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Understanding Student Learning Preferences and Engagement in Digital Islamic Education: A VARK Model Approach

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ABSTRACT

Research Problem: The rapid advancement of digital technology has transformed Islamic education by enabling more adaptive, flexible, and student-centered learning environments. In higher education, understanding students' learning preferences has become increasingly important for supporting effective digital learning practices and accommodating diverse ways of processing information.

Research Purposes: This study aims to examine postgraduate students' learning preferences based on the VARK model and their relationship with perceived learning effectiveness in digital Islamic education contexts.

Research Methods: A quantitative correlational research design was employed involving 30 postgraduate students from the School of Education, College of Arts and Sciences, Universiti Utara Malaysia. Data were collected through a structured questionnaire adapted from the VARK learning preference framework and analyzed using Pearson's Product-Moment Correlation with SPSS.

Results and Discussion: The findings reveal that all four VARK modalities (Visual, Aural, Read/Write, and Kinesthetic) demonstrate significant positive relationships with students' perceived learning effectiveness in digital Islamic education. Among these modalities, Visual and Kinesthetic preferences show stronger associations, indicating the critical role of multimedia resources and interactive learning activities in supporting digital learning experiences.

Research Implications and Contributions: This study contributes to the growing literature on personalized and multimodal learning by providing empirical evidence from a postgraduate Islamic education setting. The findings highlight the necessity of accommodating learner diversity when designing inclusive digital learning environments that integrate technological innovation with Islamic educational values, concluding that multimodal instructional designs foster more responsive and effective pedagogical practices.

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Keywords: Digital Islamic Education; Student Engagement; Learning Preferences; VARK Model; Higher Education.

INTRODUCTION

The rapid evolution of digital technologies has reshaped the landscape of higher education by transforming how knowledge is produced, distributed, and experienced. The emergence of Education 4.0 has encouraged universities to integrate digital platforms, artificial intelligence, multimedia resources, and technology-mediated learning environments to support more flexible and learner-centred educational practices (Benavides et al., 2020; Bonfield et al., 2020). Digital transformation in education is no longer limited to the adoption of technological tools but involves a broader pedagogical shift that emphasizes personalization, accessibility, interaction, and student autonomy (Bond et al., 2021; Zhu & Liu, 2020). Recent studies have highlighted that successful digital learning implementation depends not only on technological infrastructure but also on the ability of educational institutions to understand learner characteristics and design learning experiences that align with students' needs (Martin et al., 2020).

In higher education, digital learning environments have created opportunities for students to engage with knowledge through various forms of representation, including visual materials, audio resources, digital texts, simulations, and interactive activities. These developments are particularly relevant in Islamic education, where learning traditionally emphasizes textual interpretation, knowledge transmission, ethical formation, and value-based understanding. The integration of digital technology into Islamic education provides opportunities to expand pedagogical approaches beyond conventional instructional methods by incorporating multimodal learning strategies (Mubiarto, 2025; Mujahid & Madum, 2026). However, the effectiveness of digital Islamic education depends on more than the availability of technological resources. It also requires an understanding of how students perceive, process, and interact with learning materials within digitally mediated environments (Huda et al., 2024; Istibana & Aimah, 2025).

The increasing diversity of learners in digital education has strengthened the importance of personalized learning approaches. Personalized learning emphasizes the adaptation of instructional strategies based on students' individual characteristics, preferences, and learning needs (Walkington & Bernacki, 2020). Within this perspective, learning preferences represent an important dimension because students may differ in how they receive, organize, and interpret information. Understanding these differences enables educators to develop learning environments that provide multiple pathways for knowledge acquisition and improve students' learning experiences, as expressed by Xie & Yang (2020).

One widely recognized framework for examining learning preferences is the VARK model developed by Fleming & Mills (1992), which categorizes learning preferences into four modalities: Visual, Aural, Read/Write, and Kinesthetic. The Visual modality emphasizes learning through images, diagrams, and graphical representations, while the Aural modality focuses on verbal explanation, discussion, and listening-based activities. The Read/Write modality represents preferences for textual information, reading activities, and written expression, whereas the Kinesthetic modality reflects learning through experience, practice, and active involvement. In digital learning contexts, these modalities become increasingly relevant because digital platforms enable educators to combine multiple instructional formats within a single learning environment.

Previous research has demonstrated that learning preferences may influence students' engagement with instructional materials and their perceptions of learning outcomes (Aboregela, 2023; Balasubramaniam & K, 2016; El-Saftawy et al., 2024). Studies in digital education have shown that multimodal learning environments can support student participation, improve learning experiences, and accommodate diverse learner characteristics (Martin et al., 2019). However, findings regarding the effectiveness of specific learning preferences remain varied, suggesting that the relationship between learning modalities and educational outcomes requires further investigation across different contexts. Moreover, much of the existing research on VARK learning preferences has been

conducted in general education settings (Alkhasawneh et al., 2008), health education (David et al., 2024; OJEH et al., 2017), and conventional classroom environments (Bazán-Perkins & Santibañez-Salgado, 2025; Hariyani et al., 2025), while studies focusing on digitally mediated Islamic education remain relatively limited.

This limitation is particularly significant because Islamic higher education represents a distinctive educational context where technological innovation interacts with religious knowledge, pedagogical traditions, and value-oriented learning objectives. Although digital transformation has increasingly influenced Islamic education institutions, empirical studies examining how students' learning preferences relate to their perceived effectiveness in digital Islamic learning environments are still insufficient (Simbulan & Simbulan, 2026; Siregar et al., 2025). Previous studies have primarily focused on technology acceptance, digital literacy, online learning readiness, or general learning satisfaction, while the role of students' learning preferences as a factor associated with learning effectiveness remains underexplored.

Furthermore, existing studies often examine learning styles as isolated learner characteristics rather than investigating their contribution within contemporary digital learning ecosystems. The relationship between multiple VARK modalities and perceived learning effectiveness among postgraduate students in Islamic education contexts requires additional empirical evidence. This research gap indicates the need for studies that examine how diverse learning preferences correspond with students' experiences in technology-supported Islamic education environments.

Therefore, this study addresses these gaps by investigating the relationship between students' learning preferences based on the VARK model and perceived learning effectiveness in digital Islamic education. The novelty of this study lies in its empirical examination of VARK learning preferences within a postgraduate Islamic education context at Universiti Utara Malaysia, providing evidence from learners who actively participate in digitally mediated educational environments. The study extends previous discussions on personalized and multimodal learning by examining how different learning modalities are associated with students' perceptions of digital learning effectiveness.

Theoretically, this study contributes to the understanding of learner-centred digital education by connecting learning preference theory with contemporary Islamic education practices. Empirically, it provides evidence regarding the role of VARK modalities in shaping students' perceived learning effectiveness in digital Islamic education. Practically, the findings may assist educators and educational institutions in designing more inclusive digital learning environments that recognize learner diversity while maintaining the educational values of Islamic higher education.

Based on this rationale, this study aims to: (1) identify students' learning preferences based on the VARK model in digital Islamic education environments; and (2) examine the relationship between VARK learning preferences and perceived learning effectiveness among postgraduate students. The study is guided by the following research question: How are students' learning preferences based on the VARK model associated with perceived learning effectiveness in digital Islamic education?

LITERATURE REVIEW

Digital Islamic Education and Personalized Learning

The transformation of higher education through digital technology has changed the way students access, process, and construct knowledge. Digital learning environments have expanded educational possibilities by enabling flexible access to learning resources, multimedia-based instruction, and interactive communication between educators and learners. However, digital transformation in education represents more than the adoption of technological tools. It also involves a broader pedagogical shift that requires institutions to redesign learning experiences around students' needs, characteristics, and learning contexts (Benavides et al., 2020). Within the framework of Education 4.0, universities are increasingly expected to develop learner-centered environments that integrate technology, autonomy, collaboration, and personalized learning approaches (Bonfield et al., 2020).

Previous studies indicate that successful digital learning implementation depends on the interaction between technological readiness, instructional design, and learner characteristics. Martin et al. (2020) emphasized that multiple factors influence online learning effectiveness, including teaching strategies, interaction quality, student participation, and alignment between learning materials and learner requirements. Similarly, Bond et al. (2021) highlighted that digital learning environments should consider students' active involvement and learning experiences rather than simply transferring traditional teaching practices into online platforms. These findings suggest that technology alone cannot determine learning success because students engage with digital environments through different cognitive processes and learning preferences.

This issue becomes particularly relevant in Islamic education, where learning involves not only knowledge acquisition but also interpretation, reflection, ethical development, and value formation. Digital Islamic education provides opportunities to expand traditional instructional approaches through multimedia resources, online discussions, digital texts, and interactive learning activities. Nevertheless, the effectiveness of digital Islamic education depends of how students interact with and interpret digital learning materials. Educational technology should therefore be accompanied by pedagogical strategies that recognize learner diversity and support meaningful learning experiences.

One approach that addresses learner diversity is personalized learning. Personalized learning emphasizes adapting educational experiences according to students' characteristics, interests, preferences, and learning needs. Walkington and Bernacki (2020) argued that personalized learning should not merely involve providing different materials but should focus on developing learning environments that respond to individual differences. In digital contexts, personalization becomes increasingly feasible because technology enables the integration of multiple forms of information representation, including visual, auditory, textual, and experiential resources. Therefore, understanding students' learning preferences becomes an important foundation for designing adaptive digital Islamic education environments.

Learning Preference Theory and the VARK Model

Learning preference theory has been widely discussed as an approach to understanding how learners interact with educational materials. The concept assumes that students may demonstrate different preferences in receiving, organizing, and processing information. Rather than viewing learners as having fixed abilities, learning preference frameworks provide insights into how instructional strategies can accommodate diversity within educational environments. This perspective has become increasingly relevant in digital education because technology allows educators to provide multiple modes of content delivery within a single learning platform.

One of the most widely recognized frameworks for examining learning preferences is the VARK model developed by Fleming & Mills (1992). The model identifies four primary learning modalities: Visual, Aural, Read/Write, and Kinesthetic. Visual learners tend to prefer information presented through diagrams, images, charts, and graphical representations. Aural learners demonstrate preferences for verbal explanations, discussions, and spoken information. Read/Write learners engage more effectively with written materials, texts, and note-taking activities, while Kinesthetic learners prefer experiential activities, demonstrations, and practical applications (Fleming & Mills, 1992a).

The VARK framework has been applied in various educational settings to explore how students' preferred learning modes relate to instructional approaches and learning experiences. However, the interpretation of learning preferences remains debated. Some scholars argue that learning styles should not be treated as rigid categories that determine academic achievement because empirical evidence regarding direct learning-style matching effects remains inconsistent. Instead, learning preferences may be more appropriately understood as indicators of students' preferred interactions with learning environments and instructional resources. This perspective positions VARK not as a mechanism for labelling students but as a framework for designing more flexible and multimodal learning experiences.

In digital education contexts, the relevance of VARK has increased because digital platforms naturally support multimodal learning. Students may simultaneously interact with videos, visual presentations, digital texts, simulations, and interactive activities. Therefore, examining VARK preferences within digital Islamic education provides an opportunity to understand how different learning modalities correspond with students' perceptions of their learning experiences. Rather than identifying a single dominant learning style, investigating multiple modalities may provide broader insights into how diverse learners respond to technology-supported education.

Learning Preferences and Digital Learning Effectiveness

The relationship between learning preferences and educational effectiveness has attracted continued scholarly attention, particularly as digital learning environments become more diverse and complex. Previous studies suggest that students' interactions with learning materials may influence their perceptions of understanding, satisfaction, and effectiveness. In technology-mediated learning environments, students are exposed to various instructional formats, and their learning experiences may differ depending on how well these resources correspond with their preferred ways of processing information.

Research on digital learning has demonstrated that multimodal instructional strategies can support student learning by providing multiple pathways for accessing knowledge. Martin et al. (2020) highlighted that effective online learning requires appropriate instructional design, meaningful interaction, and consideration of learner characteristics. Similarly, studies on personalized learning suggest that accommodating individual differences can improve students' engagement with learning activities and strengthen their learning experiences (Walkington & Bernacki, 2020).

Nevertheless, previous findings regarding the relationship between learning preferences and educational outcomes remain inconclusive. While some studies indicate that certain learning preferences are associated with improved academic experiences, other studies suggest that the effectiveness of learning environments depends more strongly on instructional quality, learning design, and contextual factors. This debate indicates that learning preferences should not be examined independently but within specific educational contexts where technology, pedagogy, and learner characteristics interact.

In Islamic higher education contexts, this relationship remains insufficiently explored. Existing digital learning studies have primarily focused on technology acceptance, digital literacy, online learning readiness, and student satisfaction. Although these studies provide important insights into digital education implementation, limited attention has been given to how students' learning preferences influence their perceived effectiveness of digital Islamic learning environments. This limitation creates a need for empirical investigation that connects learner characteristics with digital learning outcomes in Islamic educational settings.

The existing literature demonstrates that digital transformation, personalized learning, and learner-centred education have become central themes in contemporary higher education research. However, several limitations remain. First, previous studies have predominantly examined digital learning effectiveness from technological and institutional perspectives, while learner preference factors have received comparatively less attention. Second, although the VARK model has been widely applied in educational research, its application within digitally mediated Islamic education contexts remains limited. Third, empirical evidence regarding the relationship between multiple VARK modalities and perceived learning effectiveness among postgraduate students remains insufficient.

These gaps indicate the need for research that examines learning preferences as an important dimension of digital Islamic education. Understanding how students' preferred learning modalities relate to perceived learning effectiveness may provide valuable insights for educators seeking to design more adaptive and inclusive digital learning environments.

Therefore, this study positions the VARK model as a conceptual framework for examining students' learning preferences within digital Islamic education. By investigating the relationship between Visual, Aural, Read/Write, and Kinesthetic preferences and perceived learning effectiveness, this study contributes empirical evidence regarding the

role of learner diversity in technology-supported Islamic higher education. The study extends previous discussions on personalized and multimodal learning by providing contextual evidence from postgraduate students at Universiti Utara Malaysia.

METHOD

Research Approach and Design

This study employed a quantitative research approach using a correlational research design. A quantitative approach was selected because the study aimed to measure students' learning preferences and examine the statistical relationship between VARK learning modalities and perceived learning effectiveness in digital Islamic education. Quantitative research enables researchers to examine relationships among measurable variables through systematic data collection and statistical analysis (Creswell & Creswell, 2023). The correlational design was considered appropriate because this study focused on identifying the degree and direction of relationships between variables without manipulating participants' learning environments (Cohen et al., 2017).

The conceptual framework of this study positioned four VARK learning preference modalities, namely Visual, Aural, Read/Write, and Kinesthetic, as predictor variables, while perceived learning effectiveness in digital Islamic education was treated as the outcome variable. This design allows the study to investigate whether variations in students' preferred learning modalities are associated with differences in their perceptions of digital learning effectiveness.

Research Setting and Participants

The research was conducted within the context of postgraduate Islamic education at the School of Education, College of Arts and Sciences, Universiti Utara Malaysia. The research setting was selected because postgraduate students in this academic environment actively participate in digitally supported learning activities as part of contemporary higher education practices.

The participants consisted of 30 postgraduate students enrolled in Islamic education-related studies. A purposive sampling technique was employed to select participants based on predefined criteria relevant to the research objectives. The inclusion criteria required participants to be active postgraduate students and have experience engaging with digital learning environments during their academic activities. Purposive sampling was selected because the study required participants who possessed specific experiences related to digital Islamic education rather than a general student population, as explained by Cohen et al. (2017).

Research Procedure

The research procedure was conducted through several systematic stages. First, the research instrument was developed by adapting relevant measurement items from the VARK learning preference framework and previous studies related to digital learning effectiveness. Second, the questionnaire was distributed to postgraduate students who met the research criteria. Participants were informed about the purpose of the study and provided voluntary responses.

After data collection, responses were screened and prepared for statistical analysis. The collected data were coded and analysed using IBM Statistical Package for the Social Sciences (SPSS). The analysis process consisted of descriptive analysis, reliability testing, assumption testing, and correlation analysis. This procedure was designed to ensure that the statistical results accurately represented the relationship between learning preferences and perceived learning effectiveness.

Research Instrument and Measurement

Data were collected using a structured questionnaire consisting of two main sections. The

first section measured students' learning preferences based on the VARK model developed by Fleming & Mills (1992). The VARK framework identifies four learning modalities: Visual, Aural, Read/Write, and Kinesthetic. These modalities represent different ways students prefer to receive, process, and interact with learning information.

The second section measured students' perceived learning effectiveness in digital Islamic education environments. The items assessed students' perceptions regarding understanding of learning materials, effectiveness of digital learning activities, and overall learning experiences within technology-supported educational settings.

All questionnaire items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Likert-type scales are widely used in educational and social science research because they allow researchers to measure respondents' perceptions, attitudes, and experiences systematically, as explained by Fowler Jr (2013).

Validity and Reliability Procedures

Before conducting the main analysis, the quality of the research instrument was evaluated through validity and reliability assessment. Instrument validity refers to the extent to which measurement items accurately represent the intended constructs, while reliability indicates the consistency of measurement results.

The internal consistency of the questionnaire was assessed using Cronbach's Alpha coefficient. Cronbach (1951) introduced coefficient alpha as a measure for evaluating the consistency among items within a measurement scale. A higher alpha value indicates stronger internal consistency among measurement items. The reliability assessment was conducted for each research construct to ensure that the questionnaire items consistently measured the intended variables.

In addition, data distribution was examined through normality testing to determine whether parametric statistical procedures could be applied. The assessment of assumptions before statistical analysis is important to ensure the appropriateness and accuracy of quantitative findings as explained by Field (2024)

Data Collection and Analysis

The primary data were collected through a self-administered questionnaire distributed to selected postgraduate students. Survey-based data collection was considered appropriate because the study aimed to capture students' perceptions regarding their learning preferences and experiences in digital Islamic education environments (Fowler Jr, 2013).

Data analysis was performed using IBM SPSS Statistics. Descriptive statistics were initially conducted to summarize participants' characteristics and identify patterns in students' learning preferences. Pearson Product-Moment Correlation analysis was then applied (Berry & Johnston, 2023) to examine the relationship between each VARK modality and perceived learning effectiveness.

Pearson correlation was selected because the study aimed to determine the strength and direction of linear associations between measured variables (Sugiyono, 2021). The correlation coefficient values were interpreted based on the magnitude and direction of relationships, while statistical significance was evaluated using the predetermined significance level. This analysis directly addressed the research objective of examining how students' learning preferences are associated with perceived learning effectiveness in digital Islamic education.

Ethical Considerations

This study followed ethical principles for research involving human participants. Participation was voluntary, and respondents were informed about the purpose of the study before completing the questionnaire. No personally identifiable information was collected, and all responses were treated confidentially. The collected data were used solely for academic research purposes

RESULTS AND DISCUSSION

Respondent Characteristics

This study involved 30 postgraduate students from the School of Education, College of Arts and Sciences, Universiti Utara Malaysia. The respondents were selected based on their involvement in digitally mediated learning activities within the context of Islamic education. The demographic characteristics of respondents were analyzed to provide an overview of the participant profile, including gender, age group, and academic level.

Table 1 presents the demographic characteristics of the respondents. The results indicate that the respondents consisted of 13 male students (43.3%) and 17 female students (56.7%). In terms of age distribution, half of the respondents were within the 20–23 years age group, consisting of 15 participants (50.0%). The second largest group was respondents aged 24–26 years, with 12 participants (40.0%), while only 3 participants (10.0%) were within the 27–30 years age category.

Regarding academic level, the majority of respondents were Master's degree students, accounting for 26 participants (86.7%). Meanwhile, 4 participants (13.3%) were doctoral students. This composition indicates that the participants were predominantly postgraduate students at the Master's level who were engaged in higher education learning activities.

Overall, the respondent characteristics provide the demographic background of the participants involved in this study. These characteristics serve as the basis for understanding the context of subsequent analyses related to students' learning preferences based on the VARK model and their perceived learning effectiveness in digital Islamic education.

Table 1. Demographic Characteristics of Respondents

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	13	43.3
	Female	17	56.7
Age	20–23 years	15	50.0
	24–26 years	12	40.0
	27–30 years	3	10.0
Academic Level	Master's Degree	26	86.7
	Doctoral Degree	4	13.3
Total		**30**	**100.0**

Students' Learning Preference Profile Based on VARK Model

The analysis of students' learning preferences was conducted using the VARK framework, which categorizes learning preferences into four modalities: Visual, Aural, Read/Write, and Kinesthetic. The descriptive analysis was performed to identify the preference patterns of postgraduate students within the context of digital Islamic education.

Table 2 presents the descriptive statistics of students' learning preferences based on the four VARK modalities. The analysis was conducted using responses from 30 participants, with each learning preference dimension measured based on the mean score and standard deviation. The results show that all VARK dimensions obtained relatively high mean scores, indicating that respondents demonstrated positive preferences across all learning modalities.

The descriptive results indicate that Visual and Kinesthetic preferences obtained the highest mean scores among respondents, with both modalities recording a mean value of 4.17 (SD = 0.699). The Aural preference showed a mean score of 4.07 (SD = 0.691), while the Read/Write preference obtained a mean score of 4.03 (SD = 0.615).

Table 2. Descriptive Statistics of Students' Learning Preferences Based on VARK Model

Learning Preference	N	Minimum	Maximum	Mean	Standard Deviation
Visual	30	3	5	4.17	0.699
Aural	30	3	5	4.07	0.691
Read/Write	30	3	5	4.03	0.615
Kinesthetic	30	3	5	4.17	0.699

The findings demonstrate that respondents exhibited relatively balanced preferences across the four VARK dimensions. Although Visual and Kinesthetic modalities showed slightly higher mean values compared with Aural and Read/Write modalities, the differences among the four dimensions were relatively small. This indicates that postgraduate students in this study displayed varied learning preferences rather than relying exclusively on a single learning modality.

The descriptive findings provide an initial overview of students' learning preference patterns before examining the relationship between each VARK modality and perceived learning effectiveness through correlation analysis.

Correlation Analysis Between VARK Learning Preferences and Perceived Learning Effectiveness

Pearson Product-Moment Correlation analysis was conducted to examine the relationship between students' learning preferences based on the VARK model and perceived learning effectiveness in digital Islamic education. The analysis was performed to determine the strength and direction of the association between each learning preference modality, including Visual, Aural, Read/Write, and Kinesthetic, with perceived learning effectiveness.

Table 3 presents the correlation results between the four VARK learning preference dimensions and perceived learning effectiveness. The findings indicate that all VARK modalities demonstrated positive and statistically significant relationships with perceived learning effectiveness.

Table 3. Pearson Correlation Between VARK Learning Preferences and Perceived Learning Effectiveness

Variables	Pearson Correlation (r)	Sig. (2-tailed)	N
Visual → Learning Effectiveness	0.845**	<0.001	30
Aural → Learning Effectiveness	0.665**	<0.001	30
Read/Write → Learning Effectiveness	0.753**	<0.001	30
Kinesthetic → Learning Effectiveness	0.845**	<0.001	30

Note: Correlation is significant at the 0.01 level (2-tailed).

The results show that Visual preference had a strong positive correlation with perceived learning effectiveness ($r = 0.845$, $p < 0.001$). Similarly, Kinesthetic preference also demonstrated a strong positive correlation with perceived learning effectiveness ($r = 0.845$, $p < 0.001$). These results indicate that higher levels of Visual and Kinesthetic learning preferences were associated with higher perceptions of digital learning effectiveness among respondents.

The Read/Write preference showed a positive and significant relationship with perceived learning effectiveness ($r = 0.753$, $p < 0.001$). Meanwhile, the Aural preference demonstrated a positive correlation with perceived learning effectiveness ($r = 0.665$, $p < 0.001$), representing the lowest correlation coefficient among the four VARK modalities. Nevertheless, the relationship remained

statistically significant.

Overall, the correlation analysis confirms that all four VARK learning preference modalities were significantly associated with perceived learning effectiveness in digital Islamic education. The findings provide empirical evidence regarding the relationship between students' preferred learning modalities and their perceptions of digital learning experiences.

Discussion

VARK Learning Preferences in Digital Islamic Education

The findings of this study reveal that postgraduate students demonstrated relatively balanced preferences across the four VARK learning modalities, including Visual, Aural, Read/Write, and Kinesthetic. Although Visual and Kinesthetic preferences obtained the highest mean scores (M = 4.17), the differences among the four modalities were relatively small. Its indicates that students in digital Islamic education environments do not rely exclusively on a single learning preference but demonstrate diverse ways of engaging with learning materials. Such findings support the perspective that contemporary digital learning environments require flexible instructional approaches that accommodate multiple forms of knowledge representation rather than applying a single instructional method.

The presence of diverse learning preferences is consistent with the development of learner-centered approaches in higher education. Digital transformation has expanded the possibilities for designing learning environments that integrate various instructional formats, including visual resources, multimedia content, digital texts, audio explanations, and interactive activities (Benavides et al., 2020; Bonfield et al., 2020). In this context, learning effectiveness is not determined solely by the availability of technology but also by how effectively digital resources correspond with students' learning characteristics and educational needs (Martin et al., 2020). Therefore, identifying students' learning preferences provides important insights for developing more adaptive digital learning strategies.

The relatively high scores across all VARK dimensions also suggest that students may benefit from multimodal learning environments. Fleming & Mills (1992) introduced the VARK framework to describe differences in learners' preferred ways of receiving and processing information through Visual, Aural, Read/Write, and Kinesthetic modalities. Although learning styles have been debated regarding their ability to predict academic achievement directly, learning preferences remain valuable as a framework for understanding learner interaction with instructional materials and supporting more diverse teaching approaches (Pashler et al., 2008). In digital education contexts, the relevance of learning preferences is strengthened because technology enables educators to combine multiple instructional representations within the same learning environment.

The higher Visual preference observed in this study reflects the increasing importance of visual-based resources in digital learning. Digital platforms commonly provide access to diagrams, presentations, illustrations, videos, and graphical representations that support students in organizing and interpreting complex information. This finding aligns with the principles of multimedia learning, which emphasize that learners can develop deeper understanding when information is presented through complementary verbal and visual representations (Mayer & Fiorella, 2022). In Islamic education contexts, visual resources may support the explanation of abstract concepts, relationships among ideas, and structured representations of learning materials.

The strong Kinesthetic preference found in this study also highlights the importance of active involvement in digital Islamic education. Although digital learning is often associated with screen-based activities, effective digital environments can incorporate experiential and interactive elements through simulations, problem-solving activities, collaborative tasks, and project-based learning. Active engagement allows students to connect theoretical knowledge with practical application, which is particularly relevant in higher education where learning requires critical reflection and contextual understanding (Bonwell & Eison, 1991; Freeman et al., 2014).

The relatively high Read/Write preference also reflects the characteristics of Islamic

education, where learning activities frequently involve reading, academic writing, and engagement with scholarly texts. Digital learning platforms provide extensive opportunities for students to access electronic books, journal articles, and written learning materials. Personalized learning approaches suggest that providing diverse learning resources enables students to interact with knowledge according to their preferred approaches while maintaining flexibility in the learning process (Walkington & Bernacki, 2020).

Meanwhile, the Aural preference, although slightly lower than other modalities, remains an important component of digital Islamic education. Audio-based explanations, online lectures, discussions, and recorded presentations can support students who prefer verbal information processing. The integration of synchronous and asynchronous communication features within digital platforms enables educators to incorporate auditory elements alongside other learning resources (Bond et al., 2021).

Overall, these findings reinforce the argument that digital Islamic education should move beyond uniform instructional approaches toward multimodal learning design. Rather than categorizing students into fixed learning types, VARK preferences can be used as a pedagogical consideration for developing flexible learning environments that provide multiple pathways for knowledge acquisition. In this regard, the findings contribute to the discussion on personalized digital learning by demonstrating that postgraduate students in Islamic education contexts exhibit diverse learning preferences that should be accommodated through integrated instructional strategies.

Visual and Kinesthetic Preferences as Indicators of Digital Learning Effectiveness

The findings of this study demonstrate that Visual and Kinesthetic learning preferences showed the strongest positive relationships with perceived learning effectiveness, with both modalities producing a correlation coefficient of $r = 0.845$ ($p < 0.001$). This finding suggests that students who reported stronger preferences for visual and experiential learning approaches also tended to perceive digital Islamic education as more effective. The result highlights the relevance of multimodal instructional design in digital learning environments, where students interact with information through various forms of representation and learning activities.

The strong association between Visual preference and perceived learning effectiveness can be understood through the characteristics of digital learning environments. Digital platforms provide extensive opportunities to integrate visual representations, including diagrams, presentations, videos, and interactive media. Mayer & Fiorella (2022) argues that meaningful learning occurs when learners actively integrate verbal and visual information rather than processing information through a single channel. Therefore, the availability of visual learning resources in digital Islamic education may support students in organizing complex concepts and developing deeper understanding.

This finding is consistent with previous research emphasizing the importance of multimedia-based learning in higher education. Digital transformation has enabled educators to move beyond text-based instruction by incorporating diverse digital resources that support cognitive processing and learner interaction (Benavides et al., 2020; Bonfield et al., 2020). Martin et al. (2020) also highlighted that effective online learning depends on the alignment between instructional design and students' learning needs. In this context, visual resources may represent an important component of digital instructional strategies because they allow students to access information through structured and meaningful representations.

The strong relationship between Kinesthetic preference and learning effectiveness provides another important insight into digital Islamic education. Although digital learning is often associated with passive consumption of online materials, contemporary digital environments increasingly support active participation through simulations, collaborative activities, problem-solving tasks, and project-based learning. The finding suggests that students who prefer learning through experience and active involvement may perceive greater effectiveness when digital platforms provide opportunities for interaction and application.

This interpretation aligns with the principles of active learning, which emphasize

that students achieve deeper understanding when they actively participate in constructing knowledge rather than simply receiving information (Bonwell & Eison, 1991). Freeman et al. (2014) further demonstrated that active learning approaches are associated with improved educational outcomes compared with traditional lecture-based approaches. Within Islamic higher education, active digital learning activities may allow students to connect theoretical knowledge with practical reflection, discussion, and contextual application.

The relationship between Kinesthetic preference and digital learning effectiveness also supports the broader perspective of Education 4.0, which emphasizes experiential, collaborative, and technology-supported learning approaches. Bonfield et al. (2020) suggested that Education 4.0 requires learning environments that encourage flexibility, creativity, and student participation. Similarly, Bond et al. (2021) highlighted that digital education should not merely replicate traditional teaching methods but should provide opportunities for meaningful engagement between students, and learning resources.

However, these findings should not be interpreted as evidence that Visual and Kinesthetic learners necessarily achieve better outcomes than students with other preferences. Learning preference research has faced ongoing debate regarding the assumption that matching instruction with a particular learning style automatically improves achievement (Pashler et al., 2008). Instead, the present findings suggest that digital Islamic education may benefit from providing diverse instructional formats that allow students to interact with knowledge through multiple pathways.

From a pedagogical perspective, the findings indicate that digital Islamic education should incorporate visual and experiential elements while maintaining balance with other learning modalities. Multimedia presentations, interactive learning activities, digital simulations, and problem-based tasks may provide opportunities for students to engage with Islamic knowledge through different cognitive processes. This approach is consistent with personalized learning perspectives, which emphasize designing educational experiences that respond to learner characteristics and preferences (Walkington & Bernacki, 2020).

Overall, the strong relationships observed between Visual and Kinesthetic preferences and perceived learning effectiveness contribute to understanding how learner characteristics are associated with experiences in digital Islamic education. These findings reinforce the importance of multimodal instructional design and suggest that effective digital learning environments should integrate both information representation and active learning opportunities.

Aural and Read/Write Preferences in Digital Islamic Learning

The findings of this study indicate that Aural and Read/Write learning preferences were also positively associated with perceived learning effectiveness in digital Islamic education. Although the correlation coefficient for Aural preference was lower compared with Visual and Kinesthetic preferences ($r = 0.665$, $p < 0.001$), the relationship remained statistically significant. Similarly, Read/Write preference demonstrated a stronger association with perceived learning effectiveness ($r = 0.753$, $p < 0.001$). These findings suggest that auditory and textual forms of learning remain important components of digital Islamic education, particularly in higher education contexts where knowledge construction involves explanation, interpretation, reading, and academic discussion.

The positive relationship between Aural preference and learning effectiveness reflects the continuing relevance of verbal communication within digital learning environments. Digital education does not eliminate the importance of oral interaction; instead, technology provides additional opportunities through recorded lectures, online discussions, podcasts, video conferences, and audio-based learning materials. Mayer & Fiorella (2022) explains that effective multimedia learning involves the integration of multiple channels of information processing, including verbal and visual representations. Therefore, auditory resources may complement other digital materials by supporting students' understanding through explanation and elaboration.

This finding is particularly relevant within Islamic education, where oral transmission has historically played an important role in knowledge dissemination. Learning activities involving explanation, discussion, recitation, and interpretation remain

significant components of Islamic educational practices. In digitally mediated environments, these traditions can be extended through online lectures, recorded instructional materials, and interactive discussions. Bond et al. (2021) emphasized that meaningful digital learning requires maintaining interaction between students, educators, and learning resources rather than relying only on independent access to digital materials.

The Read/Write preference showed a relatively strong relationship with perceived learning effectiveness ($r = 0.753$, $p < 0.001$). This finding indicates that textual engagement remains an important aspect of digital Islamic learning. Unlike some educational contexts that have shifted toward highly visual and interactive resources, Islamic education continues to involve substantial engagement with written knowledge sources, including academic articles, digital books, religious texts, and scholarly interpretations. Digital platforms have expanded access to these resources through electronic libraries, online databases, and learning management systems.

The importance of textual learning aligns with the broader concept of academic literacy in higher education. Students' ability to engage with written materials, evaluate information, and construct academic arguments represents an essential component of postgraduate learning (Lea & Street, 2006). In Islamic higher education, these literacy practices are particularly relevant because students frequently engage with complex theoretical discussions, contemporary scholarship, and analytical writing activities.

The findings also support the perspective of personalized learning, which emphasizes that effective learning environments should provide multiple pathways for students to access and process information Walkington & Bernacki (2020). Digital learning environments offer opportunities to integrate written materials with other instructional formats, allowing students with stronger Read/Write preferences to engage with detailed textual resources while still benefiting from complementary multimedia elements.

However, the results should not be interpreted as indicating that Aural or Read/Write preferences are inherently superior or inferior to other modalities. Previous research has highlighted that learning preferences should be understood as tendencies in interacting with learning environments rather than fixed characteristics that determine educational achievement (Pashler et al., 2008). The significant relationships observed in this study suggest that providing diverse instructional resources may better accommodate students' different approaches to learning.

From a pedagogical perspective, the findings highlight the importance of maintaining balance between multimedia-based instruction and traditional knowledge engagement in digital Islamic education. While visual and interactive resources may enhance digital experiences, textual and auditory resources remain essential for supporting comprehension, reflection, and knowledge development. Therefore, digital Islamic education should incorporate a combination of written materials, oral explanations, visual representations, and interactive activities to create a more inclusive learning environment.

Overall, the relationship between Aural and Read/Write preferences with perceived learning effectiveness demonstrates that digital Islamic education requires instructional flexibility. The findings contribute to the understanding that effective digital learning is not dependent on one dominant learning preference but on the integration of diverse learning modalities that correspond with the characteristics of postgraduate learners.

Implications for Digital Islamic Education

The findings of this study provide several implications for the development of digital Islamic education, particularly regarding the importance of designing learning environments that accommodate diverse student learning preferences. The significant relationships between VARK learning modalities and perceived learning effectiveness indicate that digital Islamic education should consider learner characteristics as an important component of instructional planning. Rather than adopting a technology-centered approach, digital transformation in education requires pedagogical strategies that integrate technology with students' cognitive and learning needs (Benavides et al., 2020; Bond et al., 2021).

From a theoretical perspective, this study contributes to the discussion on personalized and multimodal learning by demonstrating the relevance of learning

preferences within a digital Islamic education context. Previous research has emphasized that personalized learning requires more than providing digital resources; it involves designing learning experiences that respond to individual differences and promote meaningful engagement with knowledge (Walkington & Bernacki, 2020). The present findings extend this perspective by showing that students' preferred learning modalities are associated with their perceptions of learning effectiveness in technology-supported Islamic education environments.

The findings also have implications for instructional design. Since Visual and Kinesthetic preferences demonstrated the strongest relationships with perceived learning effectiveness, educators may consider incorporating more visual representations and interactive learning activities into digital Islamic education. Multimedia presentations, concept maps, interactive simulations, and problem-based activities can provide alternative pathways for students to understand complex concepts. Meyer's et al. (2014) cognitive theory of multimedia learning suggests that combining verbal and visual information can facilitate deeper cognitive processing when instructional materials are designed appropriately.

However, the implications of this study should not be interpreted as suggesting that digital Islamic education should prioritize only Visual and Kinesthetic approaches. The findings indicate that Aural and Read/Write modalities also demonstrated significant relationships with learning effectiveness. This highlights the importance of maintaining balanced instructional strategies that integrate audio explanations, textual resources, discussions, and interactive components. In Islamic higher education, written and oral traditions remain fundamental because learning frequently involves textual interpretation, scholarly reading, discussion, and knowledge transmission.

At the institutional level, the findings suggest that universities should consider learner diversity when developing digital learning policies and learning management systems. Digital platforms should provide flexible learning resources rather than relying on a single instructional format. Research on technology-enhanced learning has emphasized that effective digital environments require alignment between technological affordances, pedagogical approaches, and learner characteristics (Hodges et al., 2024; Martin et al., 2020). Therefore, institutions should support educators through digital pedagogy training, instructional design development, and access to appropriate educational technologies.

The findings are also relevant to the broader development of Education 4.0, which emphasizes student-centered learning, flexibility, collaboration, and technology integration. Bonfield et al. (2020) argued that Education 4.0 requires a transformation of teaching practices rather than simply the adoption of new technologies. Similarly, Redecker (2017) highlighted that digitally competent educators need the ability to design inclusive learning experiences that consider both technological opportunities and learner needs. In the context of Islamic education, this approach is particularly important because technological innovation must remain connected with educational values, ethical considerations, and meaningful knowledge development.

Furthermore, this study provides implications for future development of adaptive digital Islamic learning environments. Recent developments in artificial intelligence and learning analytics have increased opportunities to identify learner characteristics and provide personalized educational experiences. Intelligent learning systems can potentially support adaptive recommendations by analyzing students' interactions, preferences, and learning patterns (Koper, 2014; Zawacki-Richter et al., 2019). However, technological adaptation should remain guided by pedagogical objectives rather than focusing solely on automated personalization.

The study also contributes to discussions regarding inclusive digital education. A multimodal learning approach may support broader participation by recognizing that students engage with knowledge through different pathways. Inclusive digital learning environments should therefore provide combinations of visual, auditory, textual, and experiential resources. This perspective aligns with universal design for learning principles, which emphasize providing multiple means of engagement, representation, and expression to support diverse learners (Meyer et al., 2014).

Based on these findings, a conceptual framework is proposed to illustrate the

relationship between students' learning preferences and digital Islamic education effectiveness. The framework positions VARK learning preferences as important learner characteristics that interact with digital instructional strategies to shape students' perceived learning effectiveness.

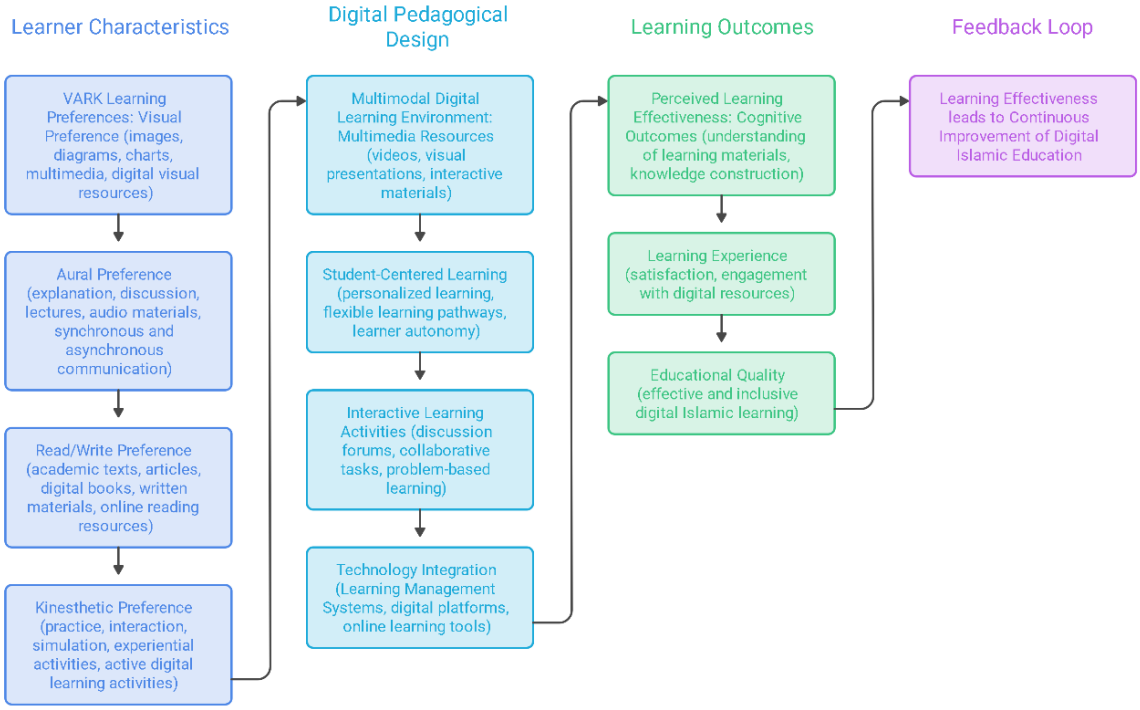


Figure 1. Conceptual Framework of the Relationship Between VARK Learning Preferences and Perceived Learning Effectiveness in Digital Islamic Education

Figure 1 illustrates the conceptual framework developed in this study to explain the relationship between students' learning preferences, digital pedagogical design, and perceived learning effectiveness in digital Islamic education. The framework positions VARK learning preferences, consisting of Visual, Aural, Read/Write, and Kinesthetic modalities, as important learner characteristics that shape how students interact with digitally mediated learning environments. These preferences are accommodated through a multimodal digital learning environment that integrates multimedia resources, student-centered learning approaches, interactive learning activities, and technology-supported instructional strategies. The framework proposes that the alignment between learner characteristics and digital pedagogical design contributes to students' perceived learning effectiveness through improved learning experiences, cognitive understanding, and educational quality. Furthermore, the framework incorporates a feedback mechanism in which learning effectiveness provides insights for continuous improvement of digital Islamic education practices. This conceptual model highlights that effective digital Islamic education requires integration between technological innovation, pedagogical strategies, and recognition of learner diversity.

Overall, the implications of this study emphasize that effective digital Islamic education requires a balanced integration of technological innovation, pedagogical strategies, and recognition of learner diversity. The findings highlight that understanding students' learning preferences can assist educators and institutions in designing more adaptive learning environments that provide multiple pathways for knowledge acquisition and engagement. By implementing multimodal instructional approaches that incorporate visual, auditory, textual, and experiential resources, digital Islamic education can better accommodate diverse student needs within contemporary higher education contexts. Furthermore, this study reinforces the importance of moving beyond technology-centered

approaches toward learner-centered digital practices that consider how students interact with and experience digital learning resources. Therefore, integrating learner characteristics with digital pedagogical design represents an important direction for developing more responsive, inclusive, and meaningful technology-supported Islamic higher education.

CONCLUSION

This study examined students' learning preferences based on the VARK model and their relationship with perceived learning effectiveness in digital Islamic education among postgraduate students at Universiti Utara Malaysia. The findings demonstrate that students exhibited diverse learning preferences across Visual, Aural, Read/Write, and Kinesthetic modalities, with Visual and Kinesthetic preferences showing the highest mean scores. Furthermore, the correlation analysis revealed that all VARK modalities were significantly and positively associated with perceived learning effectiveness, indicating that students' preferred ways of engaging with learning materials are relevant considerations within digitally mediated Islamic education environments.

The study contributes to the understanding of digital Islamic education by highlighting the importance of learner-centered and multimodal instructional approaches. Rather than relying on a single mode of knowledge delivery, effective digital learning environments should integrate various forms of representation, including visual resources, textual materials, auditory explanations, and interactive activities. This approach allows educators to accommodate learner diversity while maintaining the intellectual and educational values of Islamic higher education.

Despite its contributions, this study has several limitations. The research involved a relatively small sample of postgraduate students from a single institution, which limits the extent to which the findings can be generalized to broader educational contexts. In addition, the study relied on self-reported questionnaire data, which reflects students' perceptions rather than direct measurements of learning performance. Future research may expand the investigation by involving larger and more diverse samples across different Islamic higher education institutions, applying mixed-method approaches, and incorporating longitudinal designs or learning analytics to explore how learning preferences interact with digital learning experiences over time.

Overall, this study provides empirical evidence that understanding students' learning preferences can support the development of more adaptive, inclusive, and responsive digital Islamic education practices. The findings highlight the importance of integrating learner characteristics with digital pedagogical design to create learning environments that accommodate diverse ways of engaging with knowledge. This study contributes to the growing discussion on personalized and multimodal learning by demonstrating the relevance of learner-centered approaches within technology-supported Islamic higher education. Therefore, the integration of technological innovation, pedagogical strategies, and learner diversity represents an important direction for the future development of digital Islamic education.

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AUTHOR CONTRIBUTIONS

Dadan F. Ramdan: Conceptualization, methodology, investigation, formal analysis, data collection, writing – original draft, writing – review and editing, visualization, and project administration. The author contributed to the development of the research framework, implementation of the study, analysis of findings, and preparation of the manuscript. Muhamad Rizza: Conceptualization, methodology, validation, and writing – review and

editing. The author contributed to refining the research design, reviewing the analytical approach, and improving the intellectual content of the manuscript. Fadwa Aly: Investigation, data analysis support, and writing – review and editing. The author contributed to the interpretation of findings and manuscript refinement. Agus Nurdiana: Methodology, validation, and writing – review and editing. The author contributed to methodological evaluation and improvement of the manuscript. Abdul Mugni: Data curation, investigation, and writing – review and editing. The author contributed to research data organization and manuscript development. Hilma Fatimatul Zahro: Data collection, investigation, visualization, and writing – review and editing. The author contributed to supporting data preparation and presentation of research findings. Yanwar Habibul Mutaqin: Data collection, formal analysis support, and writing – review and editing. The author contributed to data processing and manuscript improvement. Niela Agustin Rahmawatie: Literature review, investigation, and writing – review and editing. The author contributed to supporting the theoretical foundation and refinement of the manuscript. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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The authors declare that there is no conflict of interest related to the research, authorship, and publication of this article.

DATA AVAILABILITY
The data supporting the findings of this study are available from the corresponding author upon reasonable request.

AI USE DECLARATION
The authors used Grammarly and Napkin AI to assist with manuscript preparation. Grammarly was used for language editing, grammar improvement, and enhancement of writing clarity. Napkin AI was used to assist in the visualization and development of conceptual framework illustrations. The use of these AI-assisted tools was limited to editorial and visualization support. All content, analyses, interpretations, and conclusions were independently reviewed and verified by the authors. The authors remain fully responsible for the accuracy, originality, integrity, and content of the manuscript.

ETHICAL CLEARANCE
Ethical clearance was not required according to the applicable institutional research ethics procedures. The participants were informed about the purpose of the study, participation was voluntary, and the confidentiality of respondents' information was maintained throughout the research process.

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