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Journal of Computing Research and Innovation 9(1) 2024

Journal of Computing Research and Innovation

The Effect of the NSPIxD Model's Integration on Knowledge, Perceived Awareness, and Perceived Motivation Through Mobile Learning

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ARTICLE INFO

Article history:
Received: 6 December 2023
Revised: 21 December 2023
Accepted: 21 December 2023
Online first: 1 March 2024
Published 1 March 2024

Keywords:
Knowledge
Perceived Awareness
Perceived Motivation
User Interaction
Mobile Learning

DOI:
10.24191/jcrinn.v9i1

ABSTRACT

Tablets, smartphones, and wearable devices can be beneficial in promoting academic learning and have evolved into the primary teaching method in formal and informal education. Concurrently, multimedia components can boost user engagement and interest in mobile applications and increase users' usage and attention to them. Celebrating the trend, a study on Islamic mobile applications integrated with the Signaling principle and Nielsen's Design Guideline investigates the knowledge and perceived awareness of the target users' context and perceived motivation in using the learning material. This research is inspired to intensify the Islamic mobile app user's motivation to use the app, uplift their interest, and increase their awareness and knowledge of Islamic content, particularly in Asmaul Husna. Islamic mobile apps are suggested to employ the Signaling principle since these principles guide attention, organization, knowledge integration, and reduce extraneous load. The research is divided into three stages comprised of theoretical study, development, and evaluation. The study generally finds that students' knowledge and perceived awareness of Asmaul Husna was increased by Asmaul Husna Mobile Application (AHMA) for both presentation modes which are AHMA-0 (not integrated with NSPIxD Model) and AHMA-NSPIxD (integrated with NSPIxD model). It demonstrates AHMA's efficacy as an alternative and creative approach to expanding the knowledge and perceived awareness of Asmaul Husna among students and their perceived motivation for the learning materials. The study sample is restricted to undergraduate students between 18 and 24. Therefore, this study suggests that future studies should also be extended to other learners' levels and a broader spectrum

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https://doi.org/10.24191/jcrinn.v9i1

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1. INTRODUCTION

In the context of education, a paradigm shift is necessary for this mobile technology to succeed. Some propose that parents and teachers inspire students to learn heutagogically (self-determined learning) (Gillaspy & Vasilica, 2021) via mobile phones under their administration and monitoring (Ng et al., 2020). In contrast, others are concerned about how mobile learning might not be suitable and can cause unnecessary extra work for teachers. Learning is accessible via mobile phones, desktop computers, and laptops. Mobile learning is an excellent initiative as it offers flexibility, luxury, and an effective learning method for generations Y and Z (Chee et al., 2017). It benefits many parties, especially digital users, who enjoy a more interactive and personalized experience through social, mobile, analytics, and cloud (SMAC) technologies (Selamat et al., 2017). Plus, embracing the MOHE's vision of Higher Education 4.0, which is to create heutagogy (self-determined learning), paragogy (peer-oriented learning), and cybergogy (virtual-based learning) (MOHE, 2018). Nevertheless, given the current COVID-19 pandemic's impact, digital tools have become critical as teaching and learning activities shift away from traditional face-to-face instruction and toward online distance learning platforms (Al-Rahmi et al., 2021; Fook et al., 2021). At the moment, mobile phones are an indispensable tool for learning, profoundly affecting education (Dollah et al., 2017; Fook et al., 2021; Mayer, 2020).

Consequently, to bridge this gap, a study on Islamic mobile applications integrated with the Signaling principle and Nielsen's Design Guideline is performed to investigate the knowledge and perceived awareness of the target users' context and perceived motivation in using the learning material. Islamic mobile apps are suggested to employ the Signaling principle since these principles guide attention, organization, and integration of knowledge (Mautone & Mayer, 2001). Generally, it reduces extraneous load and unnecessary memory burden, which can cause a decrease in learning outcomes (Richter et al., 2016). The signals ease the demands on the user's working memory. Thus, reducing the cognitive load and the information is easily comprehended conjointly with Nielsen's design guideline to determine the usability trends. Therefore, this research is inspired to intensify the Islamic mobile app user's motivation to use the app, uplift their interest, and increase their awareness and knowledge of Islamic content, particularly in Asmaul Husna learning.

This research involved two presentation modes: Asmaul Husna Mobile Application (AHMA) integrated with NSPIxD model (Signaling principle hybridizes with Nielsen's design guidelines); AHMA-NSPIxD and mobile application without the proposed model; AHMA-0. The objectives are to investigate the effects of the validated NSPIxD Model through prototyping, and user experience in knowledge, perceived awareness, and perceived motivation towards the learning material.

2. LITERATURE

2.1 Mobile Learning

The transition from traditional information dissemination and acquisition modes to mobile technology has been swift. While individuals require various devices to communicate and perform multiple tasks, a smartphone is now sufficient as a standard and intuitive means of interacting with other people, places, and objects (Nielsen & Arvidsen, 2021). Wireless technology, particularly mobile phones or smartphones, has fundamentally altered how people communicate and manage their personal and social lives. The exponential growth in mobile phone penetration rates across Asia, including Malaysia, demonstrates this. In 2019, 98.2 percent of Malaysian households had access to a mobile phone (Department of Statistics Malaysia, 2020). As a consequence, the proliferation of smartphones has rendered mobile applications a crucial instrument for individuals to effectively oversee their day-to-day activities (Cheng & Sabran, 2023). However, a paradigm shift is required for this mobile technology to succeed in education. According to some, lecturers and teachers must encourage students to learn independently using technology, such as

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mobile phones, while still being supervised and monitored (Ng et al., 2020); others are concerned about how this learning may be inappropriate and lead to additional work for teachers. It also suggests that mobile devices are more comfortable making learning happen anywhere than worn-out and perishable notebooks (Rosmani et al., 2014). Mobile learning applications can be created for various purposes, one of which can assist students with their studies. Customized online learning strategies responsive to students' needs can enhance the online learning experience and outcomes (Ranganathan et al., 2021). However, these benefits require new pedagogics and a new approach to conveying and facilitating instructions. If adequately encouraged, mobile learning can benefit students by providing teaching materials and interactions through mobile devices anywhere and whenever needed (Al-Rahmi et al., 2021; Ng et al., 2020). Additional Malaysian material, such as food, natural resources, rituals and beliefs, storytelling, dance, martial arts, Malay, and history, should be enhanced via mobile content.

2.2 Knowledge

According to Benjamin (Bloom, 1956), learning is when learners can remember, recall, retrieve, or recognize information, ideas, and principles in the approximate form they were learned from previously learned material. Questions are asked solely to test whether a learner has gained specific information from the lesson and includes knowledge of the main ideas being taught. Bloom's Taxonomy was created to categorize the levels of reasoning skills required in classroom situations. There are six levels in the taxonomy, each requiring a higher level of abstraction from the students. The six levels of Bloom's Taxonomy are; 1) Knowledge, 2) Comprehension, 3) Application, 4) Analysis, 5) Synthesis, and 6) Evaluation. Knowledge is one of the dependent variables examined in this study. The researcher must ensure that users better understand the context by utilizing the generated app. Existing knowledge of Allah's 99 names also contributes to their increased understanding of this subject.

2.3 Perceived Awareness

Awareness refers to processing the organism's nervous system (including the sensory device) and its environment. This processing results in the primary organism's ability to respond to environmental stimuli (Arp, 2007). Awareness is associated with sentience, perception, feeling, and cognition. It requires mental activity from the central nervous system or awareness to conscious experience in a psychological state. Awareness is also defined as understanding others' actions and providing context for one's activities (Dourish & Bellotti, 1992). However, it is essential to state that a lack of awareness can lead to systematic efforts and slow down innovation (Reinhardt et al., 2012). In this study, perceived awareness is the second dependent variable.

2.4 Perceived Motivation

Motivation is one of the most common words in psychology that refers to the factors that move or stimulate creatures. It can be deduced that motivation exists when people work hard towards a specific goal. For example, a student who gave his best effort in nearly every task can conclude that he is motivated to accomplish it. Motivation also refers to the underlying causes of behavior characterized by readiness and stance. Intrinsic motivation is powered by personal enjoyment, interest, or pleasure, while defense contingencies control extrinsic motivation. Motivation involves the constellation of beliefs, perceptions, values, interests, and closely related actions. Motivation in individuals tends to vary in all areas, and these domains' specificity increases with age (Lai, 2011). The motivational role is somewhat less evident in the Cognitive Theory of Multimedia Learning (CTML). However, the theory distinguishes between the three memory capacity requests during learning: external, necessary, and generative. In CTML, motivation is a force that incites, improves, and maintains generative processing, leading to better learning outcomes. The learner is not continually overloaded with extraneous processing or overly distracted from necessary processing (Mayer, 2014; Mayer & Estrella, 2014). Therefore, Keller (2010) proposes a motivational model to analyze students' motivational characteristics and design a motivational approach.

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2.5 Asmaul Husna

Asmaul Husna is Allah's 99 most beautiful name and is stated in the Qur'an and Hadith. They represent each of the Creator's characters, and understanding them is essential for achieving ma'rifatullah based on the Qur'an and Sunnah. By repeatedly calling the unique Name of Allah (dhikr) and praying, asking for energy from God through the soul, energy will flow through the soul, and the energy produced will flow to the brain, the heart, and the body. This technique is stated in Al-Quran in Surah Al A'raf verse 180. Of the 99 names of Allah, 69 names are found in the Holy Qur'an with different frequencies, ranging from 1 to 138 times. The other 30 names are located in the Hadith of the Prophet. Unfortunately, the public is unaware that Asmaul Husna contains beautiful meanings that can be used in everyday life either as a supplication or dhikr (Ab Rahman, 2016; Abdul Muhsin Al-Badr, 2020; Al-Qurtubi, 2017; Nik Mat, 2016; Wan Mohd, 2015a). It has been supported by Surah Al-A'raaf verse 180, "And to Allah belong the best names, so invoke Him by them. And leave [the company of] those who practice deviation concerning His names. They will be recompensed for what they have been doing".

3. METHODOLOGY

This study intends to examine the effects of two mobile applications in assessing Muslims' knowledge, perceived awareness of Asmaul Husna, and perceived motivation for mobile apps. The mobile applications consisted of AHMA-NSPIxD and AHMA-0. The prototype design is represented in Fig. 1.

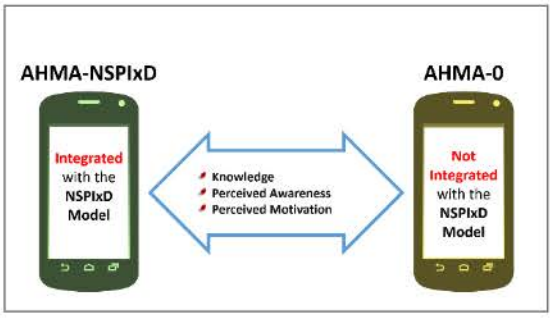


Fig. 1. Prototypes Used in the User Experience Tests

One of these apps (AHMA-NSPIxD) has been integrated with the NSPIxD Model (Rosmani et al., 2021) as depicted in Fig. 2, which was developed before this prototype's development. This model has been implemented through a prototyping process where each component, element, principle, and guideline adapted into the model are included in the prototype, a mobile app (Rosmani et al., 2022). Next, experts review this app to ensure that every item in the model is well-adapted. After receiving comments and criticism from experts, these mobile apps have been improved and subsequently used by users through quasi-experiments that have been conducted. This model was first validated by experts who hold a doctor of philosophy degree in a field related to the study. They are comprised of experts in HCI, Multimedia Learning, Software Engineering, Instructional Design, Interaction Design, Multimedia Systems, and Usability. Each of them inspected and provided the best input to improve the model and subsequently amended and made the final model before being implemented into the prototype. It ensures that the model has been produced with the appropriate framework and functionality to guide the development of other prototypes in the future.

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3.1 The NSPIxD Model

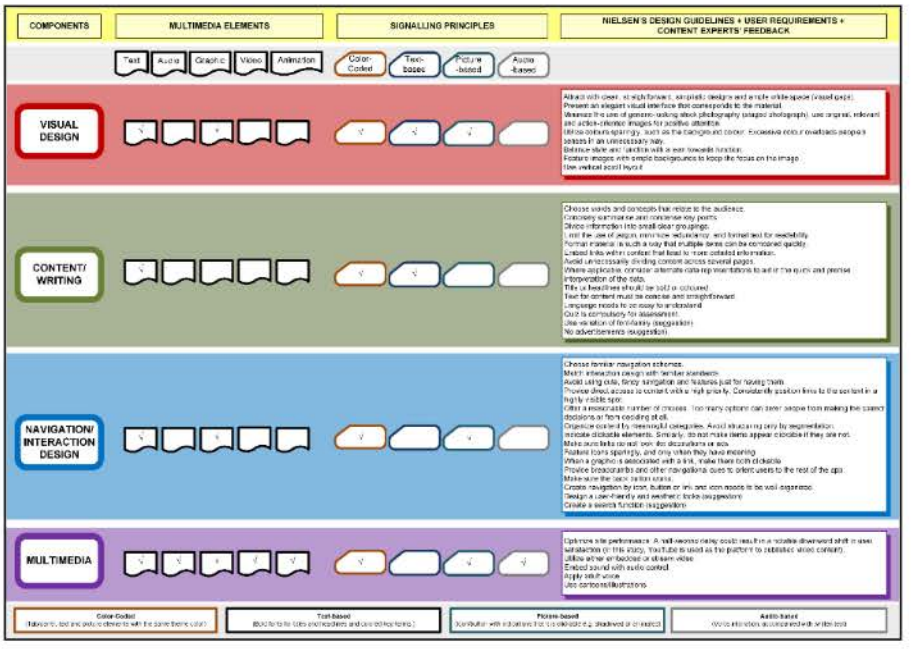


Fig. 2. NSPIxD Model

According to Shneiderman et al. (2010), three to five experts are needed for expert analysis. This report has enlisted more than enough experts in response to those recommendations, whose details are listed in Table 1. Experts from various public higher institutions were involved through interview sessions.

Table 1. List of Experts

No.	Gender	Education	Fields of Expertise	Experience (Year)	Affiliations
1.	Male	Ph.D.	HCI, Usability	19	Universiti Utara Malaysia
2.	Male	Ph.D.	Software Engineering	14	Universiti Teknologi MARA
3.	Male	Ph.D.	Instructional Design	21	Universiti Sains Malaysia
4.	Male	Ph.D.	Interaction Design	14	Universiti Kebangsaan Malaysia
5.	Female	Ph.D.	Multimedia Learning	10	Universiti Utara Malaysia
6.	Female	Ph.D.	Multimedia Systems, HCI	13	Universiti Utara Malaysia

The proposed guidelines were printed in color and A3 size and presented face-to-face to each expert. After scrutinizing the proposed guidelines, each has suggested a few added or eliminated factors from the list. The suggestions are listed in Table 2.

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Table 2. Experts Review and Comments

Experts	Comments or Remarks
Expert 1	Overall, the components of the model are clearly stated. Information related to each component needs to be listed in detail.
Expert 2	Which theory and approach do you use to construct all the components, elements, and design principles? Do you have justifications for each component, element, and design principle? Simplify your terms and sentences; avoid ambiguous meanings.
Expert 3	The model should tally with the mobile applications, ensuring the principles are embedded precisely.
Expert 4	The model readability could be improved (it may need some rearrangement to ease reading flow). For example, use tick boxes instead of arrows.
Expert 5	Signaling/cueing could be used for multiple components, e.g., text-based can be used for interaction design, content, multimedia, and visual design.
Expert 6	Same comment as expert 5.

After five experts' reviews, the results were saturated, and the sixth expert no longer offered additional findings. As a result, the results obtained are adequate. As illustrated in Figure 2, the NSPIxD Model is revised to incorporate expert advice and comments and serve as the foundation for prototype development. The process is used to validate and refine the proposed model before implementing it in AHMA-0. Note that this model has been used and implemented in the AHMA-NSPIxD mobile application and has been checked by three experts with Heuristic Evaluation (Rosmani et al., 2021).

3.2 Research Population and Sampling

The populations of this study are Muslims in Malaysia and those familiar with mobile applications. Based on the target audience, Muslims, and the mobile app's primary users, the most suitable candidates are between 18 and 24 years old, mainly university and college students (Malaysian Communications and Multimedia Commission, 2017, 2018). Purposive sampling is appropriate and attainable for this study (Cohen & Swerdlik, 2009; Randolph, 2008). The sample is chosen using an appropriate sampling method for quantitative analysis, and the minimally acceptable sample size is usually 30 participants (Brown & Green, 2016; Cohen & Swerdlik, 2009; Gay et al., 2012; Randolph, 2008; Roblyer, 2006). A successful study with a sample size of 10 to 20 is also attainable in experimental research with adequate experimental control. This study was conducted at several universities to obtain homogeneous sampling as university students are equivalent regardless of demographic aspects and possess the same abilities in the area tested (Brown & Green, 2016; Cohen & Swerdlik, 2009). Consequently, Universiti Utara Malaysia, Universiti Malaysia Perlis, and Universiti Teknologi MARA Perlis are chosen based on the homogeneity characteristics.

3.3 Validation and Reliability of Instruments

For quantitative data analysis, validity and reliability issues are essential, and it is to demonstrate that the method of choice measures what is intended to be measured. It also ensures that the measurement is stable and consistent and that no errors or biases exist from respondents or researchers (Dawson, 2002). The validation process is conducted to check and validate the items in the instruments used in the study. Suitable content experts are chosen to fulfill this task. Simultaneously, the Cronbach Alpha test is performed accordingly to ensure that the instruments are reliable for the study. Cohen and Swerdlik (2009) and Heale and Twycross (2015) recommend that Cronbach's Alpha is one of the best methods to obtain internal consistency reliability estimates.

(i) Pre-test and post-test instruments validity (AHKAI)

Validity is an instrument's capability to measure the actual value (Chua, 2012). Three experts from local public universities have checked and validated the instruments.

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(ii) Pre-test and post-test instrument reliability (AHKAI)

Reliability relates to the consistency of a measure; an acceptable reliability score is 0.7 or higher (Heale & Twycross, 2015). Thirty-one sample feedbacks have been done to check the reliability of these instruments; the Cronbach alpha value is 0.718, which is greater than the minimum acceptable reliability score of 0.7. Therefore, the instrument is considered reliable and consistent.

This study is classified into a quantitative category and utilizes a quasi-experimental approach, as illustrated in Fig. 3, using pre-test and post-test factorial design (Randolph, 2008). Both treatment groups experienced different mobile applications intended to develop their understanding of Asmaul Husna.

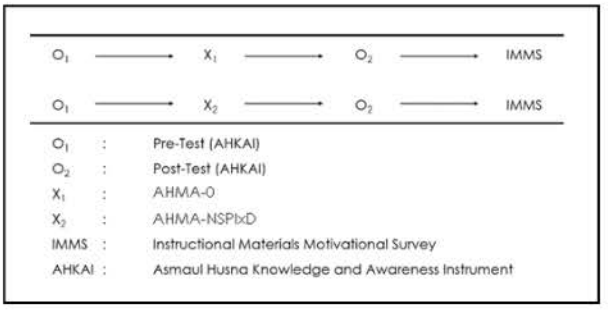


Fig. 3. Research Design

3.4 Experiment Procedures

This experiment is in 2 phases, (i) pilot study and (ii) actual study.

(i) Pilot Study

Before the actual study, a pilot study is carried out to validate research procedures and instruments, gather feedback on the mobile app from learners for improvement, and expose the shortcomings in the experiments' design or the proposed method. A group of students at a selected university has participated in the pilot study sessions, and these students are not involved in the actual study. Initially, they are given a pre-test question to answer before implementing the treatment using AHMA adapted to the NSPIxD model (AHMA-NSPIxD). The questionnaire that is used in the pre-test is AHKAI. Two weeks after the pre-test, the post-test is later done to prevent the students from remembering the questions. After two weeks, the treatment begins after the facilitator introduces AHMA and describes the treatment procedure. Students can seek help from facilitators during treatment. After one hour of using AHMA, the student took the post-test using AHKAI. The post-test questions are the same as the pre-test, but the items are randomly arranged to avoid the possibility of memorizing the answers. Finally, the students took the IMMS questionnaire to complete the research procedure. Feedback from students during the pilot test was considered and used to improve the app's effectiveness and usability for execution in actual experiment sessions. The data collected in this study is analyzed using descriptive statistics involving pre-test, post-test, and IMMS.

(ii) Actual Study

The actual study is implemented at the three universities; each university from each area is randomly assigned to different mobile apps to curb the probability of exchanging apps between diverse participants. Before treatment, the facilitator informs the participants of the treatment session and introduces them to AHMA. Students are involved in experimental studies during the same week but with different group schedules. This session is conducted in classes and computer labs, and the treatment period is approximately an hour a week. At the beginning of the session, the participants were scheduled to sit for the pre-test. Then, after two weeks, they were briefed on the interface and navigation of the AHMA. After that, the participants

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were allowed to explore it by themselves. The group was monitored and provided help when necessary. Immediately after the treatment, they were given the post-test questions (AHKAI). This period was chosen to minimize the question remembering the effect of pre-test questions on post-test questions. Finally, after answering the post-test questions, the participants received the perceived motivation test using AHMA and IMMS. The participants were given unique links to download the mobile app according to their group, either AHMA-NSPIxD or AHMA-0. It eliminates the internal threat. With this precaution, they do not accidentally download both apps simultaneously.

3.5 Data Analysis Technique

IBM SPSS Statistics Version 26 analyses all the data obtained through this study. The analysis used is descriptive and inferential statistics conducted before in the same manner suggested by (Abdul Wahab, 2016; Melhem, 2014; Menon, 2016; Osman, 2015; Othman, 2015).

(i) Descriptive Statistics

Descriptive statistics are used to analyze the data regarding the essential features that resulted from this study. It encompasses the median, mean, standard deviation, and frequency as summaries for the pre-test and post-test.

(ii) Inferential Statistics

Inferential statistics for the data analysis are t-test, Analysis of Variance (ANOVA), Analysis of Covariance (ANCOVA), and Pairwise Comparisons. ANCOVA evaluates the pre-test and post-test results to investigate the significant difference among dependent variables: knowledge and perceived awareness of participants on the mobile application between the two mobile applications and the moderator variable. In contrast, ANOVA investigates the significant difference among the dependent variables, perceived motivation on the mobile application, between the two mobile apps.

3.6 Null Hypotheses

The experiment investigates the effects of Asmaul Husna Mobile Application (AHMA) integrated with the NSPIxD model, AHMA-0, and mobile application without the proposed model; AHMA-NSPIxD enhances users' knowledge, perceived awareness, and perceived motivation of the context; Asmaul Husna. Therefore, there are three hypotheses generated for this purpose. The hypotheses are:

1. There is no significant difference in users' knowledge of Asmaul Husna between the mobile application integrated with NSPIxD (AHMA-NSPIxD) and the mobile app without the model (AHMA-0). To support that, the following subsidiary hypotheses need to be tested:
H01a: There is no significant difference in users' knowledge of Asmaul Husna between AHMA-0 and AHMA-NSPIxD.

2. There is no significant difference in users' perceived awareness of Asmaul Husna between the mobile application integrated with NSPIxD (AHMA-NSPIxD) and the mobile app without the model (AHMA-0). To support that, the following subsidiary hypotheses need to be tested:
H02a: There is no significant difference in users' perceived awareness of Asmaul Husna between AHMA-0 and AHMA-NSPIxD.

3. There is no significant difference in users' perceived motivation of Asmaul Husna between the mobile application integrated with NSPIxD (AHMA-NSPIxD) and the mobile app without the model (AHMA-0). To support that, the following subsidiary hypotheses need to be tested:

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H03a: There is no significant difference in users' perceived motivation toward learning material between the AHMA-0 and AHMA-NSPIxD.

4. RESULTS AND DISCUSSIONS

Results from the tests performed were then analyzed and tabled to indicate and discover the effects on the three variables tested and to reflect on the null hypotheses erected early in the research.

4.1 Effects of AHMA on Knowledge

ANCOVA was conducted to see whether there is a significant difference in knowledge between the AHMA-NSPIxD and AHMA-0 participants. The results obtained are summarized in Table 4. The p-value is shown to be 0.000, which is under 0.05. Hence this result is significant. There is a substantial difference between both apps in the knowledge score. Therefore, these results explain that participants who used the AHMA-NSPIxD received higher scores on their knowledge than AHMA-0. Thus, the AHMA-NSPIxD is effective in enhancing the students' understanding.

Table 4. ANCOVA Analysis for Knowledge Score between Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	161.090[a]	2	80.545	39.443	0.000
Intercept	320.816	1	320.816	157.105	0.000
Pre-Test	155.737	1	155.737	76.265	0.000
Group	57.583	1	57.583	28.199	0.000
Error	355.317	174	2.042		
Total	12477.000	177			
Corrected Total	516.407	176			

a. R Squared = .312 (Adjusted R Squared = .304)

A pairwise comparison is then carried out to examine whether there is a substantial difference in knowledge gained between participants in both groups. Finally, a separate variance analysis was performed to assess which group was responsible for the effect. The results of the pairwise comparison are detailed in Table 5. The findings showed a substantial difference in knowledge gain between the treatment group participants and the control group (p-value=0.000, mean difference=1.264). This outcome suggests that relative to AHMA-0 presentation modes, participants using AHMA-NSPIxD obtained higher knowledge. Both apps had a positive impact on students' knowledge. The statistical findings suggest that both mobile apps' average knowledge assessment ratings increased. Students who used AHMA-NSPIxD, on the other hand, reported a much higher knowledge score than students who used AHMA-0. The learners learned more about Asmaul Husna when they utilized AHMA-NSPIxD; therefore, Mayer's CTML (2001) is supported. Mayer believes learning can improve when visual cues and signals are used. It is founded on the premise that learners can easily interpret clues when offered.

Table 5. Pairwise Comparisons for Knowledge Scores Between Groups

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[b]
AHMA-0 (Control)	AHMA-NSPIxD (Treatment)	-1.264*	.243	.000
AHMA-NSPIxD (Treatment)	AHMA-0 (Control)	1.264*	.243	.000

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4.2 Effects of AHMA on Perceived Awareness

ANCOVA research was carried out to determine whether there is a substantial difference in participants' perceived awareness between AHMA-NSPIxD and AHMA-0. The obtained findings are described in Table 6. It is shown that the p-value is 0.013, which is below 0.05. This result is, therefore, vital. The perceived awareness score shows a significant difference between the apps.

Table 6. ANCOVA Analysis of Perceived Awareness Pre-Test Score between Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	927.504[a]	2	463.752	102.614	.000
Intercept	336.792	1	336.792	74.522	.000
Awareness Pre-Test	893.467	1	893.467	197.697	.000
Group	28.236	1	28.236	6.248	.013
Error	786.372	174	4.519		
Total	178636.000	177			
Corrected Total	1713.876	176			

a. R Squared = .541 (Adjusted R Squared = .536)

These findings from pairwise comparisons in Table 7 clarify that participants who used the AHMA-NSPIxD earned higher scores on their perceived awareness than those using the AHMA-0 mode. The mean difference is 0.856. In terms of students' perceived awareness, the results of this study revealed a considerable difference between both groups of students. According to the study, students who used the AHMA-NSPIxD had a considerably higher perceived awareness score than those who used the AHMA-0. When students utilized AHMA-NSPIxD, they became more aware of Asmaul Husna. AHMA-NSPIxD encourages learners to employ their available cognitive capacity for active cognitive processing during learning, and it has been associated with rising interest in awareness. The information should be structured into logical representations, including pictorial and verbal representations and prior knowledge.

Table 7. Pair-Wise Comparison for Perceived Awareness Score between Group

I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[b]
AHMA-0 (Control)	AHMA-NSPIxD (Treatment)	-.856*	.343	.013
AHMA-NSPIxD (Treatment)	AHMA-0 (Control)	.856*	.343	.013

4.3 Effects of AHMA on Perceived Motivation

In particular, ANCOVA was intended to examine a significant difference in perceived motivation scores between participants using the two mobile apps. Table 8 displays the results, showing that the p-value (0.000) is less than 0.05, indicating a sign of significance. It implies a substantial distinction in the perceived motivation scores between AHMA-NSPIxD and AHMA-0. Therefore, participants who used AHMA-NSPIxD showed higher perceived motivation scores than those who used AHMA-0.

Table 8. ANCOVA Analysis for Perceived Motivation Score between Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7445.290[a]	1	7445.290	48.744	.000
Intercept	3569912.160	1	3569912.160	23371.913	.000
Group	7445.290	1	7445.290	48.744	.000
Error	26730.145	175	152.744		
Total	3606044.000	177			
Corrected Total	34175.435	176			

a. R Squared = .218 (Adjusted R Squared = .213)

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A separate variance study was conducted to compare pairwise to determine which group was responsible for the effect. The results are detailed in Table 9. The table illustrates that in motivation scores where p-value = 0,000, there is a significant difference between AHMA-NSPIxD. Consequently, the treatment group participants obtained higher motivation than the control group. The results of students' perceived motivation scores calculated using the IMMS questionnaire in this study indicate that students perceived all presentation styles as motivating them. However, there is a substantial difference between the two modes in the perceived motivation among students. The study reveals that students exposed to AHMA-NSPIxD have a higher perceived motivation than students who used AHMA-0. While both presentation styles were similarly established, the type with signals and cues was highly likely to motivate AHMA-NSPIxD to be a better learning material for instruction. Students may be inspired to learn when they believe the teaching is attentive, engaging, and essential to their needs; according to (Keller, 1987, 2010), such findings are imperative to performance. Students would feel more inspired if the learning environment could capture their attention. A summary of the research findings is listed in Table 9.

Table 9. Pair-Wise Comparison for Perceived Motivation Score between Groups

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[b]
AHMA-0 (Control)	AHMA-NSPIxD (Treatment)	-12.972*	1.858	.000
AHMA-NSPIxD (Treatment)	AHMA-0 (Control)	12.972*	1.858	.000

5. CONCLUSION AND RECOMMENDATIONS

This study aims to develop and assess the effects of AHMA-0 and AHMA-NSPIxD on university students to increase their knowledge, perceived awareness, and perceived motivation for learning materials on Asmaul Husna. The developed mobile app design and development provide a theoretical design structure that can guide other mobile apps' design and development for multimedia learning. In general, the study finds that for both presentation modes, students' knowledge and perceived awareness of Asmaul Husna was increased by both mobile apps. It demonstrates the app's efficacy as an alternative and a creative approach to expanding the knowledge and perceived awareness of Asmaul Husna among students. The results also show that relative to AHMA-0, students who used AHMA-NSPIxD performed significantly higher in their knowledge, perceived awareness, and motivation. In conclusion, the study results also showed that the proposed model's mobile app has increased students' knowledge and perceived awareness of Asmaul Husna. This research, therefore, supports the advantage of hybridizing the Signaling principles and Nielsen design guidelines through the construction of the NSPIxD model. This study implies that future research should be expanded to additional levels of learners to assess the efficacy of employing AHMA-NSPIxD to improve other users' knowledge, perceived awareness, and motivation in a different context. Future research may be able to generalize the findings to a larger sample size.

6. ACKNOWLEDGMENT

Thank you, especially, to JCRINN, Universiti Teknologi MARA Cawangan Perlis for the opportunity to publish.

7. FUNDING

The authors thank the Ministry of Higher Education Malaysia for funding this research via the Fundamental Research Grant Scheme with Project Code: 14189.

https://doi.org/10.24191/jcrinn.v9i1

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8. AUTHOR CONTRIBUTION

Author 1 prepared the literature review and oversaw the article writing, wrote the research methodology, performed fieldwork, conducted the statistical analysis, and interpreted the results. Authors 2 and 3 oversee, supervise, and advise on the research and proofread the contents.

9. CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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