

# Digital transformation of education: The legacy of Arab-Muslim pedagogy in the development of modern learning platforms

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## ABSTRACT

Learners from diverse cultural backgrounds are often marginalized by digital learning platforms, which tend to reflect the pedagogical traditions of the Western world. As a result, this study investigated the extent to which the pedagogical principles of Arab Muslims are reflected in contemporary digital learning platforms. A qualitative content analysis was employed to examine four platforms: Noon Academy, Bayyinah TV, Edraak, and Coursera. The findings revealed that key Arab-Muslim pedagogical principles include *ijtihad* (critical thinking), *shura* (collaborative learning), and *adab* (etiquette), all of which play a vital role in modern IT-based education. Notably, platforms originating from the Arab world emphasized *adab* and moral engagement, highlighting the importance of cultural context in the design of digital learning environments. These results have significant implications for the development of educational technology, underscoring the necessity of culturally responsive design. The study suggests that Arab-Muslim pedagogy provides valuable models for ethical, learner-centered digital education.

**Keywords:** Personalization, Collaboration, Critical Thinking, Mentorship, Adaptability

## 1. Introduction

The importance of education cannot be overemphasized due to the critical role it plays in empowering individuals and fostering intellectual and personal growth, enabling them to become active members of society. According to Ref. [1], education entails not only the acquisition of knowledge but also the development of critical thinking competencies and skills. To achieve this goal effectively, digital transformation is essential. Globally, the emergence of information technology represents a significant trend in the digital transformation of education [2]. Information technology-based platforms have reshaped teaching methods, making education more flexible, personalized, and accessible. Digital tools enhance interactive and immersive experiences, enable effective feedback mechanisms, provide diverse educational resources, and facilitate collaborative learning. In this context, it is vital to prudently implement modern technologies in educational institutions to ensure accessible, flexible, enjoyable, effective, and efficient teaching and learning processes that prepare individuals to thrive in the 21st century, where the world is increasingly interconnected and complex. Similarly, Ref. [3] highlights that artificial intelligence (AI) is a major driver of digital transformation, promoting adaptive and automated learning. Learning Management Systems (LMS) help teachers manage assignments and student progress through centralized platforms. Massive Open Online Courses (MOOCs) provide high-quality educational content, allowing learners to partner with top instructors and universities [4]. Massive open online courses (MOOCs) have provided various forms of interactive learning such as gamification, discussion forums and peer assessment [5]. According to Ref. [6], the widespread adoption and use of mobile devices has accelerated the application of digital learning, enabling students to access educational content at their convenience. Historically, Arab-Muslim pedagogy dates back to early days of Islamic civilization. In the 10th century, the madrasah tradition helped to shape the educational and intellectual landscape of the Islamic world [7]. Arab-Muslim pedagogy emphasizes critical thinking, pursuit of knowledge and moral-ethical education. *Ijtihad*, or critical thinking is a well-recognized principle in Arab-Muslim pedagogy. The use of Arab-Muslim

pedagogy enables learners to participate in independent reasoning and the interpretation of various Islamic texts, developing learners' ability to understand complex concepts and analytical skills [8]. Shura, another important principle, refers to collaboration, aiding students in collective knowledge gain and understanding [9]. Moral-ethical education is encouraged, helping students build character and responsibility. The concept of adab focuses on humility, respect, and compassion, highlighting the relationship between intellectual growth and moral development [10]. The pedagogical principles of Arab-Muslim education have evolved over time, shaped by intellectual, cultural, and social factors [11]. When educators clearly understand the core principles and the history of Arab-Muslim pedagogy, they gain valuable insights into how intellectual and cultural traditions shape the learning process and how these principles can be applied in modern educational settings [12]. The ideology embedded in Arab-Muslim pedagogy is essential to digital learning environments and the knowledge society. In today's information age, Ref. [13] emphasizes the importance of independent reasoning and critical thinking. Students need skills to evaluate, navigate, and apply knowledge effectively. Collaborative learning is crucial, facilitating connection and idea-sharing among students [14]. Kazakhstan's unique position at the crossroads of Central Asia and Eastern Europe makes it an important case study for examining the intersection of post-Soviet and Islamic traditions of education [15]. The country's experience in managing Islamic cultural identity alongside its post-Soviet transition offers valuable lessons for other nations [16]. It reflects the modernization impulses of its Soviet legacy, the cultural heritage of its Islamic traditions, and the spiritual dimension of its secular governance. Incorporating Kazakhstan's perspective provides deeper insight into how these two educational traditions, Islamic and Soviet, coexist and inform one another. The country's approach to navigating the complexities of post-Soviet transformation and Islamic cultural identity presents important implications for countries facing similar challenges [16]. Scholars gain a clearer understanding of how diverse historical and cultural variables shape pedagogy and educational policy through the examination of Kazakhstan's educational strategies [17]. Thus, including Kazakhstan's perspective enriches discussions on cultural diversity, educational development, and globalization by contributing to the advancement of a more effective and inclusive educational system.

Digital platforms have increasingly been utilized to transform the educational landscape, particularly in terms of how teaching and learning processes influence the pedagogical literacy of Arab-Muslim societies. Historically, Arab pedagogy has emphasized nurturing leadership, deep religious faith, and strong moral values, which collectively shape future leaders. With the digital transformation of Islamic education, new learning opportunities have emerged, offering access to digital technologies and supporting educators in adopting innovative teaching strategies. Arab-Muslim pedagogy emphasizes analytical thinking, engagement with Islamic texts, and the comprehension of complex variables, while also fostering independent reasoning. Accordingly, it can be inferred that Arab-Muslim pedagogy promotes teamwork, effective communication, critical thinking, and collaborative learning. It therefore becomes prudent to study how elements of Arab-Muslim pedagogical traditions are reflected in the design, structure, and educational strategies of selected modern digital learning platforms.

### **1.1. Statement of the research problem**

Ordinarily, the essence of digital education is to harness learning platforms that accommodate diverse pedagogical and cultural traditions, provide effective and inclusive teaching and learning experiences for learners from different backgrounds. Unfortunately, there is a stark contrast because most digital learning platforms still reflect pedagogical traditions of the western world and overlook the rich educational heritage in other countries. This issue tends to have a significant effect such as marginalization of students who are not from the western world, as they are disconnected from the learning experiences and content offered by these platforms. In addition, the absence of cultural responsiveness in digital learning platforms may result in low academic engagement, low motivation and poor academic performance among students from different cultural backgrounds.

Some efforts have been made to address the issue such as the incorporation of different perceptions towards digital learning platforms and the development of learning materials that are culturally sensitive. Despite these efforts to manage the problem, the challenge continues. Several studies have extensively examined the effectiveness of digital learning platforms and tools in Western contexts, but inadequate attention has been given to the philosophical and cultural underpinnings that go a long way to shape educational practices in different contexts. Specifically, there is paucity of research that dealt with the incorporation of digital learning tools and platforms in pedagogical principles from the traditions of non-western world, such as Arab-Muslim pedagogy.

This lack of understanding motivated the researcher to ask questions about the importance, cultural sensitivity and effectiveness of digital learning platforms in the non-Western world; hence, the need for the study.

## **1.2. Research aim**

The aim of this study is to explore how elements of Arab-Muslim pedagogical traditions are reflected in the design, structure, and educational strategies of selected modern digital learning platforms.

## **1.3. Research questions**

The following research questions were raised for the purpose of this research:

1. Which pedagogical principles from the Arab-Muslim tradition are most relevant to modern IT-based education?
2. How are these principles reflected (explicitly or implicitly) in the content and features of current digital learning platforms?
3. What similarities and differences exist between Western and Arab-world EdTech platforms in terms of pedagogical structure?

## **2. Literature review**

### **2.1. The evolution of Arab-Muslim pedagogy**

Historically, Arab-Muslim pedagogy is rooted in the tradition of Islamic education, tracing back to the early days of Islam. The Quran, regarded as the holy book of Islam, emphasizes education and knowledge pursuit, encouraging Muslims to seek wisdom and understanding. This emphasis on intellectual inquiry and learning laid the foundation for a vibrant educational tradition that flourished in the Islamic world for centuries. The Prophet Muhammad's mosque in Medina served as a learning center where companions and learners gathered to study the Hadith, Quran, and other Islamic knowledge. As Islam spread throughout North Africa, the Middle East, and beyond, pedagogical methods and institutions evolved to meet diverse needs. Madrasas emerged as central learning hubs, offering comprehensive education in subjects like medicine, literature, Arabic language, mathematics, theology, and jurisprudence. Madrasas were often attached to mosques, and their curricula were structured and designed to equip learners with a better understanding of Islamic practices or knowledge.

### **2.2. The contributions of golden age of islamic scholarship to knowledge and learning**

Historically, Ref. [18], states that the Golden Age of Islamic Scholarship started from the 8th to the 14th century.

This was a period of remarkable intellectual and cultural achievement in the Islamic world. Researchers from the Arab-Muslim tradition made significant contributions to various academic fields, including mathematics, astronomy, and philosophy [19]. The development of education and the influence of Western thought gained momentum when the works of Islamic scholars were disseminated throughout the Islamic world. Scholars such as Ibn Sina (Avicenna), Ibn Rushd (Averroes), and Al-Khwarizmi had a profound impact on their respective disciplines, laying the foundations for future philosophical and scientific inquiry [20]. For instance, Al-Khwarizmi's research in algebra and geometry led to the development of algebraic methods and the introduction of Arabic numerals to Europe, revolutionizing the field of mathematics. Ibn Sina's Canon of Medicine became a standard medical textbook in Europe for centuries, while Western philosophical thought was shaped by Ibn Rushd's commentaries on Aristotle's works.

According to Ref. [21], core characteristics of the Islamic Golden Age include a spirit of tolerance, intellectual curiosity, and openness to knowledge from diverse sources. Researchers from various faiths and backgrounds, particularly Christians, Jews, and others, collaborated, shared knowledge, and built upon one another's discoveries [22]. This cross-cultural exchange facilitated the transmission of knowledge from Persia and Greece to the Islamic world and, subsequently, to Europe (2023). The legacy of the Islamic Golden Age continues to inspire modern scholarship, reminding us of the importance of critical thinking and intellectual inquiry in advancing human understanding [24].

### **2.3. The evolution of pedagogical innovation from madrass to MOOCs**

Historically, pedagogical innovations have evolved from traditional education systems to modern online platforms, particularly Massive Open Online Courses (MOOCs), as a result of the pursuit of knowledge and the dynamic nature of educational systems. According to Ref. [25], madrasas, which emerged during the medieval period in the Islamic world, were institutions of higher learning that focused on subjects such as law and Islamic

theology. These institutions played a significant role in preserving and transmitting Islamic pedagogical approaches and scholarly traditions [26]. Instructional methods included discussions, debates, and lectures, all designed to promote intellectual inquiry and critical thinking. In contrast, the widespread adoption of the internet and technological advancements has led to the recent development of MOOCs. These online courses offer free, flexible, and accessible education to a broad audience [27]. Both madrasas and MOOCs emphasize the relevance of critical thinking, discussion based learning and intellectual inquiry. In madrasas, Ref. [28], maintains that the learners would participate in discussions and debates with their colleagues and teachers while MOOCs utilize live sessions and online discussion forums where students' can interact with their teachers and colleagues. The history from madrasas to MOOCs shows the resilience and adaptability of pedagogical methods and educational institutions. As technology continues to advance and new problems surface, teachers and learners are left with no choice other than to innovate and adapt. They seek new ways to promote intellectual growth and knowledge acquisition.

#### **2.4. Arab-Muslim scholars and western educational thought**

Arab-Muslim scholars have significantly influenced Western educational thought and as a result, as aspect education history is overlooked. Arab-Muslim scholars played an important role during the Middle Ages, in transmitting, translating and preserving the knowledge of ancient civilizations Rome and Greece to Europe.

The transmission of knowledge by Arab-Muslim scholars had a significant positive impact on the growth and development of Western education, particularly during the Renaissance and Enlightenment periods [29]. Commentaries on Aristotle's works were written by scholars such as Ibn Rushd (Averroes) and Ibn Sina (Avicenna). These commentaries were later studied by European scholars and translated into Latin. The works of Ibn Rushd and Ibn Sina not only preserved Aristotle's writings but also introduced new ideas and perspectives that influenced the development of Western philosophical thought. Research conducted by Arab-Muslim scholars also contributed to advancements in various fields, including medicine, mathematics, philosophy, and astronomy. For instance, the concept of "zero" was introduced to Arab mathematicians and later transmitted to Europe, revolutionizing mathematics and facilitating scientific progress [30].

The Western educational system was influenced by Arab-Muslim thinkers, as evidenced by the establishment of public institutions and universities in Europe, many of which were modeled after institutions in the Islamic world. The University of Al-Karaouine in Morocco, founded in 859 AD, is considered one of the earliest universities in the world and served as a model for several European universities. According to Ref. [30], Arab-Muslim scholars significantly shaped Western educational thought through cross-cultural exchange and the promotion of intellectual curiosity, which remain central to the evolution of human knowledge. Recognizing and appreciating these contributions offers a deeper understanding of the complex and interconnected nature of global education and intellectual history.

#### **2.5. Digital learning platforms and the revival of Arab-Muslim pedagogical principles**

The recognition of digital learning tools and platforms has created new opportunities for teachers to deliver and design effective and engaging learning experiences. It is clear that some of the methods and principles used in Arab-Muslim pedagogy tradition, more particularly, peer-to-peer learning, critical thinking and emphasis on personalized learning, are being incorporated and revisited into modern digital learning tools and platforms [31]. Digital learning tools and platforms can enhance personalized learning as it provides learners with flexible pacing, and adaptive assessments tailored content. This approach according to Ref. [32], is recognized because of the traditional Arab-Muslim pedagogical method of *ijtihad*. Through this approach students engage in critical thinking and independent reasoning to arrive at new understanding and ideas. Another key aspect of Arab-Muslim pedagogy is peer-to-peer learning which is being utilized in digital learning tools and platforms. Collaborative projects, online discussion forums, social learning networks, enable learners to interact with their colleagues, learn from one another's experiences and share knowledge [33]. Digital learning tools and platforms can enhance intellectual inquiry and critical thinking; in traditional Arab-Muslim education, these values were highly prized. Incorporating interactive simulations, multimedia content and real-world case studies, teachers can create challenging and engaging learning experiences that enhance problem solving and critical thinking [34]. Digital learning platforms help preserve and transmit cultural heritage, enabling learners to engage with and appreciate the rich cultural traditions of the Arab-Muslim world. Consequently, educators promote cross-cultural appreciation and understanding, while also fostering a sense of identity and belonging among students from diverse cultural backgrounds. Al-Farabi, a renowned Arab-Muslim pedagogue and philosopher, is one of the key figures who made a lasting impact on the growth and development of modern learning platforms. His

pedagogical and philosophical ideas, emphasizing intellectual curiosity, the importance of education, and critical thinking, have significantly influenced contemporary approaches to teaching and learning [41]. Al-Farabi's educational legacy is evident in the design of modern learning platforms, which aim to provide engaging and meaningful learning experiences. These platforms incorporate elements such as personalized learning, gamification, and social learning, all of which are designed to enhance deeper understanding and learner engagement [42].

## **2.6. Literature gap**

Many Arab-Muslim scholars have made significant contributions to the development of education and pedagogy. However, to the best of the researchers' knowledge, there remains a notable gap concerning the relationship between modern digital platforms and the legacy of Arab-Muslim pedagogy. While numerous studies have examined the historical contributions of Arab-Muslim scholars and the evolution of Islamic education [35], [36], these studies primarily focus on the influence of Arab-Muslim thinkers on the development of education and other related fields. In contrast, relatively few studies have addressed the application of Arab-Muslim pedagogical principles within modern digital learning environments [37], [38]. This lack of research presents an opportunity for the current study. By integrating Arab-Muslim pedagogical principles into digital learning environments, educators can design more inclusive and effective learning experiences that honor cultural heritage while utilizing contemporary technological advancements. It is also important to state clearly that, to the best of the researchers' knowledge, the studies reviewed thus far differ from the present research in terms of content and scope. This distinction underscores the necessity of the current investigation.

## **3. Research method**

### **3.1. Research design**

A qualitative research design was adopted in this research, which made use of four digital learning platforms based on systematic selection. It was followed by comparative methods and content analysis of pedagogical dimensions. The qualitative method was used to analyze the features and content of the platforms with the aim of drawing concrete conclusions regarding how elements of Arab-Muslim pedagogical traditions are reflected in the design, structure, and educational strategies of selected modern digital learning platforms.

### **3.2. Selection criteria**

In this research, four digital learning platforms were selected in line with a specific criterion. Noon Academy (Saudi Arabia) was selected for its recognition and popularity in the context of the Arab-Muslim context. Bayyinah TV (Islamic learning) was selected for its integration of contextual appropriateness and Islamic values. Edraak (a MOOC platform based in Jordan) was selected because it centers on Islamic education as well as regional relevance. Coursera (a global MOOC platform with courses relevant to Islamic education) was chosen for its content in Islamic education and global content.

### **3.3. Content analysis**

Basic pedagogical principles were used to code the features and content of the platforms, including *ijtihad*, *shura*, and *adab*. *Ijtihad*, understood as independent learning, was coded through problem-solving activities and critical thinking tasks. Additionally, collaborative learning and discussion forums were used to represent consultation, or *shura*. *Adab*, referring to etiquette and moral conduct, was coded using content focused on moral guidance and values-based education.

### **3.4. Comparative analysis**

Four pedagogical dimensions, namely moral engagement, adaptability, learner autonomy, and peer collaboration, were used to compare the platforms in order to identify their similarities and differences within the educational context and to determine how Arab-Muslim pedagogical principles are reflected in modern digital learning platforms (see Appendix for the coding matrix). An example code tree was developed to categorize codes under the four main dimensions: learner autonomy, peer collaboration, adaptability, and moral engagement. Subcodes captured specific features within each dimension, such as adaptive learning, collaborative learning, values-based content, and self-paced learning. This structure facilitated a systematic

analysis of how each platform supports student interaction, instructional flexibility, moral development, and personalized learning.

### 3.5. Tools and procedures

NVivo qualitative software was utilized to analyze the data. To carry out the analyses effectively, the platform features and content were imported into NVivo, and codes were applied based on pedagogical principles and pedagogical dimensions of Arab-Muslim. The coded data were categorized into themes, and results were interpreted to identify patterns and insights. The platforms were selected based on their relevance to Islamic pedagogy, popularity, and local context (see appendix). A rigorous and systematic analysis of data was carried out through the help of the tools and procedures used in this study, enabling the researcher to draw conclusions based on the data analyzed.

## 4. Results and discussion

### 4.1. Data analysis for the study

Table 1. Presence of Arab-Muslim pedagogical principles in digital learning platforms

Pedagogical Principle	Noon Academy	Bayyinah TV	Edraak	Coursera
Ijtihad	Present	Present	Present	Present
Shura	Present	Limited	Present	Present
Adab	Present	Present	Limited	Absent

Data in Table 1 reveal that in modern IT-based education, both ijthad, shura, and adab are highly relevant in the world of Arab-Muslim. Across Arab world platforms, these pedagogical principles are present. This findings show the relevance of Arab-Muslim pedagogical principles for designing and developing digital learning platforms (Figure 1).

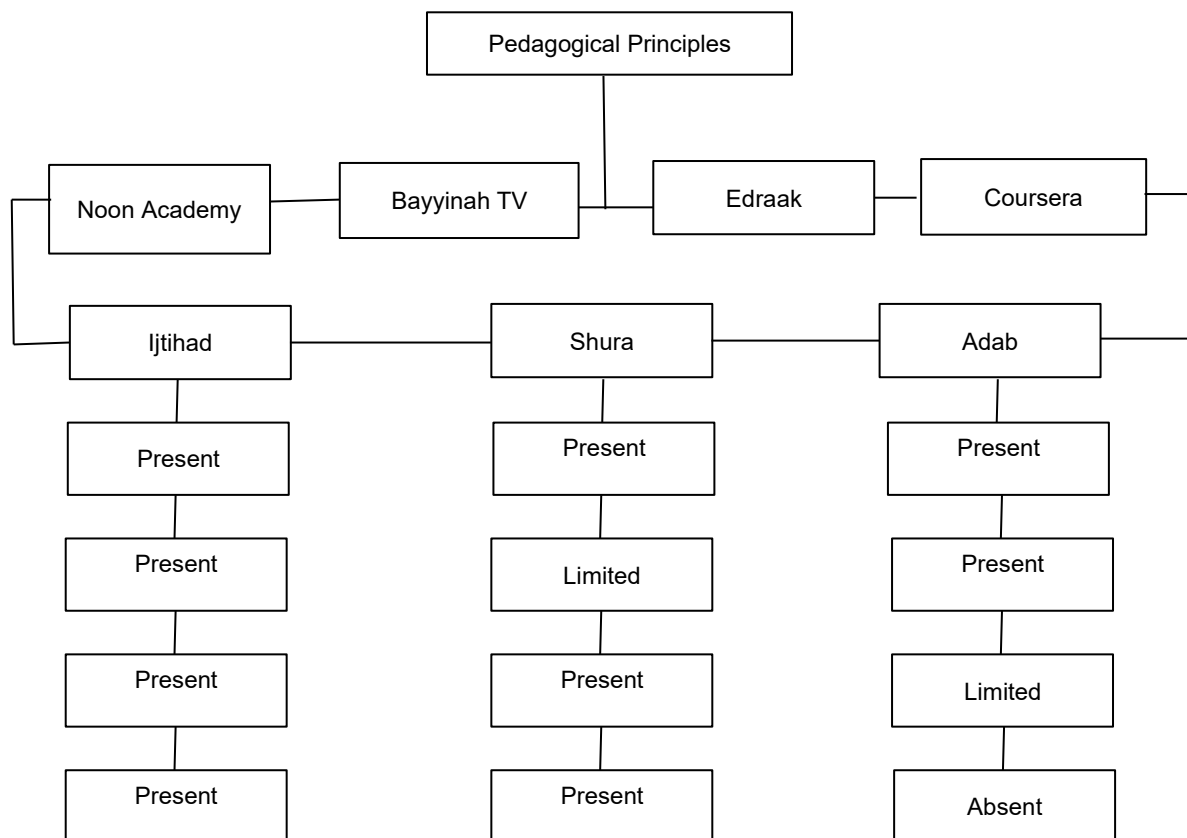


Figure 1. Diagrammatical representation of the result for presence of Arab-Muslim pedagogical principles in digital learning platforms

Table 2. Reflection of Pedagogical Principles of Arab-Muslim in Platform Features

Platform Feature	Noon Academy	Bayyinah TV	Edraak	Coursera
Moral Engagement	Explicit	Explicit	Implicit	Limited
Critical Thinking	Implicit	Implicit	Explicit	Explicit
Collaborative Learning	Explicit	Limited	Explicit	Present

In Table 2 the finding shows in diverse ways the Arab-Muslim pedagogical principles. The result therefore reveals that Bayyinah TV, Noon Academy, adab were explicit while Edraak show implicit. It clearly means that the pedagogical principles of moral engagement, critical thinking and collaborative learning are highly relevant to modern It-based education in Arab-Muslim context (Figure 2).

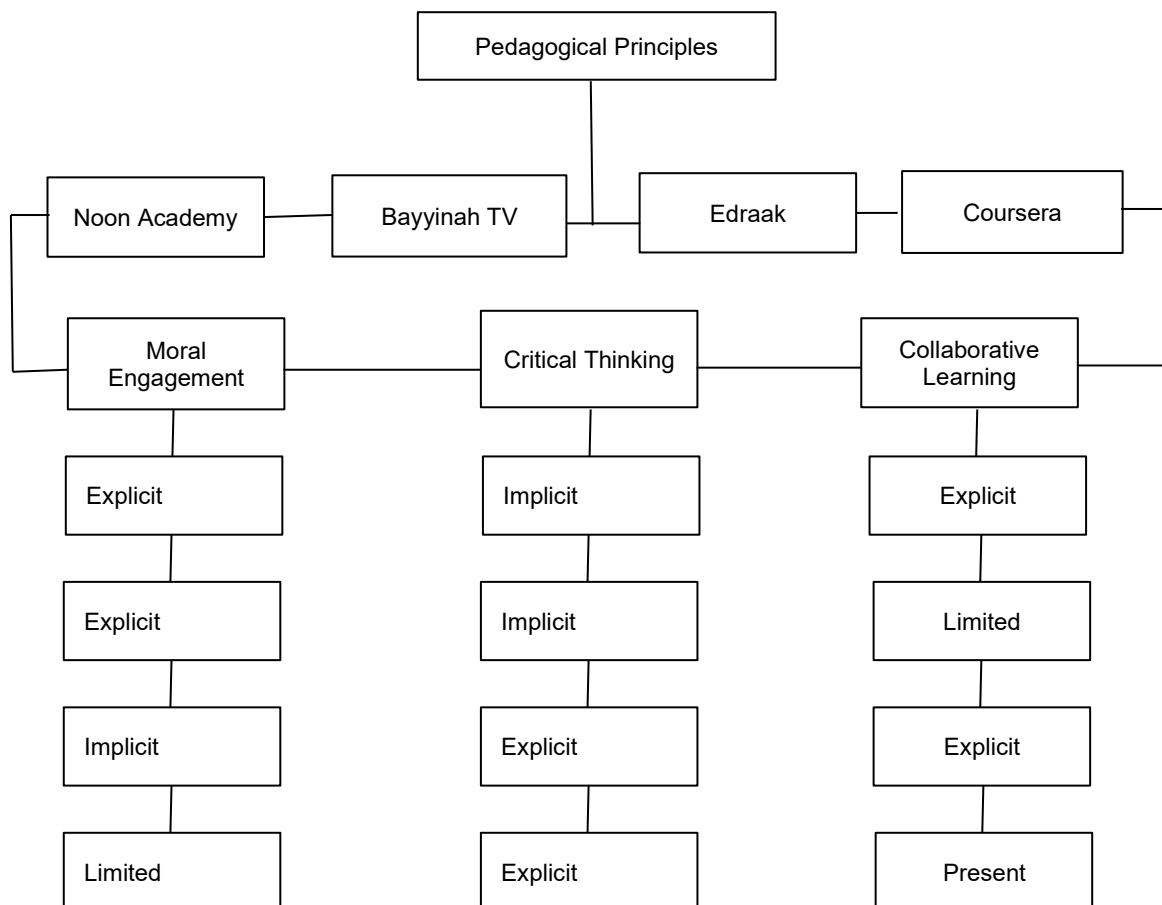


Figure 2. Diagrammatical representation of the result for reflection of pedagogical principles of Arab-Muslim in platform features

Table 3. Comparing pedagogical dimensions of western platforms and Arab-world EdTech

Pedagogical Dimension	Western (Coursera)	Arab-world (Noon Academy, Bayyinah TV, Edraak)
Moral Engagement	Limited	High
Adab (Etiquette)	Absent	Present
Learner Autonomy	High	Moderate
Critical Thinking	High	High

Data in Table 3 show that platforms of Arab-world tend to encourage adab (etiquette) and moral engagement, whereas the platforms of the Western world focus more on personalization and learner autonomy. Hence, while there are areas of similarities and differences between the educational technology of the Arab-world and Western platforms, such as critical thinking and collaborative learning methods, there are also key disparities as seen in Table 3 and Figure 3.

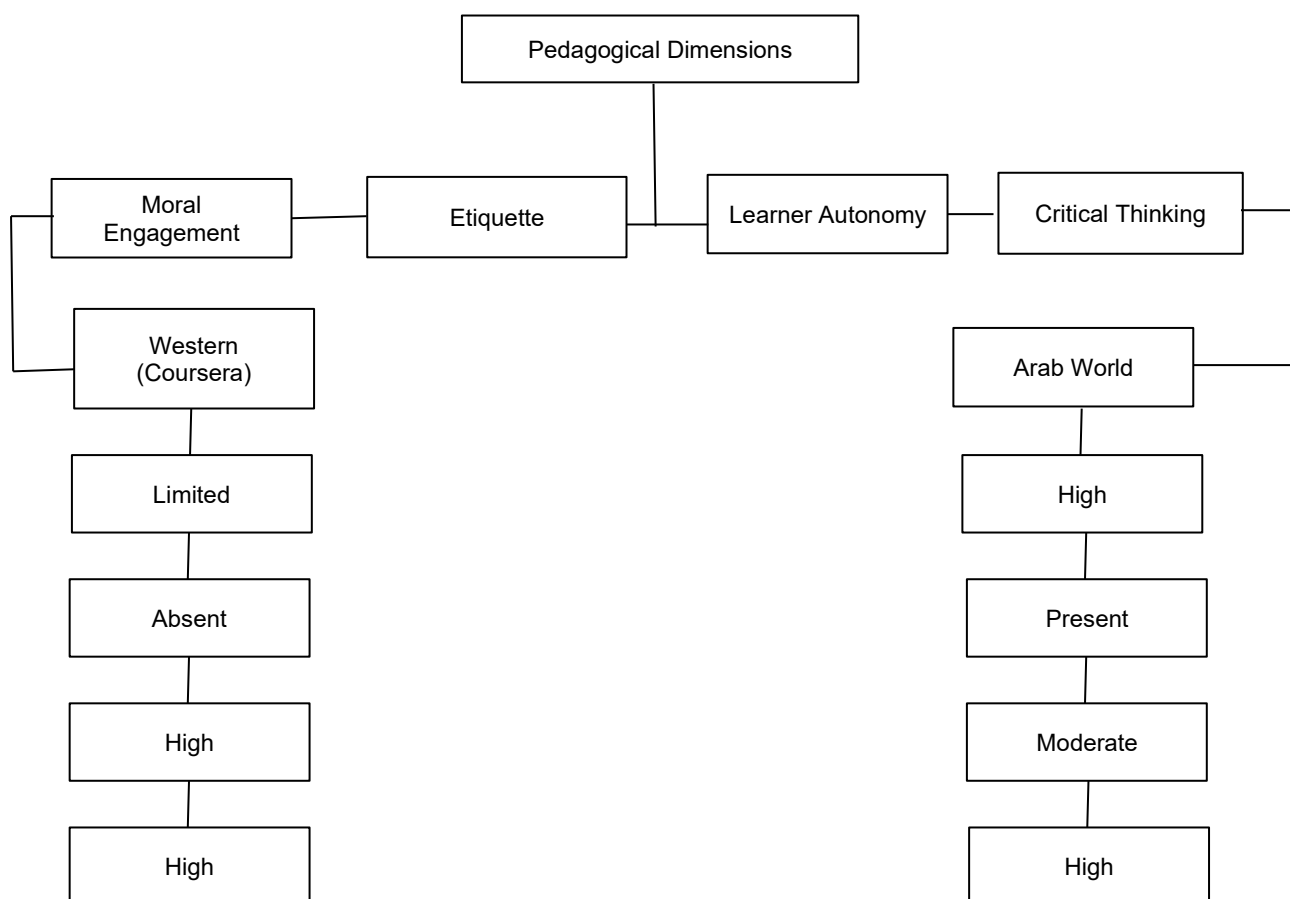


Figure 3. Diagrammatical representation of the result for pedagogical dimensions of western platforms and Arab-world EdTech

On a general note, the findings of this research imply that one cannot neglect the importance of Arab-Muslim pedagogical principles to modern IT-based education. A comparative analysis of the two diagrams reveals that while Arab-Muslim pedagogical principles are reflected in various ways across digital learning platforms, there are notable differences in emphasis between Arab-world and Western platforms. Specifically, Arab-world platforms tend to prioritize Adab (etiquette) and moral engagement, whereas Western platforms focus more on personalization and learner autonomy. Despite these differences, both types of platforms share commonalities in promoting critical thinking and collaborative learning. The findings suggest that cultural and pedagogical contexts play a significant role in shaping the design and content of digital learning platforms.

#### 4.2. Discussion

The findings of the study, in line with the first research question indicate that Arab-Muslim pedagogical principles such as: *ijtihad*, *shura* and *adab* are highly relevant to the development of modern IT-based education. The findings reveal that different forms pedagogical principles were present across the platforms of Arab-world. This result suggests that pedagogical principles are in fact a necessity in the design and development of digital learning platforms which will address the challenges confronting Arab-Muslim students. A surprising result was the significant relevance of Arab-Muslim pedagogical principles such as *ijtihad*, *shura*, and *adab* in modern IT-based education. These principles were notably found in diverse forms across digital platforms in the Arab-Muslim context. This result is in accordance with the findings by Ref. [35], who notes that the incorporation of Islamic values in educational institutions enhances academic engagement and motivation among learners. Similarly, Ref. [36], [47] agrees that contextualizing teaching and learning is crucial for catering to learners' needs from different cultural backgrounds. The present result is also supported by a study carried out by Ref. [37], which reported that digital learning tools and platforms that incorporate culturally responsive pedagogies enhance the academic performance of learners from diverse backgrounds. However, some findings contradict the present study. For instance, Ref. [38] stated that emphasizing Islamic values in education can limit creativity and critical thinking, which contradicts the present result that highlights the importance of *ijtihad* (critical thinking) in Arab-Muslim education. Differently stated, the findings by Ref. [39], argued that incorporating Islamic values in digital learning tools and platforms was perceived as restrictive and may not be important for

all students' from different backgrounds, which is not in line with the present result. The result of the present study contributes to broader debates regarding the decolonization of Islamic values, digital pedagogy, and global South EdTech, in IT-based education. The research shows the need to consider pedagogical and cultural contexts in the development and design of digital learning tools and platforms, more particularly in the global South. When the pedagogical principles of Arab-Muslim are incorporated into digital learning platforms, students are provided with culturally responsive and effective learning experiences from the backgrounds of Arab-Muslim. The findings of the study in accordance with second research question indicate in different ways the Arab-Muslim pedagogical principles. Hence, the findings therefore reveal that Bayyinah TV, Noon Academy, adab were explicit while Edraak show implicit. Simply interpreted, the findings reveal the importance putting cultural and pedagogical context into consideration more particularly in the design and development of digital learning platforms. The surprise finding is that while some platforms (Bayyinah TV and Noon Academy) explicitly incorporated the pedagogical principles of Arab-Muslim like adab, another platform (Edraak) demonstrated them implicitly, showing the varying ways these principles can be integrated into digital learning platforms. These findings are similar to the findings by Ref. [40], [46], who supports that culturally responsive pedagogy promotes excellent academic motivation and engagement. In addition, the findings by Ref. [17], [45], also showed the teaching practices that are culturally responsive is important for promoting social mobility and academic achievement, which is similar to the findings of the present study. In contrast, not all researchers agree with the report of the present study. In that regard, Ref. [16], [44], agrees that digital learning environment that are culturally responsive are often limited by the Western-centric design that become dominant in the diverse EdTech platforms. These findings contradict the result of the study for the second research questions. Moreover, the findings by Ref. [25], notes that when culturally responsive pedagogy is incorporated in digital leaning platforms, time consuming becomes a major problem. This shows that the implementation of culturally responsive pedagogy can be difficult in a digital learning environment. There is more argument regarding the role of culture and pedagogy in promoting digital learning tools more particularly in the context of non-Western states.

The findings of this study, in response to the third research question, revealed both similarities and differences in the pedagogical structures of Arab world EdTech and Western platforms. Critical thinking and collaborative learning were promoted by both Western educational platforms and Arab world EdTech. However, Arab world platforms placed greater emphasis on etiquette (adab) and moral engagement. Put differently, the results also showed that Western platforms supported personalization and learner autonomy. These findings highlight the importance of considering both pedagogical and cultural contexts in the development and design of digital learning platforms. It is noteworthy that, although Arab world and Western EdTech shared similarities in fostering collaborative learning and critical thinking, Arab world platforms emphasized etiquette (adab) and moral values, whereas Western platforms focused more on learner autonomy and personalized learning. This finding is supported by Ref. [24], [34], which indicate that cultural differences significantly influence the development and design of digital learning tools. In contrast, Ref. [38], [43] maintain that many EdTech platforms share similar pedagogical approaches, which differs from the findings of the present study. The coding procedures in this study involved a systematic analysis of the features and content of digital learning platforms based on Arab-Muslim pedagogical principles. A coding framework was developed, and codes were applied to the data using NVivo qualitative software. The coding process was iterative, with the researcher refining the codes and themes as necessary. To ensure reliability, a second researcher independently coded a subset of the data, and inter-coder reliability was calculated. Any discrepancies were resolved through discussion and consensus. The coded data were then analyzed to identify patterns and insights, and the results were used to draw conclusions about the relevance of Arab-Muslim pedagogical principles in modern IT-based education. Moreover, a study by Ref. [11], reported that the globalization of EdTech influences the homogeneity of pedagogical approaches, which reduces the cultural differences in digital learning tools and platforms. The result of this study also contributes to broader argument regarding the importance of EdTech globalization as well as cultural context which go a long way in enhancing digital learning environment.

## 5. Limitations

The first limitation of the study centres on a few digital learning platforms that were used in the study. Consequently, the result of the present study may not be representative of the entire landscape of educational technology. Arab-Muslim popularity and its importance were considered in the selection criteria. The scope of the study therefore failed to cover the dimensions of educational technology. Again, language restrictions was another problem as this research was based on English and Arabic content platforms which affects the

generalizability of the findings the platforms of educational technologies that could address the academic needs of the learners who language content for other countries. The study utilized only qualitative approach for content analysis which might have affected the result in one way or the other because it is solely based on the perception of researcher. Hence, the result of the study could be subjected to academic bias. The nature of educational technology, which is dynamic was not considered, which implies that the result of the study might not really reflect the platform updates. Hence. The validity and unique necessity for studying becomes questionable. However, the present study despite these challenges enlightens educational stakeholders regarding the approaches and teaching structure of the platforms of educational technology more particularly in Arab-Muslim context. The study clearly shows that it is highly necessary to consider the context of culture and pedagogy when developing or designing platforms and tools for digital learning.

## 6. Conclusions

This study examined the reflection of Arab-Muslim pedagogical principles in modern digital learning platforms. The findings reveal that *ijtihad*, *shura*, and *adab* are essential in the Arab-Muslim world, particularly in modern IT-based education. These pedagogical principles were present across various platforms in the Arab world, highlighting their importance in designing and developing digital learning platforms. The study also found that Arab-Muslim pedagogical principles are reflected in various ways across different platforms. For example, Bayyinah TV and Noon Academy explicitly incorporated *adab*, whereas Edraak demonstrated it implicitly. Additionally, Arab world platforms emphasized moral engagement and etiquette (*adab*), while Western platforms focused more on learner autonomy and personalization. The results of this research underscore the importance of integrating Arab-Muslim pedagogical principles into modern digital learning environments.

This study provides a baseline for future researchers conducting similar investigations. By promoting cultural responsiveness and learner-centered approaches, developers of educational technology can design more effective and engaging learning experiences that enhance academic performance and support social mobility. Importantly, the study's reliance on existing platforms may limit the exploration of emerging trends and innovative pedagogical models.

## Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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## Author contribution

The contribution to the paper is as follows: Y. Paltore, D. Kokeyeva: study conception and design; A. Mustafayeva: data collection; Y. Paltore, A. Mustafayeva, K. Kassimbayev: analysis and interpretation of results; A. Mustafayeva, K. Aubakirova: draft preparation. All authors approved the final version of the manuscript.

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## Appendices

### Coding matrix of Arab-Muslim pedagogical principles and pedagogical dimensions

Pedagogical Principles	Codes	Description	Examples
Ijtihad (independent reasoning)	Critical thinking	Activities promoting problem solving and critical thinking.	Debates, Puzzles and Case studies.
	Problem Solving	Opportunities for learners' knowledge to solve real life situations.	Scenario-based learning, project, group work.
Shura (Consultations)	Collaborative learning	Features facilitating discussion and peer to peer interaction.	Group chat, discussion forums, peer review.
	Feedback mechanisms	Opportunities for learners to provide and receive feedback.	Rating systems, peer assessment, discussion forums.
sAdab (Etiquette and moral conduct)	Moral Guidance	Content promoting moral guidance and values.	Stories, reflective exercises, examples.
	Values based learning	Activities stressing Islamic principles and values.	Service learning, character development, role modelling.
<b>Pedagogical Dimensions</b>			
Dimensions	Codes	Description	Examples
Peer collaboration	Student-to-student interaction	Features that facilitates collaboration and peer interaction.	Discussion forums, group work and peer review.
Learner Autonomy	Flexibility	Opportunities for learners to manage their learning pace and path.	Personalized learning plans, self-paced learning.
	Personalization	Features allowing learners to tailor their learning experience.	Learning pathways, adaptive assessment.
Adaptivity	Adaptive learning	Features adjusting to individual abilities and needs.	AI-powered feedback, adaptive assessment.
Moral Engagement	Values based content	Content that promote Islamic principles and values.	Service learning, moral guidance and character development.