

Preparing Omani Pre-service Teachers for Online Teaching: Design, Development and Evaluation of a Professional Development Course

Rouhollah Khodabandelou¹, Abdelrahman Elhag¹, Ahmed Mohamed Fahmy Yousef¹

¹Instructional and Learning Technologies, College of Education Sultan Qaboos University, Muscat, Sultanate of Oman

Correspondence: Rouhollah Khodabandelou, Instructional and Learning Technologies, College of Education, Sultan Qaboos University, Muscat, Sultanate of Oman.

Received: June 6, 2026

Accepted: July 27, 2026

Online Published: July 29, 2026

doi:10.11114/jets.v14i4.8909

URL: <https://doi.org/10.11114/jets.v14i4.8909>

Abstract

This study addresses the current need for professional development programs to prepare Omani pre-service teachers to design online courses. Through a TPACK framework and a mixed-methods approach, we designed, implemented, and evaluated a professional development program intended to enhance both the pedagogical and technological competencies for online teaching. The program consisted of four modules on the foundation of online pedagogy, syllabus design, content development, and course management, contextualized to meet Omani educational needs. Data from 60 pre-service teachers via surveys, and reflections showed that there was a significant development in their confidence and skills regarding online course design. Findings reveal that high-quality course content, engagement, and effective organization are crucial for successful online teaching. This research identifies the need to develop necessary digital skills among future teachers and informs future professional development initiatives through a recommended empirical framework. The study identifies the development of online teaching competencies within teacher education programs as a strategic response to the evolving landscape of higher education in Oman.

Keywords: pre-service teacher, online course design, professional development, TPACK, active learning

1. Introduction

In alignment with global priorities, the demand for online education in Oman, continue to grow (Al-Fazari, 2023; Al-Omairi & Hew, 2022; Magd & Jonathan, 2023). Accordingly, the number of students taking online courses in Oman has been increasing annually, as reported in the *Annual Report on Higher Education Statistics in the Sultanate of Oman* (Ministry of Higher Education, Research and Innovation, 2022). However, designing high-quality courses has remained one of the main challenges of online teaching practice (Caskurlu et al., 2021; Hassan, 2021). Designing online courses fundamentally differs from that of traditional courses, requiring a distinct set of pedagogical and technological skills and competencies (Khodabandelou et al., 2024). Key pedagogical skills such as student-centered course design (Mucundanyi, 2021); the facilitation of interaction (Nilson & Goodson, 2021); and the implementation of effective assessment and feedback strategies (Pardino et al., 2018) have previously been investigated. These skills are critical for designing successful online courses. Additionally, proficiency with Learning Management Systems (LMS), data literacy, and multimedia content creation have been identified as the main and critical technological factors of an online course design (Bawa, 2020; Joosten et al., 2020).

Furthermore, teacher preparedness is critical for students' successful learning outcomes as it influences their academic performance (Damien & Claire, 2022) and increases teachers' long-term retention in their schools (Viviani et al., 2023). Knowledge supported by technology is an important aspect of modern societies. It is essential for sustainable development, particularly in knowledge-intensive sectors such as education, culture, and the economy. Oman recognizes this principle as a national priority. It aims to strengthen individuals' ability to use current information and modern technologies. It also promotes the production, dissemination, and effective use of knowledge and technology. In addition, it emphasizes awareness of information security and technology-related issues. It encourages the development of intellectual capital and supports the transition to a knowledge-based economy. National efforts also focus on producing and developing local knowledge, advancing information technology, strengthening research and technological capacity, and equipping individuals with the competencies and skills needed for the knowledge society (Education Council, 2017).

Research has shown that teacher preparedness enhances teaching effectiveness and improves teaching experiences (Lasagabaster, 2022). It has also become a key factor in promoting effective and equitable teaching practices. The integration of pedagogical, technological, and content knowledge is conceptualized in the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler et al., 2013; Mishra & Koehler, 2006). TPACK is widely recognized as a foundational framework for designing effective online courses (Anderson et al., 2013; Benson & Ward, 2013). The framework consists of three core knowledge domains: content knowledge (understanding the subject matter), pedagogical knowledge (understanding effective teaching and learning strategies), and technological knowledge (understanding digital tools and technologies). TPACK emphasizes that effective teaching requires more than mastering each domain independently. Rather, teachers must understand how these domains interact to select appropriate technologies that support pedagogical approaches and effectively represent subject content in specific learning contexts as depicted in Figure 1.

Following Mishra and Koehler (2006), designing effective online learning requires instructional designers to align technological tools with pedagogical strategies and content-specific characteristics to create dynamic and meaningful learning experiences. From an operational perspective, the TPACK framework is widely used to guide instructional designers in integrating technology, pedagogy, and content when designing online courses. This integrated approach helps create learning experiences that are engaging, effective, and aligned with instructional goals (Mishra et al., 2022).

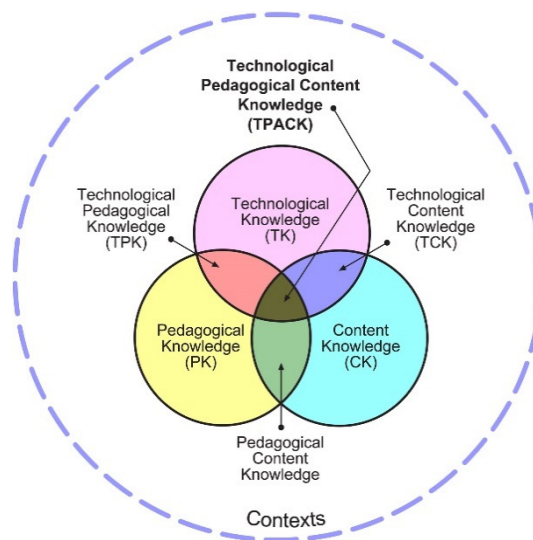


Figure 1. TPACK model (Mishra et al., 2022)

Designing an effective online course requires consideration of factors beyond technology, pedagogy, and content. These factors include learner diversity, learning environments, industry standards, accessibility, safety, and cost. They also include the growing role of artificial intelligence (AI) in teaching and learning. Recent research has extended the TPACK framework to AI-TPACK. This framework highlights the integration of AI technologies with pedagogical approaches and subject content to create meaningful and personalized learning experiences (Zhang et al, 2026). Another important framework is the Universal Design of Instruction (UDI). UDI provides principles for designing learning environments that are accessible and usable by all learners without requiring adaptation or specialized design (Burgstahler, 2020). As a result, UDI has become an important framework for developing inclusive online learning environments and has been widely applied in educational research (Levey, 2018; Rao et al., 2014).

Additionally, Bawane and Spector (2009) proposed a set of roles that online instructors are required to take in online teaching practices. These roles are essential successful competencies for designing online courses. Pedagogical, technologist, evaluator, social, administrator, advisor, and researcher are some of the identified roles of instructors in online learning environments. Of those listed, pedagogical roles are ranked most significant/ most important. Bawane and Spector's (2009) approach is more flexible to online course design skills due to the variety of roles and competencies applied in online settings (Roddy et al., 2017). As Khodabandelou et al. (2024) articulate, "...experiencing successful online teaching in higher education requires acquiring a wide range of roles and competencies ..." (p. 2515).

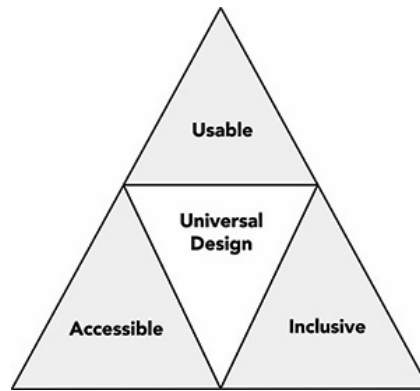


Figure 2. Universal Design of instruction (Burgstahler, 2020)

Globally, higher education has faced several major challenges in recent years. These challenges became more significant during the COVID-19 pandemic (Elmesalawy et al., 2021). They have continued to grow with the rapid development of artificial intelligence (AI), increasing cybersecurity threats, and changing workforce demands. Higher education institutions have also experienced curriculum changes, evolving campus roles, rising educational costs, and rapid technological advancement (Gallagher & Savage, 2023; Kumi-Yeboah, 2018; Rawas, 2024). Among these, technological advancement has had the greatest impact on teaching and learning. As a result, many institutions have expanded online education. Online learning provides greater flexibility, accessibility, and continuity (Metwally et al., 2020). Although it presents several challenges, it continues to grow and offers many educational benefits (Kebritchi et al., 2017). One important application of online learning is the delivery of professional development (PD) programs for educators.

These professional development programs may improve instructors' teaching knowledge, skills, and instructional practices (Kara & Yildirim, 2020; Satar & Akcan, 2018). In Oman, such programs include workshops on online teaching, learning management systems (e.g., Moodle), digital assessment, educational technologies, and, more recently, the integration of artificial intelligence into teaching and learning (Elhag et al., 2025; Yousef et al., 2025). Most preservice teachers in Oman are preparing to teach in face-to-face classrooms. However, they are also expected to work in technology-rich learning environments. Recent reforms have strengthened digital competencies through national standards and accreditation requirements. These reforms include educational technologies, information technology skills, and, more recently, artificial intelligence (AI) in teacher preparation programs. However, digital literacy alone is not enough. Future teachers also need the skills to design high-quality online and blended learning experiences. These skills help teachers support flexible learning, use AI effectively, integrate learning management systems, and respond to future educational challenges. Therefore, preparing preservice teachers to design online courses has become an important part of teacher education in Oman (Al-Amri et al., 2021; Al Shabibi & Silvennoinen, 2018). Nowadays, the debate has no longer focused on comparing the effectiveness of online courses, but on how to train students to teach effectively online later (Dolighan & Owen, 2021; Philipsen et al., 2019, 2023). Unfortunately, most PD programs targeting online teaching are only for faculty members teaching or expected to teach online in higher education settings (Alzahrani & Althaqafi, 2020). Therefore, there is a lack of online PD programs to prepare pre-service teachers to design online courses, particularly in Oman (Al Jabri et al., 2018; A. Al Shabibi et al., 2019; Al Shabibi & Silvennoinen, 2018). Hence, this study aimed to address this gap. It designed, developed, and evaluated an online professional development (PD) program for undergraduate pre-service teachers in Oman. The program aimed to improve their knowledge and skills in online course design. The study was guided by the following research question: How can an online professional development program be designed, developed, and evaluated to enhance Omani pre-service teachers' knowledge and skills in online course design?

2. Method

This study adopted the Design-Based Research (DBR) methodology. It followed the framework proposed by McKenney and Reeves (2018). DBR is a systematic and flexible research methodology for improving educational practices (Jia et al., 2023). It enables researchers and instructional designers to develop, implement, and refine learning environments in authentic educational settings. DBR also integrates design principles and learning theories to address complex educational problems (Barab & Squire, 2016). The methodology has been widely used in educational technology research (Du et al., 2024; Jia et al., 2023; Oyelere et al., 2018). It helps overcome some of the limitations of traditional research methods (Amiel & Reeves, 2008). Interest in DBR has continued to grow over the past two decades (Anderson & Shattuck, 2012). Although several DBR models have been proposed (Amiel & Reeves, 2008; Anderson & Shattuck, 2012; Easterday et al., 2014; Wang & Hannafin, 2005), this study followed the procedure developed by McKenney and Reeves (2018).

2.1 DBR Procedure

According to McKenney and Reeves (2018), Design-Based Research (DBR) consists of four iterative phases. The first phase is analysis and exploration, in which researchers identify the problem and examine the theoretical and practical context. The second phase is design and construction, in which the intervention is designed and developed. The third phase is evaluation and reflection, which involves testing, evaluating, and refining the intervention. The final phase is implementation, in which the intervention is applied in a real-world setting. Following this framework, the present study designed, developed, evaluated, and implemented an online professional development (PD) course to prepare Omani pre-service teachers to design online courses. Figure 3 illustrates the four phases of the study. The phases were implemented iteratively throughout the research process.

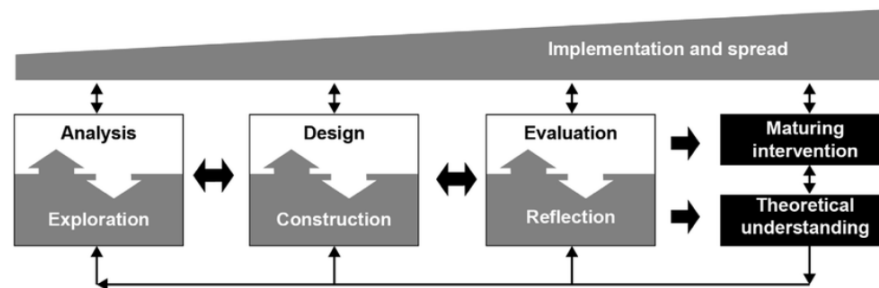


Figure 3. Generic model for conducting educational design research (McKenney & Reeves, 2014)

2.2 Context and Participants

The testbed was a 4-week PD modular-based course. The main aim of the PD course was to increase pre-service teachers' knowledge and skills in online course design. The whole course was delivered online. The study was conducted at an Oman public university. The course is offered to three classes of students including TECH3006, TECH5001, and TECH2108 in a single fall semester as presented in Table 1. These are service courses of the ILT department that are offered to pre-service teachers every semester. The instructor and students in their conventional classes met face-to-face first. The instructor described the aim and procedure of the study clearly. Then he asked those who were interested in participating in the study to read and sign the agreement paper.

The majority of the participants were female 42 (70%) which represents, a significant number of the sample. In contrast, only 18 (30%) were male students showing a notable gender imbalance among the respondents.

Table 1. Participants' details

No	Class	Number of Participants	Percentage
1	TECH3006	21	33.33%
2	TECH5001	19	23.81%
3	TECH2108	20	42.86%
Total		60	100%

2.3 Instrumentation

The online PD course was evaluated using two instruments: a custom-designed survey and a student reflection. The survey evaluated the course in terms of relevance, engagement, and organization. It also measured participants' confidence in different aspects of online teaching and their perceptions of the course materials. The survey consisted of 20 items rated on a 5-point Likert scale. To reduce potential bias and improve content validity, the survey items were developed based on the study objectives and relevant literature. They were reviewed by experts in educational technology and instructional design before implementation. A pilot test was also conducted with a small group of students to evaluate item clarity and wording. Feedback from the expert review and pilot test was used to revise the survey before it was administered. The final version was created using Google Forms and administered at the end of the course. Table 2 presents the interpretation of the 5-point Likert scale used in this study.

Table 2. Level of agreement description

Likert scale	Scale value	Level of agreement
1	1.00–1.80	Very low
2	1.81–2.61	Low
3	2.62–3.42	Moderate
4	3.43–4.23	High
5	4.24–5.00	Very high

Phase 1: Analysis/Exploration/Needs Assessment

The first phase of DBR involves identifying the research problem through a review of the literature and a needs assessment. We reviewed the literature on online course design and surveyed the target participants. The findings showed that, although preservice teacher education programs in Oman are strengthening digital competencies, they provide limited preparation for designing online courses. This gap informed the design of the professional development program.

To gain deeper insights, a comprehensive needs analysis was conducted to examine online teaching readiness among Omani pre-service teachers. The participants were enrolled in two teacher preparation courses, TECH5001 and TECH3006. These courses introduce the concepts of educational technology and instructional media. They also focus on online learning and digital learning resource design. In addition, they emphasize the integration of emerging educational technologies into teaching and learning. Students develop practical skills in creating presentations, interactive learning materials, concept maps, educational videos, virtual classrooms using learning management systems, websites, and digital portfolios.

A total of 25 pre-service teachers participated in this phase. Data were collected using a survey and focus group discussions with the student participants. The survey identified the prevalence of the challenges, while the focus groups provided a deeper understanding of students' experiences and training needs. The findings revealed limited exposure to digital tools, insufficient preparation in online pedagogy, and limited hands-on experience in designing engaging, effective, and efficient online learning environments (Merrill, 2002, 2012). These findings highlighted the need for a professional development (PD) course on online course design. The results also guided the learning objectives and design requirements of the PD course. Accordingly, the course focused on developing practical knowledge and skills in online course design to enhance student engagement in online learning environments.

Phase 2: Course Design

We then propose a set of design activities to address the above-mentioned challenges. These design activities, formulated based on the results of the previous stage. During the design stage, researchers utilize design propositions to support the design of the intervention. TPACK, UDI, and Bawane and Spector's (2009) online teacher competencies list were used to design the modules. The combination of these theories and models led to the creation of four (4) modules:

1. Foundations of Online Teaching: Focused on fundamentals of online pedagogy.
2. Planning and Syllabus Design Online Course: Getting to know about backward design and Practical training on platforms like Google Classroom, and Nearpod.
3. Developing Online Content & Assessments: Focused on best practices for creating multimedia content, types of online assessments, and tools for content creation: H5P, Padlet, and Google Forms.
4. Course Management and Accessibility: Focused on principles of accessibility and universal design for learning, and strategies for effective communication and collaboration.

The content was contextualized to align with Omani cultural and educational needs, ensuring relevance and applicability. The course learning materials, activities, and theoretical underpinnings are summarized in Table 3.

Table 3. The course learning materials, activities, and theoretical underpinnings

Module	Goal	Activities	Theoretical Framework	Alignment with Omani National Priorities
1. Foundations of Online Course Design	Introduce the concepts, principles, and importance of online learning.	Group discussions and exploration of online course fundamentals.	Bawane & Spector (2009)	Supports the Philosophy of Education by developing digital literacy, technology awareness, and competencies for the knowledge society (Education Council, 2017). Aligns with teacher preparation standards for educational technology.
2. Planning and Syllabus Design	Develop skills in planning and designing online courses using backward design.	Design an online syllabus and learning outcomes.	UDI; Bawane & Spector (2009)	Supports learner-centered curriculum design, inclusive education, and quality assurance requirements in Omani higher education.
3. Developing Online Content	Develop skills in creating online learning materials and digital assessments.	Create multimedia learning resources and online assessments.	UDI	Aligns with national priorities for integrating educational technologies, developing digital content, and promoting innovative teaching practices.
4. Course Management	Develop skills in managing online courses and supporting learner engagement.	Apply strategies for communication, collaboration, accessibility, and feedback.	TPACK	Supports effective technology integration, inclusive learning environments, and professional competencies expected of future teachers under Oman's teacher education standards.

Phase 3: Program Development

Instructional materials were developed by the authors and uploaded into TalentLMS (the most recent LMS tool) to support the program, including lesson plans, video tutorials, and interactive activities. TalentLMS (See Figure 4) was implemented because it is a common application used to enhance knowledge and skills acquisition by professionals (Udosen & Edem, 2024). Additionally, TalentLMS offers a user-friendly interface, customization and flexibility, and analytics and reporting features. Multimedia resources, and step-by-step guides, were created to enhance engagement and usability. A preliminary pilot of these materials was conducted with a small group of students to refine content and ensure clarity.

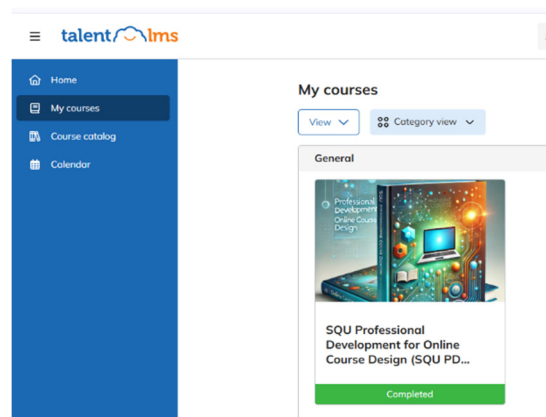


Figure 4. Professional development for online course design on TalentLMS

Instructional strategies

The instructional strategies were carefully selected to promote active learning, collaboration, and sustained engagement. The professional development program was delivered fully online through a module-based structure. Each module included clear learning objectives, learning materials, practical activities, and assessments. Virtual office hours were provided to support participants, answer questions, and provide timely feedback. Collaborative activities, such as online discussions and peer interaction, encouraged participants to share ideas and learn from one another. Motivational strategies, including regular reminders, progress tracking, and timely feedback, were used to encourage participants to complete the program. The course was delivered over four weeks. This duration was selected based on the recommendation of Darling-Hammond et al. (2024), who argued that effective professional development should be sustained over time to improve learning outcomes and teaching practice.

Phase 4: Implementation

The program was conducted with a cohort of Omani pre-service teachers (students in TECH5001, TECH2108, and TECH3006) through an online delivery format using TalentLMS. The total participants were 60 students. Training emphasized hands-on practice, collaborative projects, and evaluations. Pre-and post-training surveys indicated improvements in participants' knowledge and skills in online course design.

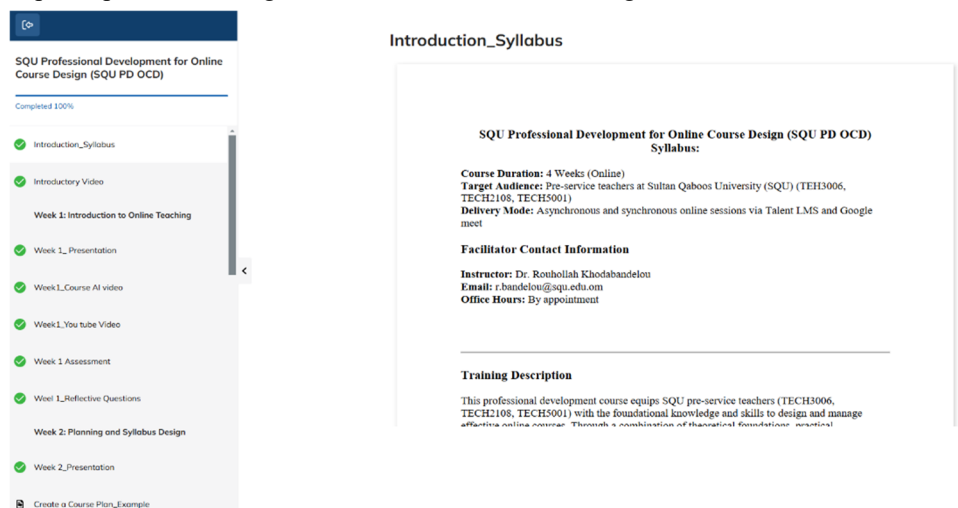


Figure 5. Illustration of the Opening page of the PD course

Phase 5: Evaluation and Refinement

Participants' feedback was collected through reflective writing at the end of the program. The reflections provided insights into their learning experiences and perceptions of the course. Participants reported improved knowledge and skills in online course design and greater confidence in using digital technologies for teaching. They also identified areas for improvement, including increasing interactive activities and simplifying some technical instructions. These suggestions were incorporated into subsequent revisions of the course. The findings from the reflections were consistent with the pre- and post-training survey results, which showed improvements in participants' knowledge and skills in online course design.

2.4 Data Analysis

The quantitative data were analyzed using descriptive statistics. Means and standard deviations were calculated for all survey items to summarize participants' responses. The qualitative data consisted of 32 written reflections completed at the end of the course. These reflections were analyzed to gain a deeper understanding of participants' learning experiences and perceptions of the PD program. Voyant Tools, a web-based text mining and visualization platform, was used to support the qualitative analysis (Gregory et al., 2022; Miller, 2018; O'Keefe et al., 2023). Voyant Tools was selected because it provides a systematic and transparent approach to exploring textual data. It identifies frequently used words, recurring themes, and relationships among concepts through word frequency analysis and text visualizations (Horenberg, 2024). The results from Voyant Tools were interpreted alongside the survey findings to provide a more comprehensive evaluation of the PD program.

3. Results and Discussion

First, the literature review and needs assessment identified a gap in PD programs for preparing Omani pre-service teachers to design online courses. The needs assessment included 25 students from two courses (TECH3006 and TECH5001). It examined their interest and training needs in online course design. The results showed that students were interested in developing these skills.

Based on these findings, the online PD program was designed and implemented. Sixty students from three College of Education courses participated in the study. Four students (two males and two females) participated in follow-up interviews. The program was evaluated using a summative evaluation approach. The evaluation focused on content quality, engagement, and organization. The results showed that the program reached the mature level in all areas. A post-course survey was conducted after completing the program. More than 60% of participants reported that the course content was very helpful.

Table 4. Participants' Perceptions of Online Professional Development Course Quality

Statement	Mean	SD
I feel confident in planning an online course.	4.07	1.03
I feel confident in writing an online course syllabus.	3.90	1.07
I feel confident in writing effective learning objectives.	4.10	0.85
I feel confident in creating my own course content.	4.06	0.89
I feel confident in using rubrics to assess the quality of an online course.	3.80	1.03
Overall, I found the course content to be good.	3.83	1.06
I found the course materials (documents, videos, websites) to be useful.	4.10	0.90
The assignments were explained clearly.	3.80	1.02
I feel more prepared to teach online after completing this course.	4.00	0.97
The course objectives were clearly defined.	4.00	1.00
Overall	3.97	0.982

As shown in Table 4, the overall mean score for course quality was high ($M = 3.97$). This indicates that participants had positive perceptions of the PD course. This result may be attributed to the structured design of the program, as well-designed PD programs can improve participants' confidence and skills in teaching and designing online courses (Kara & Yildirim, 2020; Kebritchi et al., 2017).

The item "I feel confident in planning an online course" received a high mean score ($M = 4.07$). This indicates that participants developed confidence in planning online courses after completing the program. Effective planning is essential in online education because it influences the learning process and outcomes (Lyublinskaya & Du, 2024). Similarly, the item "I feel confident in writing effective objectives" received a mean score of 4.10. This result shows that participants gained confidence in developing clear learning objectives. These objectives help guide course structure and assessment activities (Daryanes et al., 2023). This finding supports previous research highlighting the importance of clear objectives in effective online learning environments (Rusticus et al., 2023).

The responses to "Overall, I found the course content to be good" (mean = 3.83) and "I found the course materials (documents, videos, websites) to be useful" (mean = 4.10) reflect positive feedback on the content delivered. This implies that the higher score for perceived usefulness of materials means participants felt that the resources used, such as documents and videos, were useful in supporting their learning. Again, this corresponds with research findings, such as Clark & Mayer (2023), which indicate the great importance of multiple forms of multimedia in online learning that can appeal to different learning styles and promote greater interaction.

The data from table 4 presents generally positive responses regarding course content development and rubric use. For example, an average of 4.06 for "I feel confident in creating my own course content" indicated that learners actually felt capable of creating original online materials, which is an integral component of engaging learning experiences in nature. However, the low mean of 3.80 for "I feel confident in using rubrics to assess the quality of an online course" indicates that there is uneasiness in the applied use of rubrics within online education despite their theoretical value highlighted by Yousef et al. (2015). Additional guidance on using rubrics could raise levels of confidence.

The participants felt prepared: the mean scores were 4.00 for "I feel more prepared to teach online" and 3.90 for "I feel confident in writing an online course syllabus." The latter score might indicate that syllabus design is complex (Hinestroza et al., 2024) and therefore more examples are needed to enhance the participants' skills. The statement "The assignments were clearly explained" had an average score of 3.80, indicating that some participants did not find the instructions for assignments clear. Research has shown that vagueness in online instructions may cause confusion and negatively affect learner outcomes (Elumalai et al., 2020). Future courses should consider clearer instructions and more detailed rubrics.

Table 5. Likert Scale results of the Engagement

Statement	Mean	SD
The time and effort I invested in the course felt worthwhile.	3.62	0.91
I found the course to be engaging.	3.59	0.92
I believe that participating in this course will positively impact my future teaching.	4.00	1.14
I would recommend this course to others.	3.73	1.02
I found the course site (LMS) easy to navigate.	3.83	1.03
Course Engagement Average	3.754	1.004

To assess students' perceptions of the course organization, five questions were asked and revealed an overall confidence in its structure. The statement "The time and effort I invested in the course felt worthwhile" received a mean score of 3.62, which indicates moderate consensus on the course's value relative to the time invested, though some divergence in opinion exists. Improving perceived value is considered very critical for learner motivation and persistence (Wei et al., 2025), so perhaps content or delivery should be improved. Engagement itself represents a crucial factor in sustaining motivation within online courses, as noted by Ferrer et al. (2022). The item for "I found the course to be engaging" reached an average of 3.59, which is a midlevel engagement, but there is definitely room for improvement, such as introducing more interactive elements.

The highest average score of 4.00 was on the statement "I believe that participating in this course will positively influence my future teaching," suggesting participants felt that the course effectively communicated relevant skills. Future courses could focus more on specific applications of the material to further reinforce its impact on teaching. Regarding navigation, the statement "I found the course site (LMS) easy to navigate" scored 3.83, indicating general user-friendliness, though a standard deviation of 1.03 suggests some participants struggled. Clear navigation is essential for effective participation, indicating a need for tutorials or guided tours to enhance the experience for all students.

These are results from the course evaluation to yield insightful feedback on statements which give participants confidence in such areas as: online course design, the adequacy of the course content and how OER could be useful. Analyses from all these statements depict strengths to pinpoint where potentially improvements can be identified as summarized in Table 6.

Table 6. Likert Scale Results of the Organization

Statement	Mean	SD
I feel confident in structuring and organizing an online course effectively after completing this course.	3.90	0.91
The amount of content covered in this course was appropriate.	3.75	1.02
I feel confident in finding and using OER for my courses after completing this course.	4.19	0.95
The course was well organized.	3.73	0.94
The structure and design of the course helped me understand what constitutes a quality online course.	3.83	0.93
Course Organization Average	3.88	0.95

Prior studies have highlighted the significance of confidence in structuring online courses and utilizing OER (Riggs, 2023). The statement "I feel confident in structuring and organizing an online course effectively after completing this course" obtained a mean of 3.90 and a standard deviation of 0.91, which signifies a relatively high level of confidence about the ability to organize and structure an online course. The current investigation found that effective course design is considered a critical feature of online learning, directly affecting student engagement and learning outcomes. As stated by Clark and Mayer (2023), the relatively positive result would indicate that the course gave useful tools and strategies for organizing course content in a coherent and engaging way.

Closer inspection of the table shows that "The amount of content covered in this course was appropriate" had a mean score of 3.75 and a standard deviation of 1.02. Although the result is positive, the standard deviation is high enough to indicate considerable variability in the responses of the participants. That is, participants were divided between the feeling that the content was either too much or too little to be covered in the time allocated. Moreover, the statement, "I feel confident in finding and using OER for my courses after taking this course," had a mean of 4.19 with a standard deviation of 0.95. This reflects strong confidence in the ability to locate and utilize open educational resources (OER), important for creating accessible and affordable learning materials (Bozkurt et al., 2023). The course appears to have provided the participants with the necessary skills and knowledge regarding the use of OER in teaching.

Turning now to this item "The course was well organized" had a mean rating of 3.73 and a standard deviation of 0.94; and item "The structure and design of the course helped me understand what constitutes a quality online course" had a mean score of 3.83, with a standard deviation of 0.93. While the score of both items is positive, the standard deviation suggests that some participants may have found the organization of the course less intuitive or efficient. Clarity and organization are vital in online courses to ensure that participants can easily navigate materials and complete assignments without unnecessary confusion (Zhu et al., 2024). To improve, in the future, the course could include a more structured roadmap or timeline at the beginning, which would include key milestones and deadlines to enhance clarity and help learners better plan their engagement with the course.

3.1 Reflection Analysis

The reflections of the students provide us valued insights into their experiences from the PD course on online course design. Overall, they appreciate the practical applications of the course and the importance of technology in teaching as highlighted in the word cloud in Figure 7.



Figure 7. Word cloud of the practical applications of the course and the importance of technology in teaching

3.2 Key Insights in Student Reflections

Students provided detailed reflections on five key themes: technology, the training program, teaching and learning, the course, and the content itself, as illustrated in Figure 8.

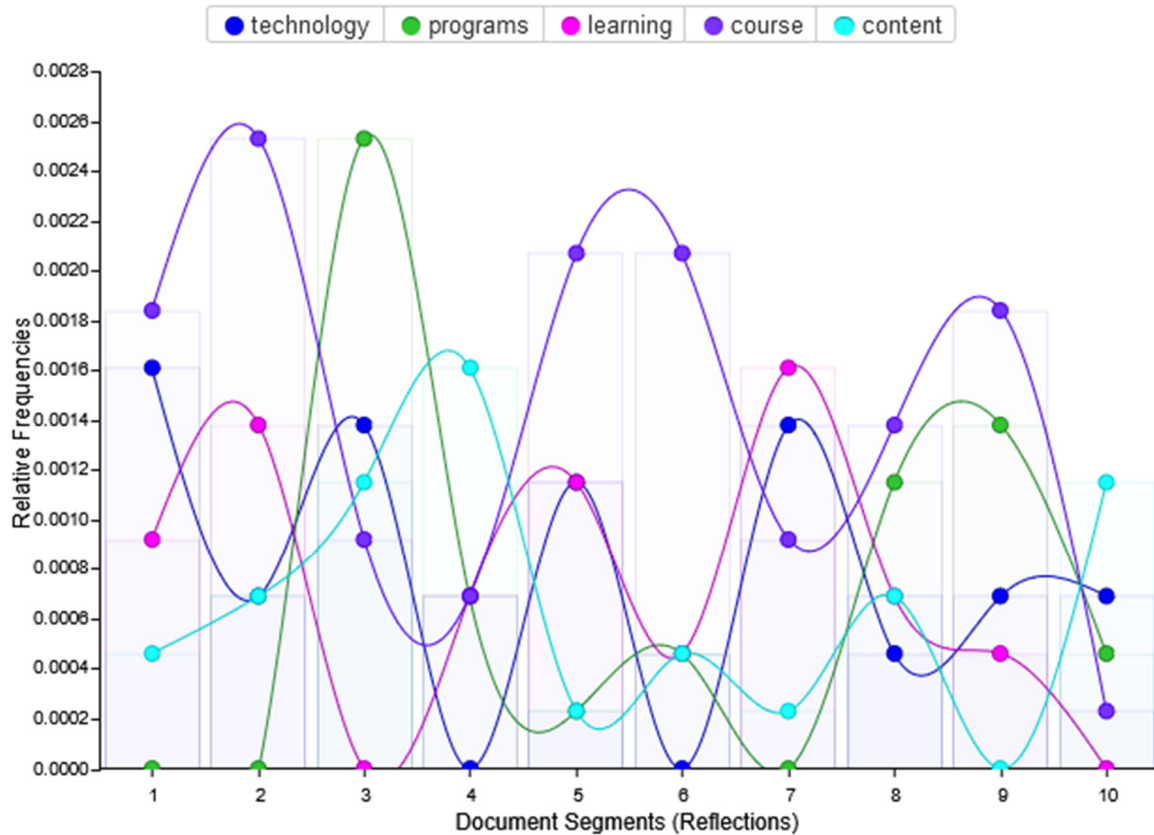


Figure 8. Key insights in student reflections

The most important result was that most of students acknowledged the integration of technology into their teaching practice. One student mentioned, "This course gave us abundant information and experience about the most important websites and programs that will facilitate the educational process." This statement demonstrates a growing realization among pre-service teachers that technology is here to stay in today's education and supports the work of Tondeur et al. (2017), who stated that teachers need to be better prepared to integrate technology into their classrooms.

Students pointed out the practical nature of the course assignments, which allowed them to apply theoretical concepts in real-world contexts, and these were linked with the course objectives and their skills as shown in Figure 9. One stated, for instance, "The tasks assigned to us were motivating and useful, especially the tasks that required us to prepare lesson plans using the TPACK and ASSURE models." This is congruent with the constructivist theory of learning, contending that experiential learning is a sure way of improving understanding.

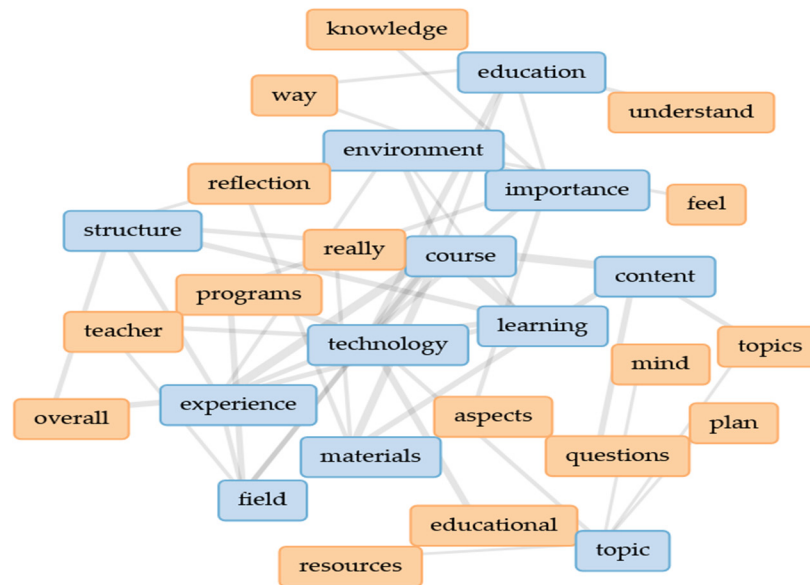


Figure 9. Linked keywords analyzed from students' reflection

We therefore had to conduct an analysis of the connections as shown in Figure 10 to clearly understand the relationships that exist among the many topics. Such an analysis has shown that areas like integration of technology in education-video usage, technological skills, and readiness to teach online-came out as the strongest contributors in the development of participants' skills.



Figure 10. Ranking of most reflected keywords

The findings highlight the vital place of technology in the digital era. With educators increasingly integrating digital tools into teaching, the need to understand how such technologies influence the development of skills becomes relevant (Ra et al., 2019). The emphasis placed on video as a learning medium underlines its effectiveness in engaging students and promoting their understanding. The experiences of the participants with the technological tools also point to an increased awareness of the need for educators to be conversant with the same.

The reflections stressed the need for clear resources and support through the course. One student highlighted that "offering more support, such as tutorials or mentorship, would help those students who are less familiar with technology." This shows how scaffolding, as argued by Børte et al. (2023), is needed to provide the learner with extra guidance on how to do something in a complex field like technology integration.

4. Implications

This study highlights several implications for future professional development (PD) in education. First, the modular design of the course improved its scalability. It can be adapted for different teacher training contexts and support the expansion of online education. Second, the program improved participants' skills in online course design and implementation. It enhanced their technological, pedagogical, and content knowledge (TPACK) and helped address gaps in online teaching skills.

Future PD programs should be guided by evidence-based frameworks. The use of Design-Based Research (DBR) allows continuous improvement and adaptation to different educational contexts. The integration of learning management systems, such as TalentLMS, and multimedia resources can also support interactive online learning environments. This approach aligns with global trends in technology-enhanced education.

The findings suggest that educational policies should give greater attention to online teaching skills within teacher preparation programs. Institutions should also reconsider their PD strategies to better prepare teachers for digital learning environments. Future research could explore the use of adaptive learning technologies and gamification to increase student engagement. Longitudinal studies are also needed to examine the long-term impact of developing online course design skills among teachers. In addition, future studies could compare the effectiveness of this program with other PD models in different institutional contexts.

5. Conclusion

Online education in Oman as in other countries continues to grow. However, teaching online requires different skills such as technological, pedagogical, and content knowledge. This research has been done to identify the importance of preparing Omani preservice teachers for their future positions. This study utilized the DBR method with the primary aim of developing a practical solution for training Omani students to design online course. Summative evaluation was used to optimize the PD program. The findings of the study showed that participants were interested to learn how to teach in online learning environment. They also recognize that skills learned for online teaching can enhance the quality of course, and student engagement. The findings of the current study highlight the need for educational policies in Oman to develop online programs for teacher education in order to familiarize them with latest advancements in online teaching practice and include them as a core element of teacher education programs. These policies can strengthen the foundation for teacher education programs.

Acknowledgments

The authors gratefully acknowledge the financial support provided by the College of Education, Sultan Qaboos University, through the Internal Grant Program (Grant No. IG/EDU/TECH/22/03).

Author contributions

Rouhollah Khodabandelou: Conceptualization, methodology, formal analysis, writing original draft preparation.

Ahmed Mohamed Fahmy Yousef: Visualization, writing original draft preparation, writing review and editing.

Abdelrahman Elhaj: Conceptualization, supervision, writing review and editing.

All authors have read and approved the final version of the manuscript.

Funding

This research was funded by Sultan Qaboos University under the Internal Grant Program (Grant No. IG/EDU/TECH/22/03).

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Redfame Publishing.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

Open access

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

References

- Al Jabri, M. J. H., Silvennoinen, H., & Griffiths, D. (2018). Teachers' professional development in Oman: Challenges, efforts and solutions. *International Journal of Learning, Teaching and Educational Research*, 17(5), 82–103. <https://doi.org/10.26803/ijlter.17.5.6>
- Al Shabibi, A. S., & Silvennoinen, H. (2018). Challenges in education system affecting teacher professional development in Oman. *Athens Journal of Education*, 5(3), 261–282. <https://doi.org/10.30958/aje.5-3-3>
- Al Shabibi, A., Al Mantheri, A., & Al Rashdi, B. (2019). Impact of teacher professional development on student attitudes and experiences in school learning—A case study of Oman. *International Journal of Learning, Teaching and Educational Research*, 18(10), 48–67. <https://doi.org/10.26803/ijlter.18.10.4>
- Al-Amri, A. S., Zubairi, Y. Z., Jani, R., & Naqvi, S. (2021). Evaluation of quality assurance instruments in higher education institutions: a case of Oman. *South African Journal of Higher Education*, 35(3), 13–28. <https://hdl.handle.net/10520/ejc-high-v35-n3-a2>
- Al-Fazari, H. (2023). Delivery of Online and Blended-Learning Higher Education Programs in the Arab world—A Case Study from Sohar University in Oman. In: Badran, A., Baydoun, E., Hillman, S., Mesmar, J. (eds) *Higher Education in the Arab World*. Springer, Cham. https://doi.org/10.1007/978-3-031-33568-6_6
- Al-Omairi, A. R. A., & Hew, S. H. I. N. (2022). Students' satisfaction of online learning in Oman. *F1000Research*, 11(101), 101. <https://doi.org/10.12688/f1000research.73579.2>
- Alzahrani, F. Y., & Althaqafi, A. S. (2020). EFL Teachers' Perceptions of the Effectiveness of Online Professional Development in Higher Education in Saudi Arabia. *Higher Education Studies*, 10(1), 121–131. <https://doi.org/10.5539/hes.v10n1p121>
- Amiel, T., & Reeves, T. C. (2008). Design-based research and educational technology: Rethinking technology and the research agenda. *Journal of Educational Technology & Society*, 11(4), 29–40. <https://www.jstor.org/stable/10.2307/jeductechsoci.11.4.29>
- Anderson, A., Barham, N., & Northcote, M. (2013). Using the TPACK framework to unite disciplines in online learning. *Australasian Journal of Educational Technology*, 29(4). <https://doi.org/10.14742/ajet.24>
- Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher*, 41(1), 16–25. <https://doi.org/10.3102/0013189X11428813>
- Barab, S., & Squire, K. (2016). Design-based research: Putting a stake in the ground. In *Design-based Research* (1st ed., pp. 1–14). Psychology Press.
- Bawa, P. (2020). Learning in the age of SARS-COV-2: A quantitative study of learners' performance in the age of emergency remote teaching. *Computers and Education Open*, 1, 100016. <https://doi.org/10.1016/j.caeo.2020.100016>
- Bawane, J., & Spector, J. M. (2009). Prioritization of online instructor roles: Implications for competency-based teacher education programs. *Distance Education*, 30(3), 383–397. <https://doi.org/10.1080/01587910903236536>
- Benson, S. N. K., & Ward, C. L. (2013). Teaching with technology: Using TPACK to understand teaching expertise in online higher education. *Journal of Educational Computing Research*, 48(2), 153–172. <https://doi.org/10.2190/EC.48.2.c>
- Børte, K., Nesje, K., & Lillejord, S. (2023). Barriers to student active learning in higher education. *Teaching in Higher Education*, 28(3), 597–615. <https://doi.org/10.1080/13562517.2020.1839746>
- Bozkurt, A., Gjelsvik, T., Adam, T., Asino, T. I., Atenas, J., Bali, M., ... & Zawacki-Richter, O. (2023). Openness in education as a praxis: From individual testimonials to collective voices. *Open Praxis*, 15(2), 76–112. <https://doi.org/10.55982/openpraxis.15.2.574>
- Burgstahler, S. (2020). Universal Design of Instruction (UDI): Definition, Principles, Guidelines, and Examples. *Do-It*. <https://doit-prod-backend.parallepublicworks.com/media/243>
- Caskurlu, S., Richardson, J. C., Alamri, H. A., Chartier, K., Farmer, T., Janakiraman, S., Strait, M., & Yang, M. (2021). Cognitive load and online course quality: Insights from instructional designers in a higher education context.

- British Journal of Educational Technology*, 52(2), 584–605. <https://doi.org/10.1111/bjet.13043>
- Clark, R. C., & Mayer, R. E. (2023). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & sons.
- Damien, N., & Claire, M. M. (2022). Influence of Teachers' Preparedness on Students' Academic Performance in Public Secondary Schools in Rwanda. *Journal of Education*, 5(2), 53–71. <https://doi.org/10.53819/81018102t5069>
- Darling-Hammond, L., Schachner, A. C. W., Wojcikiewicz, S. K., & Flook, L. (2024). Educating teachers to enact the science of learning and development. *Applied Developmental Science*, 28(1), 1–21. <https://doi.org/10.1080/10888691.2022.2130506>
- Daryanes, F., Darmadi, D., Fikri, K., Sayuti, I., Rusandi, M. A., & Situmorang, D. D. B. (2023). The development of articulate storyline interactive learning media based on case methods to train student's problem-solving ability. *Heliyon*, 9(4), e15082. <https://doi.org/10.1016/j.heliyon.2023.e15082>
- Dolighan, T., & Owen, M. (2021). Teacher efficacy for online teaching during the COVID-19 pandemic. *Brock Education Journal*, 30(1), 95–116. <https://doi.org/10.26522/brocked.v30i1.851>
- Du, J., Hew, K. F., & Zhang, L. (2024). Designing a recommender system to promote self-regulated learning in online contexts: A design-based study. *Education and Information Technologies*, 1–40. <https://doi.org/10.1007/s10639-024-12867-w>
- Easterday, M. W., Lewis, D. R., & Gerber, E. M. (2014). Design-Based Research Process: Problems, Phases, and Applications. *ICLS*. <https://doi.org/10.22318/icls2014.317>
- Education Council. (2017). *Philosophy of education in the Sultanate of Oman*. General Secretariat of the Education Council. <https://www.educouncil.gov.om/downloads/xAy73yr2nnGn.pdf>
- Elhag, A., Al Abri, M., & Yousef, A.M.F. (2025). The effect of generative AI tools (ChatGPT, Gemini, etc.) on students' achievement and their motivation towards learning. *Journal of Technology and Science Education*, 15(3), 746-759. <https://doi.org/10.3926/jotse.3410>
- Elmesalawy, M. M., Atia, A., Yousef, A. M. F., Abd El-Haleem, A. M., Anany, M. G., Elmosilhy, N. A., ... & El Din, E. S. (2021, May). Ai-based flexible online laboratory learning system for post-covid-19 era: Requirements and design. In *2021 international mobile, intelligent, and ubiquitous computing conference (MIUCC)* (pp. 1-7). IEEE. <https://doi.org/10.1109/MIUCC52538.2021.9447601>
- Elumalai, K. V., Sankar, J. P., John, J. A., Menon, N., Alqahtani, M. S. M., & Abumelha, M. A. (2020). Factors affecting the quality of e-learning during the COVID-19 pandemic from the perspective of higher education students. *Journal of Information Technology Education: Research*, 19, 731-753. <https://doi.org/10.28945/4628>
- Ferrer, J., Ringer, A., Saville, K., A Parris, M., & Kashi, K. (2022). Students' motivation and engagement in higher education: The importance of attitude to online learning. *Higher Education*, 83(2), 317-338. <https://doi.org/10.1007/s10734-020-00657-5>
- Gallagher, S. E., & Savage, T. (2023). Challenge-based learning in higher education: an exploratory literature review. *Teaching in Higher Education*, 28(6), 1135–1157. <https://doi.org/10.1080/13562517.2020.1863354>
- Gregory, K., Geiger, L., & Salisbury, P. (2022). Voyant tools and descriptive metadata: A case study in how automation can compliment expertise knowledge. *Journal of Library Metadata*, 22(1–2), 1–16. <https://doi.org/10.1080/19386389.2022.2030635>
- Hassan, M. K. (2021). Online teaching challenges during COVID-19 pandemic. *International Journal of Information and Education Technology*, 11(1), 10–18178. <https://dx.doi.org/10.18178/ijiet.2021.11.1.1487>
- Hinestroza, J. M., Strange, M. D., & Townsell, C. D. (2024). Centering mathematics pre-service teachers' whole selves: A collaborative approach to course syllabus design. *Mathematics Teacher Educator*, 12(2), 89-110. <https://doi.org/10.5951/MTE.2023-0031>
- Horenberg, L. (2024). Voyant Tools' Little Outing: How a Text Reading and Analysis Environment Can Help Literary Translators. In *Computer-Assisted Literary Translation* (pp. 203–218). Routledge.
- Jia, C., Hew, K. F., Jiahui, D., & Liuyufeng, L. (2023). Towards a fully online flipped classroom model to support student learning outcomes and engagement: A 2-year design-based study. *The Internet and Higher Education*, 56, 100878. <https://doi.org/10.1016/j.iheduc.2022.100878>
- Joosten, T., Lee-McCarthy, K., Harness, L., & Paulus, R. (2020). Digital Learning Innovation Trends. In *Online Learning Consortium. Every Learner Everywhere*. <https://www.everylearnereverywhere.org/resources/digital-learning-innovation-trends/>
- Kara, M., & Yildirim, Z. (2020). Identification of the optimal faculty behaviors for performance improvement in

- distance education. *Asia Pacific Education Review*, 21(1), 83–97. <https://doi.org/10.1007/s12564-019-09610-3>
- Kebritchi, M., Lipschuetz, A., & Santiago, L. (2017). Issues and challenges for teaching successful online courses in higher education: A literature review. *Journal of Educational Technology Systems*, 46(1), 4–29. <https://doi.org/10.1177/0047239516661713>
- Khodabandelou, R., Chaharbashloo, H., Ghaderi, M., Zeinabadi, H., & Karimi, L. (2024). A systematic review on university instructors' roles and competencies in online teaching environments. *Interactive Learning Environments*, 32(6), 2506–2519. <https://doi.org/10.1080/10494820.2022.2152057>
- Koehler, M. J., Mishra, P., Akcaoglu, M., & Rosenberg, J. M. (2013). The technological pedagogical content knowledge framework for teachers and teacher educators. *ICT Integrated Teacher Education: A Resource Book*, 2–7.
- Kumi-Yeboah, A. (2018). Designing a cross-cultural collaborative online learning framework for online instructors. *Online Learning Journal*, 22(4), 181–201. <https://doi.org/10.24059/olj.v22i4.1520>
- Lasagabaster, D. (2022). Teacher preparedness for English-medium instruction. *Journal of English-Medium Instruction*, 1(1), 48–64. <https://doi.org/10.1075/jemi.21011.las>
- Levey, J. A. (2018). Universal design for instruction in nursing education: An integrative review. *Nursing Education Perspectives*, 39(3), 156–161. <https://doi.org/10.1097/01.NEP.0000000000000249>
- Lyublinskaya, I., & Du, X. (2024). Preservice teachers' TPACK learning trajectories in an online educational technology course. *Journal of Research on Technology in Education*, 56(4), 444–461. <https://doi.org/10.1080/15391523.2022.2160393>
- Magd, H., & Jonathan, H. (2023). Limitations and challenges of online teaching at higher education institutions in Oman. *International Journal of Information and Education Technology*, 13(5), 831–837.
- McKenney, S., & Reeves, T. (2018). *Conducting educational design research* (2nd ed.). Routledge.
- McKenney, S., Reeves, T.C. (2014). Educational Design Research. In: Spector, J., Merrill, M., Elen, J., Bishop, M. (eds) *Handbook of Research on Educational Communications and Technology*. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-3185-5_11
- Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development*, 50(3), 43–59. <https://doi.org/10.1007/BF02505024>
- Merrill, M. D. (2012). *First principles of instruction* (1st ed.). San Francisco: Pfeiffer.
- Metwally, A. H. S., Yousef, A. M. F., & Yining, W. (2020, July). Micro design approach for gamifying students' assignments. In *2020 IEEE 20th International conference on advanced learning technologies (ICALT)* (pp. 349–351). IEEE. <https://doi.org/10.1109/ICALT49669.2020.00112>
- Miller, A. (2018). Text mining digital humanities projects: Assessing content analysis capabilities of voyant tools. *Journal of Web Librarianship*, 12(3), 169–197. <https://doi.org/10.1080/19322909.2018.1479673>
- Ministry of Higher Education, Research and Innovation. (2022). *Annual report on higher education statistics in the Sultanate of Oman 2021/2022*. Muscat, Oman. <https://www.moheri.gov.om/InnerPage.aspx?id=53c48c8e-d793-44e6-9a04-32d13ad404b3&culture=en>
- Mishra, M., Gorakhnath, I., Lata, P., Rani, R., & Chopra, P. (2022). Integration of technological pedagogical content knowledge (TPACK) in classrooms through a teacher's lens. *International Journal of Health Sciences*, 6(S3), 12505–12512. <https://doi.org/10.53730/ijhs.v6nS3.9536>
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684>
- Mucundanyi, G. (2021). Design Strategies for Developing an Engaging Online Course in Higher Education. *International Journal of Education and Development Using Information and Communication Technology*, 17(3), 198–206.
- Nilson, L. B., & Goodson, L. A. (2021). *Online teaching at its best: Merging instructional design with teaching and learning research* (2nd ed.). San Fransico: John Wiley & Sons.
- O'Keefe, H., Rankin, J., Wallace, S. A., & Beyer, F. (2023). Investigation of text-mining methodologies to aid the construction of search strategies in systematic reviews of diagnostic test accuracy—a case study. *Research Synthesis Methods*, 14(1), 79–98. <https://doi.org/10.1002/jrsm.1593>
- Oyelere, S. S., Suhonen, J., Wajiga, G. M., & Sutinen, E. (2018). Design, development, and evaluation of a mobile learning application for computing education. *Education and Information Technologies*, 23, 467–495. <http://dx.doi.org/10.1007/s10639-017-9613-2>

- Pardino, A., Gleyzer, I., Javed, I., Reid-Hector, J., & Heuer, A. (2018). The best pedagogical practices in graduate online learning: A systematic review. *Creative Education*, 9(07), 1123. <https://doi.org/10.4236/ce.2018.97083>
- Philipsen, B., Tondeur, J., Blieck, Y., & Vanslambrouck, S. (2023). Teacher professional development for online teaching: An update of insights stemming from contemporary research. In *Learning, Design, and Technology: An International Compendium of Theory, Research, Practice, and Policy* (pp. 527–554). Springer. https://doi.org/10.1007/978-3-319-17461-7_167
- Philipsen, B., Tondeur, J., Pareja Roblin, N., Vanslambrouck, S., & Zhu, C. (2019). Improving teacher professional development for online and blended learning: A systematic meta-aggregative review. *Educational Technology Research and Development*, 67, 1145–1174. <https://doi.org/10.1007/s11423-019-09645-8>
- Ra, S., Shrestha, U., Khatiwada, S., Yoon, S. W., & Kwon, K. (2019). The rise of technology and impact on skills. *International Journal of Training Research*, 17(sup1), 26–40. <https://doi.org/10.1080/14480220.2019.1629727>
- Rao, K., Ok, M. W., & Bryant, B. R. (2014). A review of research on universal design educational models. *Remedial and Special Education*, 35(3), 153–166. <https://doi.org/10.1177/0741932513518980>
- Rawas, S. (2024). ChatGPT: Empowering lifelong learning in the digital age of higher education. *Education and Information Technologies*, 29(6), 6895–6908. <https://doi.org/10.1007/s10639-023-12114-8>
- Riggs, S. (2023). *Thrive online: A new approach to building expertise and confidence as an online educator*. Taylor & Francis.
- Roddy, C., Amiet, D. L., Chung, J., Holt, C., Shaw, L., McKenzie, S., Garivaldis, F., Lodge, J. M., & Mundy, M. E. (2017). Applying best practice online learning, teaching, and support to intensive online environments: An integrative review. *Frontiers in Education*, 2, 59. <https://doi.org/10.3389/feduc.2017.00059>
- Rusticus, S. A., Pashootan, T., & Mah, A. (2023). What are the key elements of a positive learning environment? Perspectives from students and faculty. *Learning Environments Research*, 26(1), 161–175. <https://doi.org/10.1007/s10984-022-09410-4>
- Satar, H. M., & Akcan, S. (2018). Pre-service EFL teachers' online participation, interaction, and social presence. *Language Learning and Technology*, 22(1), 157–184. <https://dx.doi.org/10125/44586>
- Tondeur, J., Pareja Roblin, N., van Braak, J., Voogt, J., & Prestridge, S. (2017). Preparing beginning teachers for technology integration in education: Ready for take-off? *Technology, Pedagogy and Education*, 26(2), 157–177. <https://doi.org/10.1080/1475939X.2016.1193556>
- Udosen, I. N., & Edem, S. N. (2024). Assessment of The Academic Performance of SS II Male and Female Biology Students Taught Using Talent Learning Management Systems (LMS) and Those Taught With Expository Method. *International Journal of Modern Health Systems and Medical Sciences*, 8(1), 85–97.
- Viviani, W., Brantlinger, A., & Grant, A. A. (2023). Teacher Preparedness and Retention. *Teacher Education Quarterly*, 50(3), 54–77. <https://www.jstor.org/stable/27257019>
- Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research and Development*, 53(4), 5–23. <https://doi.org/10.1007/BF02504682>
- Wei, Y., Jiang, Y. H., Liu, J., Qi, C., Jia, L., & Jia, R. (2025, March). The advancement of personalized learning potentially accelerated by generative AI. In *Society for Information Technology & Teacher Education International Conference* (pp. 991-1000). Association for the Advancement of Computing in Education (AACE). Retrieved July 19, 2026 from <https://www.learntechlib.org/primary/p/225625/>
- Yousef, A. M. F., Khatiry, A. R., Elhag, A., Al-Saadi, Z., Hussain, R. M. R., & Khalil, H. (2025, February). Insights from Faculty and Students on AI Assessment Practices: Threat or Opportunity?. In *International Conference for A* (Vol. 2, pp. 0-2). <https://doi.org/10.1109/AI2E64943.2025.10983074>
- Yousef, A. M. F., Wahid, U., Chatti, M. A., Schroeder, U., & Wosnitza, M. (2015, May). The impact of rubric-based peer assessment on feedback quality in blended MOOCs. In *International conference on computer supported education* (pp. 462-485). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-29585-5_27
- Zhang, W., Mita, R., & Darko, E. N. K. O. (2026, June). Preparing teachers for the age of artificial intelligence: understanding the challenges and needs of AI-TPACK in Indonesian elementary education. In *Frontiers in Education* (Vol. 11, p. 1769204). Frontiers Media SA. <https://doi.org/10.3389/feduc.2026.1769204>
- Zhu, M., Berri, S., Koda, R., & Wu, Y. (2024). Exploring students' self-directed learning strategies and satisfaction in online learning. *Education and Information Technologies*, 29(3), 2787–2803. <https://doi.org/10.1007/s10639-023-11914-2>