.

4.5.1 Student-Reported Challenges

Students identified a moderate level of challenges in relation to the use of e-learning as demonstrated by students’ overall weighted average of M = 3.13 (SD = 0.625). The challenge that students identified as having the highest average score was “Difficulty applying AI such as ChatGPT to Good Use in Academia (M = 3.41, SD = 1.096). Therefore, this indicates the difficulties that students encounter when they attempt to apply AI tools when trying to study for academic success. There were other moderate-level challenges, such as: “Difficulty Trying to Understand Study Material” (M = 3.23, SD = 0.908); “Poor Access to Proper Devices” (M = 3.17, SD = 0.970); and Challenge Complexities, in terms of System Complexity, such as: “Too Many Platforms to Use” (M = 3.08, SD = 0.970); and Technical Infrastructure, such as: “Poor Internet Connectivity” (M = 3.06, SD = 1.039). Both were also rated at a moderate level of difficulty. Finally, “Limited Technical Support” (M = 3.01) and “Lack of Interaction” (M = 2.97) were the two highest-lowered rated challenges, however, were both in the range of moderate levels of difficulty.

4.5.2 Instructor-Reported Challenges

The instructors’ results on the Instructors’ Challenges Survey showed a moderate level of challenge with a total weighted average of M = 2.63 (SD = 0.647). Instructors rated their biggest difficulty as: “Limited AI training” (M = 2.90, SD = 1.153), followed by “Internet Issues” (M = 2.77, SD = 1.036). Other difficulties include: “Lack of Technical Support” (M = 2.52, SD = 0.922), “Student Engagement Issues” (M = 2.48, SD = 1.111), and “Resistance to Technology” (M = 2.46, SD = 1.110). Although these ratings were lower than

the other challenges rated by the respondents, the severity of the ratings for these three challenges is still considered moderate.

4.6 Group Differences Based on Demographic Variables

4.6.1 Gender Differences

Independent samples t-tests established that there were no statistically significant differences between male and female participants on major e-learning variables. That implies that gender does not play an important role in the uptake, perception of, or preparedness to utilize e-learning in this study.

4.6.2 Academic Year Differences

One-way Analysis of Variance (ANOVA) revealed significant differences across academic years for the Student's Training and Readiness. Senior year students exhibited greater familiarity with and confidence in e-learning systems when compared to their first-year counterparts due to their greater exposure and experience to e-learning systems owned by the institution.

4.6.3 College-Based Differences

A single factor variance test was employed to verify whether study behavior, attitudes toward success in learning via the internet, levels of preparation, and difficulties experienced are significantly different in various faculties at Sultan Qaboos University. The findings of the test are presented in Table 2.

Among the institutions, considerable variation was noted in the way students utilized e-learning, perceived it, received preparation for it, and encountered challenges – all of which indicated significance at 'p' less than 0.01. Variation in these four aspects was markedly distinguishable when contrasted between colleges. It is worth noting that the extent of e-learning use did have a considerable variation between the colleges. This is supported by the significance value of $p < .001$. Next, after the analysis of between-subjects variance revealed the differences between groups, the Medicine and Health Sciences group emerged as the one where the use of e-learning was more pronounced. Here, the mean value was 3.28 and the standard deviation was 0.47. This was similar for the Engineering group as well. However, the Education group expressed a lower preference for e-learning use.

The perception of students towards the effectiveness of e-learning varied according to their college, $F (8, 426) = 11.48$, $p < .001$. Although students of Economics and Political Sciences were quite appreciative ($M = 3.60$, $SD = 0.47$), similar trends were visible in Medicine and Health Sciences ($M = 3.58$, $SD = 0.58$) as well. However, students of Education were less in their assent ($M = 2.89$, $SD = 0.64$). Slightly higher but equally modest was the case with Arts and Social Sciences ($M = 3.03$, $SD = 0.41$).

In the area of training and readiness, the differences among the colleges were evident, $F(8, 426) = 32.97$, $p < .001$. The students in Engineering were significantly more ready on average: 3.95 on the scale with a deviation of 0.52, compared to the students of Arts and Social Sciences, whose average score was 2.84 with a deviation of 0.38. The students of Medicine and Health Sciences were not far behind the

engineers with a score of 3.91 on average with a deviation of 0.42. In contrast, the students of Education scored 2.98 on average with a deviation of 0.65 on the readiness scale. Finally, the nursing students scored 2.99 with a deviation of 0.46. All the above differences proved to be statistically significant through follow-up tests.

Perceptions with respect to challenge differ for college groups, F (8, 426) = 3.43, p = .001. When pairwise comparisons are considered using Tukey's test, students in Economics and Political Science perceived higher levels of challenge, averaging 3.37 on the scale (SD = 0.49), compared to Education students, who averaged 2.85 (SD = 0.64) on the scale. The difference of this size showed up sharply in the data.

4.7 Correlation Analysis

Pearson correlation coefficients are calculated to investigate the correlations among the core variables in the study. Both student-related variables and teacher-related variables are analyzed separately in accordance with the study design.

Table 2
One-Way ANOVA Results for Differences in E-Learning Variables by College

Variable	Source	SS	df	MS	F	*p*
E-learning Usage	Between Groups	17.003	8	2.125	7.65	< .001
	Within Groups	118.424	426	0.278		
	Total	135.427	434			
Perceptions of E-learning	Between Groups	27.344	8	3.418	11.48	< .001
	Within Groups	126.828	426	0.298		
	Total	154.172	434			
Training and Readiness	Between Groups	74.733	8	9.342	32.97	< .001
	Within Groups	120.689	426	0.283		
	Total	195.422	434			
Challenges	Between Groups	10.236	8	1.279	3.43	.001
	Within Groups	159.145	426	0.374		
	Total	169.381	434			

4.7.1 Student Variables

Pearson correlation analysis was employed to analyze the results for students to determine the inter-relationships between e-learning usage frequency, e-learning effectiveness, training and readiness, and challenges faced. The results are presented in Table 3. The data suggest that the student variables are

all significantly and positively correlated ($p < 0.01$). E-learning usage was moderately correlated with students' perception of e-learning effectiveness and readiness ($r = 0.456$). However, a stronger positive correlation was found between students' perception and readiness ($r = 0.573$). The perceived challenges also correlated positively with usage ($r = .253$), perceptions ($r = .326$), and readiness ($r = .373$). Though these values are lower in strength, all are significantly correlated.

4.7.2 Instructor Variables

A Pearson correlation test was employed to determine the relationships between instructors' use of e-learning, best practices in e-learning, perceptions of challenges in e-learning, and beliefs about e-learning. The correlation test results are presented in Table 3. The results of the analysis made it clear that a strong and positive relation exists between instructors' e-learning usage and best practices applications ($r= .749$, $p< .01$). There are moderate and positive correlations between e-learning beliefs and best practices applications ($r= .493$, $p< .01$). There were smaller positive associations between usage and challenges ($r = .274$) and between beliefs and usage ($r = .271$). The correlation between beliefs and challenges is small and not statistically significant ($r = .089$).

4.8 Summary of Key Findings

Findings suggest e-learning tools see regular adoption among faculty and learners at Sultan Qaboos University, especially official platforms like LMS and online classroom environments. Still, newer tech - such as AI-based programs - is applied far less often. Though institutional support drives common usage patterns, cutting-edge digital resources remain on the margins of daily teaching practice.

Table 3
Pearson Correlation Matrix for Student and Instructor E-Learning Variables

Panel A: Student Variables (N = 435)				
Variable	**1**	**2**	**3**	**4**
1. Usage Frequency	1			
2. Perceptions	.456**	1		
3. Training & Readiness	.456**	.573**	1	
4. Challenges	.253**	.326**	.373**	1
Panel B: Instructor Variables (N = 48)				
Variable	**1**	**2**	**3**	**4**
1. Usage Frequency	1			
2. Best Practices	.749**	1		
3. Challenges	.274	.339*	1	
4. Beliefs	.271	.493**	.089	1
Note. $p < .05$. **p** < .01 (two-tailed).				

Most learners along with teachers saw clear benefits in online education, particularly when it came to reaching courses easily, adapting schedules, or staying in touch. Still, views on artificial intelligence features stayed somewhere in the middle - neither fully skeptical nor convinced, just carefully weighing what these systems contribute inside classrooms.

Although the awareness of digital systems and artificial intelligence was apparent in the audience, their perception of appropriate support in learning remained in the middle ground. This was reflected in the feedback given by learners and teachers alike as to how comfortable they felt using online learning platforms. Although technology was in widespread use, it was not yet fully facilitated in preparation. The thing to note here is that experience does not necessarily translate to confidence. One of the themes that emerged as relating to intermediate barriers in implementing e-learning was matched by another one. Barriers related to artificial intelligence were also recurrent in answers. Issues related to systems and connectivity were also common. Looking closer at the numbers, “year of study and college” were important in determining the way students used e-learning, their attitudes towards e-learning, their readiness for e-learning, and the barriers they experienced. Not so for “gender” – these did not appear in the numbers. Correlation analysis indicated that there is a positive relationship between usage and perceptions of effectiveness, training, readiness, and challenges among both students and lecturers.

5.0 Discussion

This paper aims to explore the usage state, perception, readiness, and challenges of e-learning among lecturers and students in the context of the Sultan Qaboos University. Findings from the study are valuable contributions to the body of knowledge in the post-pandemic adoption of digital and AI-based learning in higher education in an Omani setting that can be considered as non-Western.

5.1 E-Learning Usage and Adoption Patterns

Consistent with previous academic research within the same discipline and geographic area (Ali et al., 2018) the data from this study shows that at SQU, e-learning platforms, particularly LMSs and Virtual Classroom Tools, have become institutionalized into teaching and learning processes. Additionally, the significant level of usage for the core LMSs indicates that the use of e-learning has been institutionalized due to the COVID-19 pandemic and represents a fundamental aspect of teaching and learning now. The current pandemic situation further emphasized this trend, where the key problem in teaching during this time remained not in providing devices but in not being competent in technology usage.

Conversely, while AI tools were found to have been used at moderate to low levels, and there appeared to be significant discrepancies between users (uniqueness in the way they are being used), AI tools appear to be in the exploratory stage in terms of e-learning applications, and this is reflective of the findings from other recent publications which demonstrate rapid popularity of AI tools but also demonstrate a hesitancy to integrate them into the curriculum as a result of uncertainty regarding the pedagogical application, ethical implications and issues around assessment validity (Kasneci et al., 2023; Zhai, 2022). Hence, the findings support the idea that the process of technology adoption (awareness and use) and technology integration (pedagogical preparation) are two separate components.

5.2 Perceptions of E-Learning Effectiveness

The students and lecturers at SQU both had positive perceptions regarding the nature of e-learning as it aided the students. They felt that e-learning offered them more flexibility regarding access and communication. Apart from these positive perceptions from both categories of users, there were some fewer positive perceptions concerning A.I. tools. For instance, despite being aware that A.I. would serve to help them gain information from different sources and completely different tasks, the students would less confidently believe that A.I. would serve to help them with academic studies. Educators found A.I to be beneficial but had some concerns about its implementation in terms of educational compatibility and integrity. The results of this study indicate a lack of relation between the usage of AI and higher-order teaching practices in literature, supporting reservations expressed in recent publications.

5.3 Training, Readiness, and the AI Paradox

A prominent contribution to this study has been the identification of what this study conceptualizes as an Artificial Intelligence Readiness Paradox. Even with moderate to high levels of exposure to the various AI tools that were available to them for a considerable amount of time, the responses from both instructors and students demonstrated that they felt unprepared to use these tools for academic purposes effectively. This is consistent with other recent studies in the literature that suggest that digital

familiarity does not necessarily correlate with digital capabilities or competence in terms of academic success at higher order levels (Zhai, 2022).

From a teaching perspective, this disparity can be associated with inadequate instructor training because there has been an overemphasis on technical features (e.g., how to use the tools) over support of instructional design (e.g., what is the most effective way to utilize these tools). Instructors and students expressed that opportunities for professional development remain restricted and that very few opportunities exist to provide them with training opportunities related to using AI in the evaluation, feedback, and analysis of student learning. Similarly, students have also reported a lack of guidance available in using AI ethically and effectively. This underscores the need to have initiatives that will instill pedagogical literacy and integrate AI in learning rather than just learning to operate AI tools.

5.4 Challenges and the Second-Level Digital Divide

Despite gaining access the barriers that have been identified within this study, including issues related to effectively using AI, and so on, are reflective of deeper structural barriers with respect to digital transformation at a higher education sector level. The barriers that have been established within the findings above also reflect a second level digital divide, whereby there is relatively equal access to technology within the sector; however, there is a vast divergence with respect to skill level, confidence, and technology usage. Moreover, the divide is shown for differences in disciplines and in the year of students as well. For instance, students in their final year and students in applied disciplines and college of science students have shown significant preparedness and use of AI, and these are likely due to their elevated usage of technology and needs of their disciplines as well.

5.5 Implications for Policy and Practice

The implications and impacts of this research study are of great significance for a variety of individuals and organizations. The university should create comprehensive professional development programs that go beyond the mere usage of platforms by developing staff skills for teaching using AI, using AI responsibly, and creating formative assessments. Coming to the level of students, there needs to be training on academic and digitals literacies, and the use of AI responsibly, such as teaching ethical usage. Coming to the nation level, this research contributes evidence and meaning to the national project, “Oman Vision 2040” by proving the need for aligning digitization in education with the readiness and teaching capabilities of the nation. Along with developing digitization, it is important for a nation to further develop instruction innovation.

5.6 Contribution to Literature

This research contributes to existing literature in three primary ways. The first of these is that it represents an integrated approach to examining the perspectives of both instructors and students from within one institution. The second is that it represents the extension of empirical evidence regarding e-learning and AI readiness within the Gulf Cooperation Council region and addresses a gap within the existing literature regarding the development of non-Western higher education. The third way in which

this research study adds to the literature is through conceptualization of the AI readiness paradox and development of a framework for understanding the disparities between exposure to technology and pedagogical ability or competence.

6.0 Study Limitations

This study has several limitations. The data gathered from a cross-sectional survey design reflect only one point in time, meaning that it is not possible to draw inference about causation or track changes over time using a longitudinal approach. Additionally, because self-reported information is collected through participant surveys, there is potential for response bias to affect the results obtained in this study. Finally, because the research was conducted solely within one public university, it will be difficult to generalize the results obtained from this study to other higher educational institutions located in Oman and the broader Gulf area.

To address the limitations of this study, future research could use longitudinal and mixed-method approaches to study how e-learning and the ability to use AI have been impacted by technological advances in higher educational systems over time. Moreover, research methodologies using interviews and classroom observation studies may offer some insight into pedagogy and context issues of technology integration within higher educational institutions. Moreover, comparisons in research studies may be carried out across public and private institutions as well as inter-country studies in the Gulf region to add to our body of knowledge regarding higher educational institutions experiencing the digital revolution. In conclusion, experimental research can be undertaken to add to our body of knowledge in this field of research witnessing rapid change and will help to collectively gain an understanding of how AI in classroom positively affects learning outcome.

7.0 Conclusion and Future Research Directions

This study examined the use of e-learning and AI technologies among undergraduate students and instructors at Sultan Qaboos University. The use of e-learning by Undergraduate Students and Instructors at the university through their use of e-learning technologies; their perceptions of eLearning; their level of preparedness to use e-learning technologies and their experiences of teaching and learning through e-learning technologies; and their perceived challenges. Using a comprehensive and comparative approach to data collection, this research produced empirical data about how students and instructors experience e-learning in Oman.

The results of this study indicate that many instructors and students have had positive experiences using e-learning technology; specifically, that the LMS and Virtual Classroom platforms are embedded into the teaching process in their respective institutions and are regularly used by all educators and their students. Both instructors and Undergraduate Students indicated that they believe e-learning is effective in meeting their teaching and learning needs, particularly in terms of flexibility and accessibility, communication and collaboration. The integration of AI-based tools into E-Learning remains slow,

primarily due to concerns over the pedagogical value of AI-based E-learning Technology; ethical use of AI-based E-Learning Technology; and how to maintain the academic integrity of assessments when AI technologies are used during the assessment processes. This study identifies an artificial intelligence readiness paradox. The data indicate that while learners and educators are exposed to and/or aware of artificial intelligence (AI) technologies, both groups lack sufficient self-efficacy and preparedness to use these technologies for academic purposes. Although both groups reported moderate levels of use, both groups identified gaps in how to be trained, supported pedagogically, and received institutional support.

Additionally, students and educators continue to be hampered by access to devices; limited internet connections; the breadth of AI platforms; and insufficient technical and pedagogical support. The exploration of demographic variables found that educational level and field of study were related to both the use and readiness level of the e-learning environment. Minimal evidence of gender differences was found in association to e-learning readiness. Specifically, upper-class students and students attending colleges of applied sciences or health sciences had greater knowledge and readiness related to e-learning than did students in other fields of study. The findings indicate that a second digital divide exists in relation to students' digital competence. The results suggest that Higher Education Institutions (HEIs) should move beyond a focus on technical infrastructure toward pedagogically driven digital transformation strategies. It is critical that HEIs include instructional designers in all Professional Development (PD) activities; the effective use of ethical AI; and strategies for evaluating learning. A structured PD system for students to develop digital literacy skills was recommended. In addition, at a national level, the study provides a basis for supporting the Oman Vision 2040 through its findings on how effective digital education requires investment in both technology and human capacity development.

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from the Sultan Qaboos University Research Ethics Committee. All research was conducted in accordance with relevant institutional and international guidelines and regulations, including the Declaration of Helsinki. All participants provided informed consent prior to participation, and appropriate measures were taken to ensure confidentiality and anonymity of the data.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author Contribution

The author, A.A., conceptualized the study and supervised the research. The authors, M.A.B,AE, and M.A.A., conducted data analysis and statistical modeling. Authors A.A., M.A.B,AE, and M.A.A drafted the manuscript. All authors reviewed and approved the final manuscript.

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Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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Figures

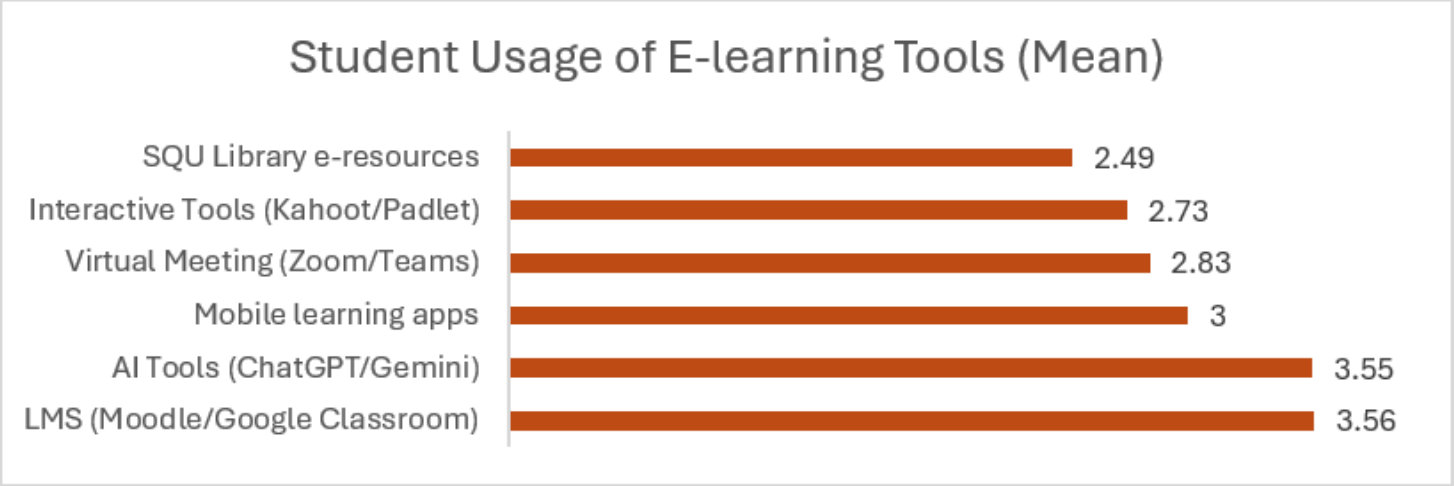


Figure 1

The frequency of e-learning tool usage among students

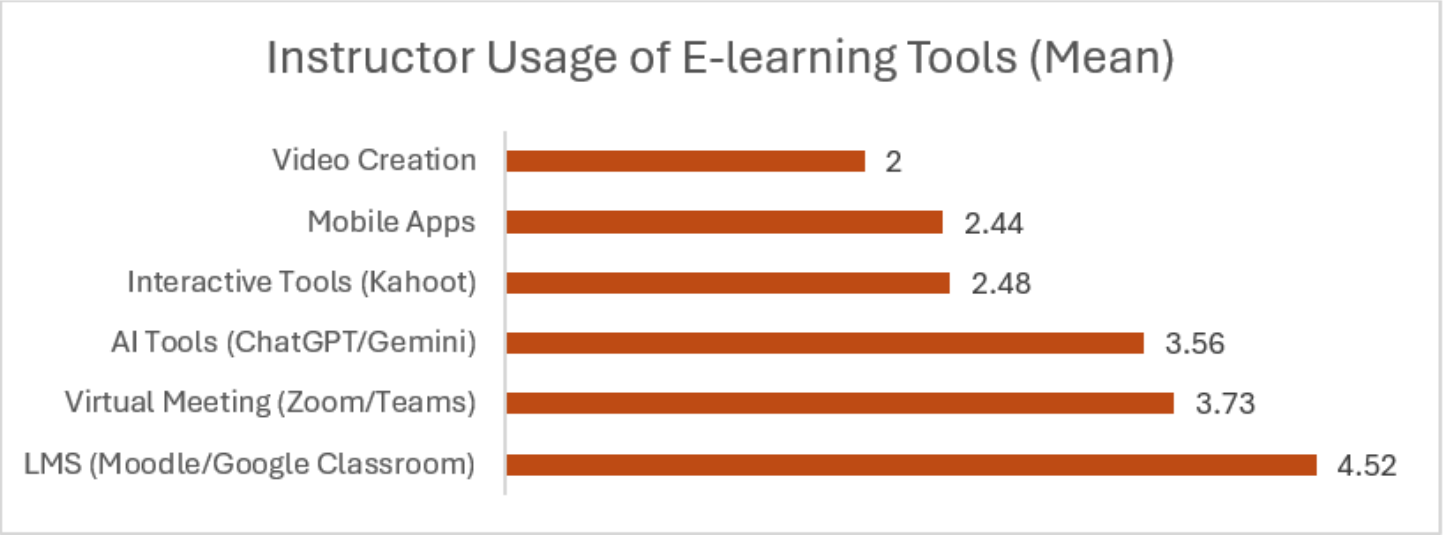


Figure 2

Instructors' frequency of e-learning and AI tool usage.