RESPONDING TO ISLAMIC FINANCE ANOMALIES IN INDONESIA: SHARIA FINANCIAL LITERACY USING VIRTUAL REALITY CONTEXT

Abstract

Purpose

The purpose of the current study is to investigate the process by which the level of immersion in virtual reality-based behavioral simulation (VR-BS) impacts on the non-cognitive and cognitive outcomes. The cognitive outcome is measured using the increase in the level of sharia financial literacy, while the non-cognitive outcome is measured using the behavioral intention to use VR-BS.

Design/methodology/approach

The method consists of two parts: First, the development of VR-BS, in the context of sharia financial literacy, using the waterfall model**.** Second, testing the effectiveness of VR-BS using the theory of interactive media effects (TIME) framework. The participants were 142 students from three secondary schools (two Islamic religious schools and one public school) in Yogyakarta and Central Java, Indonesia. Partial least squares structural equation modeling (PLS-SEM) was used for testing the hypotheses.

Findings

VR-BS creates a perceived coolness and vividness, which in turn has an impact on increasing the participants' engagement. Also, the use of VR has an impact on natural mapping, which increases a user's engagement through its perceived ease of use. As predicted, the user's engagement affects VR's behavior, mediated by the user's attitude toward VR media. VR's interactivity, however, does not impact on the cognitive aspect.

Research limitations

The participants were not randomly selected, as the data were collected during the COVID-19 pandemic. As a result, the majority of the participants had never tried VR before this study. The participants, however, were digital natives.

Practical implications

It is implied from the findings that Islamic financial business actors and the relevant government agencies (e.g., the Indonesian Financial Services Authority [OJK], the Ministry of Education, Culture, Research and Technology, and the Ministry of Religious Affairs) should collaborate to best prepare the future generation of *ummah* by using VR-BS in their joint promotion and education programs. The results of the current study reveal that the use of VR-BS may attract people to engage in Islamic financial activities. By engaging in such activities, or at least engaging in real-life simulations/classes/workshops, people may gradually acquire more knowledge about Islamic finance.

Keywords: sharia financial literacy, halal lifestyle, virtual reality, behavioral simulation, financial literacy

Introduction

When it comes to Islamic finance, there is an anomaly in Indonesia. As a countercyclical policy against the impact of the spread of coronavirus, the government merged three Islamic banks (Bank Syariah Mandiri, BRI Syariah, and BNI Syariah) in early 2021. The result of the merger of these Islamic banks increased their Islamic financial assets by IDR214.6 trillion[1] and propelled the merged banks into the top 10 largest Islamic banks in the world, in terms of market capitalization (Bisnis, 2021). However, the market share of Islamic finance is still very low (9.9%) compared to that of conventional finance, even though Indonesia has the largest Muslim population in the world (87% of the total population are Muslims). In addition, according to the Indonesian Financial Services Authority's 2022 survey, big gaps remain between Islamic financial literacy levels (9.14%) and conventional financial literacy levels (49.68%) and also between Islamic financial inclusion (12.12%) and conventional financial inclusion levels (85.10%) (OJK, 2022). As such, efforts are needed to increase awareness about Islamic finance, one way is through sharia financial literacy. Sharia financial literacy is arguably able to change the mindset of people and prepare future generations for a better and more sustainable Islamic economy and financial future. Sharia-based financial literacy must be taught as early as possible, as part of the efforts to prepare to improve the welfare of society.

Information technology supports the learning process and is a solution when dealing with digital natives (Hussain et al., 2018). One of the information technologies that can be used to efficiently and effectively support sharia financial literacy's learning process is virtual reality (VR). VR is an innovative approach that provides real-life experiences, thereby increasing the user's immersion (Jagger and Sloan, 2016). The use of innovative VR technology aims to respond to the expectations of today's audience, who are millennials with an educational instrumentalist outlook (Venkat Raman et al., 2019) and look for a return on their investment from whatever they learn (Clayson and Haley, 2005). Business analysts predict that VR could become the biggest technology in the future (Greenlight and Roadtovr, 2016). VR is also projected to play an important role in education, by increasing the user's engagement and motivation. The emotional impact of immersion is an important factor, as VR induces a higher level of immersion than other forms of

[1]In early July 2023, 1USD is around IDR15,000.00

media and thus facilitates learning through positive emotions (e.g. Picard and Burleson, 2004). Therefore, it is important to understand the impact of VR when applied to sharia financial literacy.

Previous studies on the use of VR appear to have focused on nursing education, surgical instruction, studying anatomy, and medical education (Guedes et al., 2019; Haque and Srinivasan, 2006; Jin et al., 2020; Kyaw et al., 2018; Zhao et al., 2020).Coban et al. (2022) performed a meta-analysis on the use of VR in learning and found that simulator-based VR is primarily used to improve teaching and performance in the surgical field. Research into the use of VR for learning Islamic financial literacy is still limited. That said, the results of previous studies examining the impact of VR in the context of education are still inconclusive. Several studies have found that VR produces positive cognitive outcomes in a number of settings, including the military (Webster, 2016), firefighting (Çakiroğlu and Gökoğlu, 2019), negotiation training (Ding et al., 2020), robotic operations (Cohen et al., 2020; Makransky et al., 2016), health training (Chow-White et al., 2017) and teaching ethics (Sholihin et al., 2020). VR also has a positive impact on non-cognitive outcomes (Makransky et al., 2016). However, Moreno and Mayer (2002) and Pfandler et al. (2017) found that immersive VR simulations did not improve the retention and transfer of learning. Makransky et al. (2016) found that VR increases immersion but has less effect on learning. Recently, Sari et al. (2021b) found that the effectiveness of VR depends on the user's learning style.

The purpose of the current study is to investigate the process by which the level of immersion in virtual reality-based behavioral simulation (VR-BS) impacts on the non-cognitive and cognitive outcomes using the theory of interactive media effects (TIME). The cognitive outcome is measured by increasing the level of sharia financial literacy, while the non-cognitive outcome is measured by the behavior intention toward the VR-BS. The TIME has been used by previous researchers in various fields: website use (Wang and Sundar, 2018), digital advertising use (Sundar et al., 2017) and virtual fitting room applications for online shopping (Lee et al., 2020). However, the use of simulations to engage in sharia financial activities is still limited. This study finds that the use of simulations impacts on the non-cognitive, but not on the cognitive aspect. The rest of the paper is organized as follows. Section 1 is the introduction, which is followed by a literature review. The third section is the method. The fourth section is the result, the fifth section is the discussion and the final section is the conclusion.

Literature Review

Sharia Financial Literacy for Digital Natives

Financial literacy is a crucial factor for improving financial well-being (Karakurum-Ozdemir et al., 2019). Financial literacy, which is a combination of skill, behavior, awareness, attitude, and individual knowledge, is needed when making financial decisions to achieve financial well-being (OECD, 2013). From a Muslim's point of view, financial literacy must be linked to sharia rules. Muslims need to understand whether the financial instruments or institutions they trust are in accordance with sharia law (Albaity and Rahman, 2019). This encourages studies related to sharia financial literacy. Antara et al. (2016) define sharia financial literacy as the individual knowledge and skills to understand financial information, especially the ability to distinguish conventional finance from Islamic finance.

According to Biplob and Abdullah (2019), sharia financial literacy is the ability to understand the concepts of money, debt, savings, expenses, zakat and other sharia compliant and non-sharia compliant elements involved in transactions that are prohibited in Islam, including usury (interest), *maysir* (gambling) and *gharar* (uncertainty). There are two challenges for a Muslim when making decisions: First, he/she must understand the financial terms and the factors that influence financial well-being. Second, a Muslim must also understand the types of financing or instruments that are in line with sharia principles (Albaity and Rahman, 2019).

Virtual Reality for the Digital Generation

VR is a computer simulation technology that provides virtual interactive experiences using three-dimensional images and special tools that support the interaction between the users and the computer programs (Yoon et al., 2015).VR is becoming popular in education because of its ability to provide immersive, imaginative, and interactive experiences (Gavish et al., 2015), so that students can engage optimally through the design of the VR technology (Serio et al., 2013). VR positively influences the user's experience and motivation (Huang et al., 2021). Students are able to explore complex topics that are unattainable with traditional teaching methods, through high-fidelity graphical features and immersive content using head-mounted displays (HMD) (Hamilton et al., 2021). Additionally, VR may encourage students to acquire cognitive skills through experiential learning (Çalişkan, 2011).

Digital natives are particularly close to technology. Prensky (2001) describes digital natives as the generation born after 1984 that have been exposed to the digital age all their lives. Digital natives are believed to have advanced technical digital skills and learning preferences that differ from previous generations. Therefore, traditional learning is not prepared, and not suitable, for them. Most students who are digital natives are surrounded by various gadgets that allow them to communicate and collaborate with others (Ahmad and Mufeed, 2018). In addition, educators also report that conventional learning methods are no longer effective. This is because students are impatient, easily distracted and frustrated, so they do not pay attention to their teachers (Hernandez and Flores, 2019). This highlights the importance of technology-based learning that can stimulate the digital generation's interest in the learning process (Bittman et al., 2011). Information technology supports the learning process by responding to the needs of the digital generation (Hussain et al., 2018). Technology is therefore not only a new challenge in the world of education, but also a solution when dealing with digital natives. VR is a solution which meets the needs of this digital generation and provides an interactive and fun learning experience (Kiat et al., 2017). In addition, VR can also increase students' engagement in learning and provide training facilities that can be used repeatedly (Hernandez and Flores, 2019).

The Theory of Interactive Media Effects (TIME)

The TIME was developed by Sundar et al. (2017) and describes an individual's response to media influenced by technology that provides an immersive experience (Sundar et al., 2017). This theory is related to four technological capabilities: modality, agency, interactivity, and navigability (Sundar, 2008). The system in the computer requires technological capabilities which include pointing, touching, and browsing, which are all generated through the technological features provided, such as the keyboard, display layer, and mouse (Wang and Sundar, 2018). The model for the TIME is depicted in the following chart:

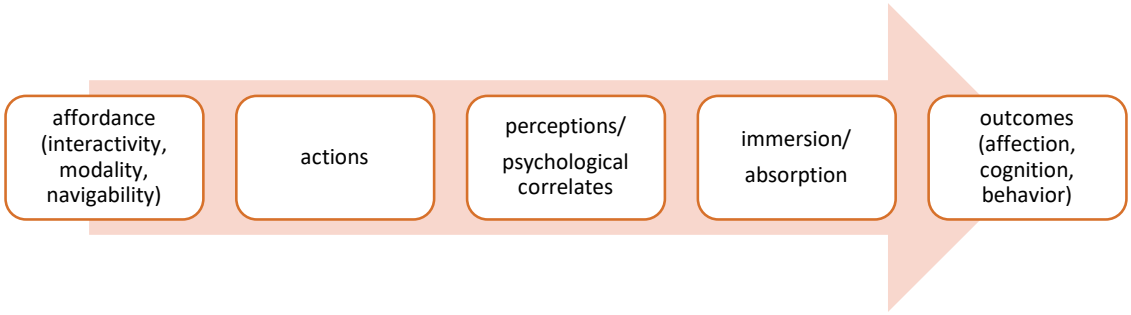

Figure 1. Model of the Theory of Interactive Media Effects (Sundar et al., 2017)

Based on this theory, media characteristics produce psychological correlations in users which are translated into immersive experiences, and then cognitive and behavioral affective responses occur (Sundar et al., 2017). The ability of technology to influence an individual's psychology occurs through two routes: the cue route and the action route. The cue route focuses on the psychology of the individual, who is influenced by the cues represented in the user's interface and auto-generated metrics. On the other hand, the action route focuses on the effect that the display interfaces have on the user's actions(Wang and Sundar, 2018).

In the cue route, the vividness and coolness of the developed technology's design tend to be the main impressions for the user (Wang and Sundar, 2018). Therefore, the perception of these two aspects is the key to the cue effect produced by VR technology. The perception of vividness is the representational richness that results from the mediated stimulus (Shen and Khalifa, 2012). Vividness refers to a two-dimensional concept consisting of sensory width and sensory depth (Steuer, 1992). Sensory width means the number of senses involved in using the media, while sensory depth refers to the extent to which the media can replicate parts of the human sensory system (Steuer, 1992). In the context of VR, vividness shows the various visual and audio dimensions contained in the developed VR's design. The perception of coolness is described as a user's multidimensional assessment of the related media (Wang and Sundar, 2018). There are three components in the perception of coolness: attractiveness, originality, and subcultural appeal (Sundar et al., 2014).

In the action route, natural mapping and the perceived ease of use are considered as cognitive evaluations that arise from the media's use (Sundar et al., 2017). Natural mapping is the level of individual interaction with the developed media (Skalski et al., 2011). Meanwhile, the perceived ease of use is the level of individual belief that, when using a particular system, no effort is required (Davis et al., 1989).

Relationships between variables

Based on the TIME framework, affordability has some effect on the user's psychology (Sundar et al., 2015). Affordability is an actionable property between the world and the actor (Gibson, 1977). Affordability influences the user's psychology through two routes: the cue route

and the action route. The cue route focuses on the presence of specific features on the interface, for example, on the number of likes on Facebook and Instagram posts. Whereas the action route represents the actual use of the interface's features to perform communication tasks, such as users broadcasting themselves via YouTube.

The psychological appeal of media via the cue route tends to be based on aspects of form and presentation, rather than on interactional features. Hence, the perception of coolness and vividness is its key aspect. Being cool is a positive trait. Users perceive qualities that discriminate between what is cool and what is not (Warren and Campbell, 2014). Leung et al. (2020) argue that messages delivered using virtual reality technology provide an immersive, high-quality experience and enable interactivity. Interactivity, originality, and high quality are components of perceived coolness (Sundar et al., 2014).

Steuer (1992) defines coolness as "the representational richness of the mediated environment," referring to sensory breadth and sensory depth. Sensory breadth is related to the number of sensory dimensions that are presented simultaneously (e.g., a user can see a scene in a market setting, hear a vendor's voice, or experience the different types of products sold in the market). Sensory depth is related to the quality of the sensory information (e.g., a realistic representation of the listening space). Clarity is associated with the quality or perceived coolness of a product's presentation (Jiang and Benbasat, 2007; Wang and Sundar, 2018; Yim et al., 2017). In the context of VR, an example of coolness is a higher image quality, so that the shape of the objects can be seen clearly. Coolness leads to a higher level of vividness (Yim et al., 2017). Thus, we propose our first hypothesis:

H1: Perceived coolness impacts on the perception of vividness.

The realistic interactions and vivid product images in this VR directly affect the user's experience. Several studies have confirmed that interactivity and vividness affect emotional experiences in virtual contexts (e.g., Aljukhadar et al., 2020; Fiore et al., 2005; Jung et al., 2018). Vividness is a heuristic that has a positive halo effect on the user's engagement (Sundar et al., 2015). Vividness consists of two aspects: breadth (i.e., the number of senses being addressed) and depth (i.e., the quality of the representation) (Kerrebroeck et al., 2017). Vividness, in the context of virtual reality, means having a higher level of clarity and depth than other forms of media, such as video. In a video, the user only looks passively at the scenarios that have been made (only the

senses of sight and hearing are involved), while in VR, users can interact, carry out explorations and even conduct behavioral simulations (involving vision, hearing, movement and even feeling), which is expected to increase user engagement. User engagement with the media refers to the extent to which users are cognitively and emotionally focused on the media's content (Oh and Sundar, 2016). Since perceived coolness impacts on the perception of vividness, and perceived vividness impacts the user's engagement, we hypothesize:

H2: Perceived coolness impacts on the user's engagement through the perception of vividness.

According to the TIME, natural mapping and perceived ease of use are both measures of the use of technical features (Sundar et al., 2015). Natural mapping shows the extent to which individuals interact with technology (Skalski et al., 2011). Natural mapping is achieved when interface controls match the actual physical behavior (Norman, 1988). An example, in the context of VR, is that natural mapping explains how naturally we know that an interface refers to a control to move locations in a virtual environment, so that without instructions we naturally already know the function of that menu.

In a sense, naturally mapped controllers do not require the user to learn new mental models in order to use them effectively**.** In a way, naturally mapped controls improve usability because users don't have to learn new mental models to use the media effectively (Wang and Sundar, 2018) thus increasing the perceived ease of use, which is the extent to which people believe that using a particular technology requires little or no effort (Davis et al., 1989).We hypothesize:

H3: Natural mapping has an impact on the perceived ease of use.

Improved perceived use, due to real models that realistically reflect real world actions, thereby enable users to easily access the mental models associated with those actions (Tamborini and Skalski, 2006), therefore increasing user engagement. According to the TIME's behavioral pathway, the user's perceived ease of use can mediate the relationship between natural mapping and user engagement (Wang and Sundar, 2018). Therefore, we propose that natural mapping increases the perceived ease of use and ultimately increases the user's engagement.

H4: Natural mapping has an impact on the user's engagement through the perceived ease of use.

O'Brien and Toms (2013) define perceived engagement as the quality of the experience that allows immersion in a particular technology. Engagement has been studied in many different ways, including attitudes toward technology (Moreira et al., 2022). However, engagement can also be expressed as beliefs (Ozkal, 2019), activities (Haines et al., 2019) or feelings (Abusamhadana et al., 2019). (O'Brien and Cairns, 2016) examine engagement in the context of health, education, games and social media. User engagement influences attitudes, behavior and cognition (Sundar, 2008). Persuasion theories such as the theory of planned behavior also suggest that attitude is a precursor of behavioral intent (Ajzen, 1991). Since user engagement impacts on the attitude toward VR media and the attitude toward VR media impacts behavior toward VR media, we therefore hypothesize:

H5: User engagement will predict the behavior toward VR media, mediated by the attitude toward VR media.

As stated by Sundar (2008), user engagement influences attitudes and cognition. VR technology improves students' retention of learned concepts (Buttussi and Chittaro, 2018; Meyer et al., 2019), improves knowledge transfer (Chittaro et al., 2018) and improves their emotional performance, which affects learning outcomes (Cheng and Tsai, 2020). Since user engagement impacts on the attitude toward VR media and the attitude toward VR media impacts on cognition, we therefore hypothesize:

H6: User engagement will predict cognition and be mediated by the attitude toward VR media.

Method

The method consisted of two parts: first, the development of VR-BS, in the context of sharia financial literacy; second, testing the effectiveness of VR-BS. The method used to develop the VR system was the waterfall model. There were five stages in its development:

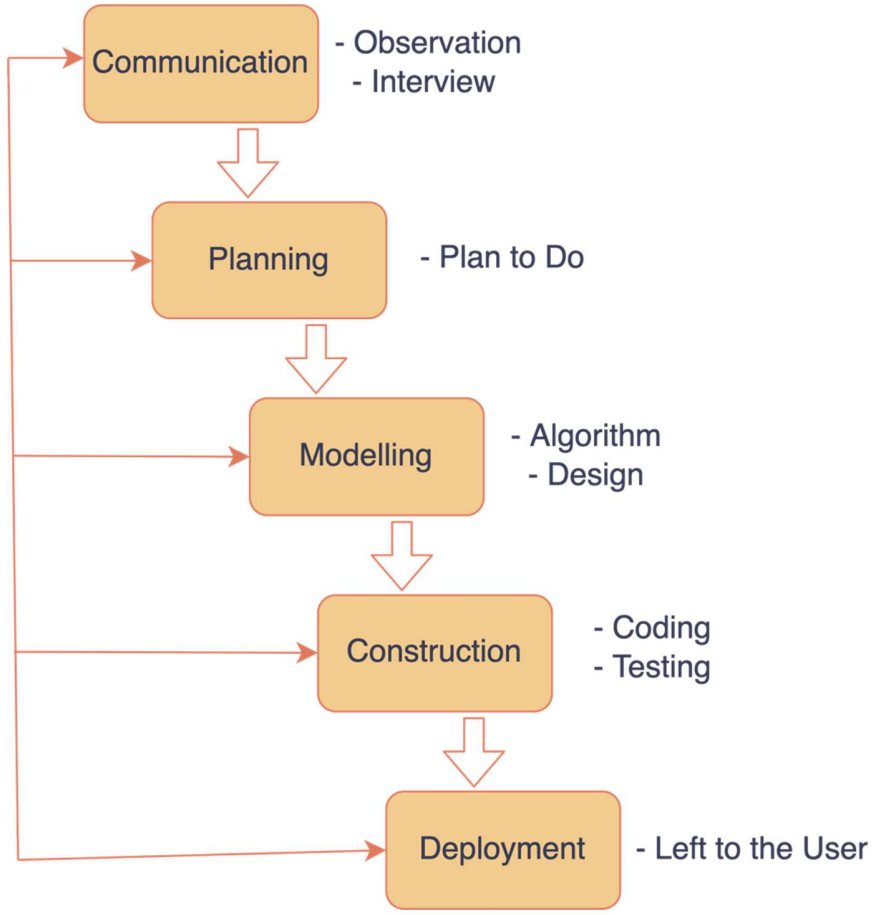

Figure 2. Waterfall Stages (2015)

1. Communication

   At this stage, information about the user's needs was obtained. Those needs were considered when developing the application.

2. Planning

   At this stage, the narratives and scenarios were created in the VR application being developed.

3. Modeling

   The design process was carried out by creating assets that would be used in the VR application. The following figure is an example of an asset that was created.

Figure 3. An example of an Asset

4. Construction

   The construction process involved arranging the assets into an environment that described events according to the storyline. (See Figure 3)

   At this stage, a black box test was carried out. Table 1 provides the results of the black box test.

Table 1. The results of the black box test

No	Scenario	Test results	
		Appropriate	Not Appropriate
1.	The application can display *halal* (permissible) and *haram* (nonpermissible) stories via video and virtual reality	✓	
2.	The screen shows the *halal* and *haram* stories in 2 parts, right and left	✓	
3.	The application's display has a convex shape to the right and left	✓	
4.	The application can be seen using the VR box device	✓	
5.	The application's display can change direction according to the movement of the smartphone	✓	
6.	On the application, the shape of the objects can be clearly seen	✓	

No	Scenario	Test results	
		Appropriate	Not Appropriate
7.	The visual direction movement moves in the direction that corresponds to the actual situation	✓	
8.	Visual animation looks natural, like a real situation	✓	
9.	The application's display shows the position of the user's head	✓	
10.	There is a dot in the center of the display to determine the center point of the view	✓	
11.	Some visual objects will appear border when viewed by the user	✓	
12.	The remote cursor can move the user's position in the app	✓	
13.	The OK button in the application can perform actions on certain objects	✓	
14.	The application's display moves according to the orders of the user	✓	
15.	Movement of the remote cursor will move the visual display	✓	
16.	The OK button shows the action according to the user's command	✓	
17.	A user command to an object makes that specific object perform an action	✓	
18.	The application responds to the given action when pressing the OK button on a particular object	✓	

5. Deployment

   After these processes, the VR-BS was ready to be given to the users.

Hypotheses testing

Partial least squares structural equation modeling (PLS-SEM) analysis using SmartPLS 4 software was performed to test the hypotheses. In contrast to the covariance-based structural equation model (CB-SEM), PLS-SEM is more oriented toward prediction; it does not assume the

normality of the sample's distribution, and it can be carried out on small sample sizes (Hair et al., 2017).

Definition of Variable and Measurement

The behavioral intentions toward VR referred to the degree to which a person was willing to use VR again, and to recommend VR to others. Behavioral intentions toward VR were measured using a modified Coyle and Thorson (2001) measure.

The perceived vividness referred to the degree to which this VR was perceived as pleasant, affective, and vivid (Collins et al., 1988). Measurement of the perceived vividness used items adapted from Collins et al. (1988).

The perceived coolness referred to the degree to which individuals perceived the VR technology as being new, interesting, having subcultural appeal and high quality (Sundar et al., 2014). The measure of its perceived coolness used a modification from Sundar et al. (2014).

Natural mapping (NM) referred to the degree to which individuals found a natural interface to use when performing a task. Natural mapping measures were adapted from Skalski et al. (2011).

The perceived ease of use (PEU) referred to the extent to which the users used the VR without any mental effort. The measure of perceived ease of use was adapted from Davis et al. (1989).

The attitude toward VR products was the degree to which the VR users found them interesting and useful. Their attitude toward the product was measured by an instrument from (O'Keefe and Delia, 1981).

User engagement was the process that encompassed the users' initial responses to technology (Sutcliffe et al., 2010), as well as their continued use and re-engagement with information systems over time (O'Brien and Toms, 2013). User engagement in this study was measured using items modified from Agarwal and Karahanna (2000). An overview of the instruments for measuring the variables is available in Table 2A in the Appendix. The measurement of the variables used a scale of 1 (strongly disagree) to 7 (strongly agree). A pilot test was carried out beforehand to evaluate the reliability and validity. Results of the pilot test can be seen in Table 5A in the Appendix.

The cognitive variable was measured by the difference in pre-test and post-test scores related to knowledge of sharia financial literacy. This study developed the measurement of sharia

financial literacy for young learners by modifying several of the categories from the instrument of Sari et al. (2021a) as referred to in Table 1A in the Appendix. An overview of the instruments for measuring sharia financial literacy is in Table 3A in the Appendix.

Participants

The participants were 142 students from three secondary schools (two Islamic religious schools and one public school) in Yogyakarta and Central Java, Indonesia. Secondary school students were selected as the participants because financial education must be given at the early stages of a child's life (Mandell, 2008) and this knowledge will accumulate at the next grade level (Sosin et al., 1997). In addition, based on the score from the Programme for International Student Assessment (PISA), the level of financial literacy of students in Indonesia was 388, which was significantly lower than the PISA financial literacy score in OECD countries (500) (OECD, 2019).

As data collection took place during the COVID-19 pandemic, the participants comprised students who were willing to participate in our research activities. All the participants received written and verbal information prior to their participation, explaining the purpose of the study and the experiment. Before interacting with VR, the participants completed a pre-assessment questionnaire. Later, they filled out another questionnaire, after using VR. Table 2 below shows the descriptive statistics for the participants.

Table 2. Descriptive Statistics

Variable		**N**	**Min**	**Max**	**Mean**	**Std.dev**
Age	School 1	25	12	15	13.92	1.58
	School 2	44	12	15	13.61	1.02
	School 3	63	12	13	12.05	0.21
Pre-test score	School 1	25	0.50	1.00	0.72	0.16
	School 2	44	0.33	1.00	0.68	0.19
	School 3	63	0.33	0.83	0.67	0.14

The average age of the respondents was 13.19 years, and there was no difference in the pre-test scores of the students from the three schools. Therefore, the students of the three schools had the same basic knowledge of sharia finance before experiencing VR-BS.

Result

A. Virtual Reality-based Behavioral Simulation in the Context of Sharia Financial Literacy

This VR-BS application has been successfully developed through a series of software engineering processes, starting from the communication definition stage to the implementation stage. This application presents a virtual environment for market simulations, in which there are several assets, such as fruit shops, vegetable shops, toy shops, conventional banks and Islamic banks. Users are required to enter the virtual market to spend money according to sharia guidelines. They spend their money according to their budget by choosing goods and transactions that are in accordance with sharia principles. After using VR-BS, the users are expected to understand the basic concepts of Islamic financial literacy, which include the ability to choose *halal* merchandise, and perform transactions that do not involve *riba* (usury), *maisyir* (gambling), and *gharar* (high uncertainty). In addition, the users also learn to manage their finances for saving, alms giving and personal consumption.

The application has been tested for its compatibility and functionality for use on all types of Android devices. This VR application (app) provides a high level of interactivity and immersion, allowing its users to perform simulations in cyberspace. To use the features of this VR, the app must be downloaded and installed on an Android device, after which the user puts the Android smartphone in the VR box and activates the Bluetooth remote control. The evaluation of the content's quality, the learning goals' orientation and motivation was carried out by two material experts, while the hardware and software tests were undertaken by two information technology experts. Table 3 shows the results of the assessments of the material and media.

Table 3. Results of Material and Media Assessment.

PANEL A. Material Assessment

	Content's quality	Learning and goals' alignment	Motivation
Material expert 1	78	75	86
Material expert 2	77	76	85

PANEL B. Media Assessment

	Hardware testing	Software testing
Media expert 1	80	79
Media expert 2	78	76

Total score conversion: highly feasible: 92 > x ≥ 74.75; feasible: 74.75 > x ≥ 57.5; fairly feasible: 57.5 > x ≥ 40.25; not feasible: 40.25 > x ≥ 23

In this VR-BS, the users act like consumers spending their money in a virtual market (Figure 4). Each user spends his/her money buying necessities according to the list provided. There are multiple choices for the products and services; each user is asked to choose *halal* goods (Figure 5) and make transactions that do not include *usury* (Figure 6)*, maisyir* (Figure 7) *and gharar* (Figure 8).

Figure 4. Virtual market condition

Figure 5. Screenshot of the VR condition depicting the activity of choosing halal and haram products and services.

Note: As can be seen from this figure, the language used in the app is Indonesian. The English tranlation of the sentence and words which appear in the screenshot is as follows: *Daftar Belanjaan* = shopping list; *Daging* = meat; *Kentang* = potato; *Jeruk* = orange; *Ayam* = chicken; *Daging apa yang harus dibeli*? = what meat must be bought?; *Beli* = buy.

An example of a usury transaction is shown in Figure 6. Users can choose to buy a toy for cash at a price of IDR90,000 using his/her own money or to borrow IDR90,000 to a bank but then return IDR100,000 to the bank. The excess debt payment (IDR10,000) is usury.

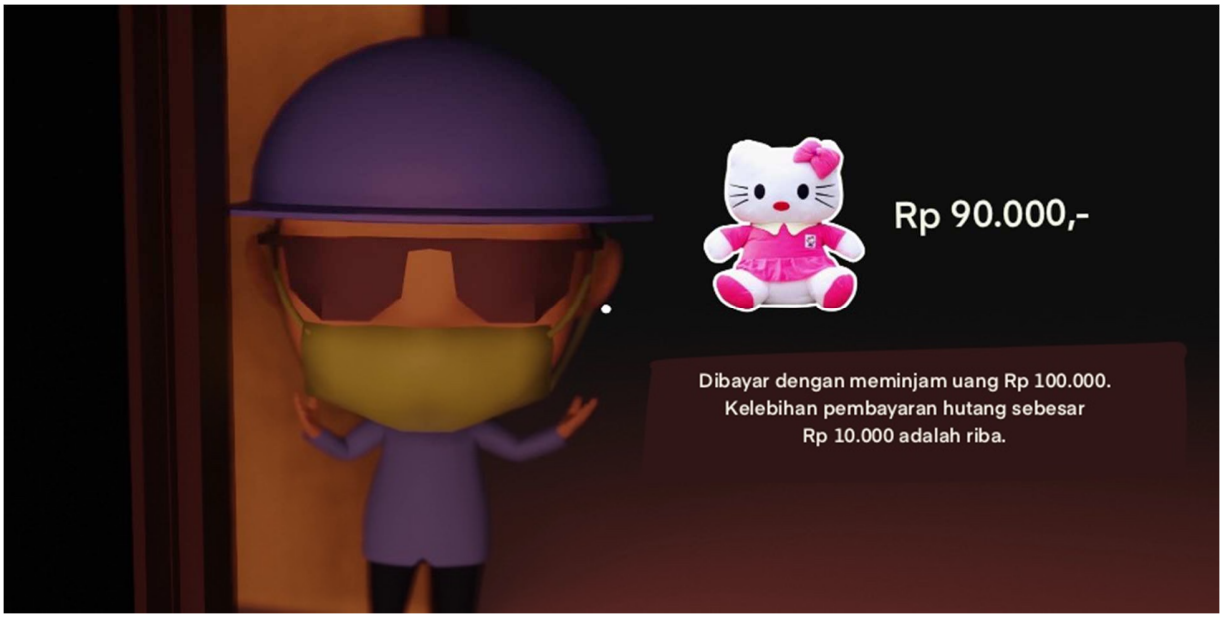

Figure 6. Example of a usurious transaction

Note: As can be seen from this figure, the language used in the app is Indonesian. The English translation of the sentence and words which appear in the screenshot is as follows: Dibayar dengan meminjam uang Rp100.000. Kelebihan pembayaran utang adalah riba=Paid by borrowing IDR 100,000. The excess for paying the debt is usury.

Maisyir transactions are exemplified in Figure 7. At this stage, the user enters the toy shop and can choose to buy a coupon with prizes, but has to guess the number. If he/she guesses the number correctly, then the user will get a toy as a prize.

Figure 7. Example of a *maysir* transaction

Transactions that contain *gharar* are illustrated in Figure 8, where the user chooses toys, including toys in sealed packaging (surprise toys), so the contents and specifications are unknown. If the user chooses the surprise toys, then the transaction contains elements of *gharar*.

Figure 8. Example of a *Gharar* transaction

Note: As can be seen from this figure, the language used in the app is Indonesian. The English translation of the sentence and words which appear in the screenshot is as follows: Apakah kamu mau membeli mainan secara tunai? = Are you going to buy toys with cash?; Beli = Buy

After the shopping list is fulfilled, the users have the flexibility to use any remaining money to buy toys, give alms, or save it in an Islamic bank. The understanding of Islamic financial transactions is assessed by comparing the user's knowledge before and after using VR-BS.

B. The Effectiveness of VR-BS in the Context of Sharia Financial Literacy

The evaluation of the construct's validity and reliability used confirmatory factor analysis. The construct's validity showed the consistency of its internal measurements. The composite reliability (CR) had to exceed 0.7. Table 4 shows that all the values for composite reliability were greater than 0.7. Therefore, the items used can be relied upon to represent the construction.

Table 4. Validity and Reliability

Variable	Total items	CR	AVE
Attitude toward the VR	2	0.871	0.772
Behavior intention toward the VR	2	0.852	0.745

Variable	Total items	CR	AVE
Perceived coolness	2	0.873	0.775
Perceived vividness	3	0.855	0.667
Perception of use	2	0.814	0.688
User engagement	4	0.847	0.584
Cognitive	N/A	1.000	1.000
Natural mapping	1	1.000	1.000

Notes: The research participants were secondary school students aged between 11 and 15 years old. According to Piaget (1929), the intellectual development of children between the ages of 11 and 16 years is at the stage of formal thinking. In this phase, cognitive functions and social skills develop well. However, children in this age group are very sensitive to contexts, and they may have their own norms. Other problems are related to lack of motivation and difficulties in maintaining concentration, which will result in poor data quality (Borgers et.al, 2000). Therefore, to address all these issues and to obtain quality data, this research uses research instruments which do not contain many question items.

Convergent validity shows the extent to which a measure/indicator is positively correlated with alternative measures/indicators for the same construct. The average extracted variance (AVE) was used to test the convergent validity. All the AVE values were greater than 0.5, which indicated good convergent validity (Hair et al., 2017). Thus, the instruments were reliable and valid, as shown in Table 5.

Table 5. Discriminant Validity

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Attitude toward the VR	**0.879**							
2. Behavior intention toward the VR	0.378	**0.863**						
3. Cognitive	-0.141	0.114	**1**					
4. Natural mapping	0.666	0.147	-0.217	**1**				
5. Perceived coolness	0.678	0.585	-0.153	0.549	**0.880**			
6. Perceived vividness	0.674	0.461	-0.109	0.620	0.788	**0.816**		

Variable	1	2	3	4	5	6	7	8
7. Perception of use	0.734	0.291	-0.254	0.650	0.648	0.709	**0.829**	
8. User engagement	0.682	0.298	-0.119	0.645	0.655	0.761	0.746	**0.764**

Note: the diagonal line (bold) is the square root of AVE of each construct. The correlations among the constructs are smaller than the square root of AVE of each construct.

The discriminant validity indicates the extent to which the latent variable or construct is completely different from the other constructs, as shown by the results of empirical research. The discriminant validity of all the latent constructs was confirmed by comparing the square root of the AVE with the correlation coefficient of the other variables. The test results in Table 5 show that the square root of AVE in the diagonal column was higher than the correlation coefficient between the variables in the same column; this showed that the discriminant validity criteria had been met. Overall, the measurement model's test results showed that the criteria for reliability, convergent validity, and discriminant validity were met.

Overall, based on the fit model indicator, this research model was considered to be a good fit (see Appendix Table 4A). RMS_{theta} assesses the degree of correlation of the outer model's residuals. Henseler et al. (2014) introduced RMS_{theta} as a fit measure for PLS-SEM which can be used to avoid model specification errors, and argued that an RMS_{theta} value below 0.12 indicated a model's fit, while a higher value indicated the lack of fit for a model. NFI represents an incremental fit measure. NFI is then defined as 1 minus the Chi^2 value from the proposed model divided by the Chi^2 value from the null model. NFI values above 0.90 usually represent an acceptable fit (Lohmöller, 1989).

Testing the relationship between the construction and predictive ability of the models was done using structural modeling. The validation of the structural model helped to consider whether the hypotheses expressed by the structural model were supported by the data (Hair et al., 2017). The results of the structural model's PLS-SEM test are shown in Figure 9.

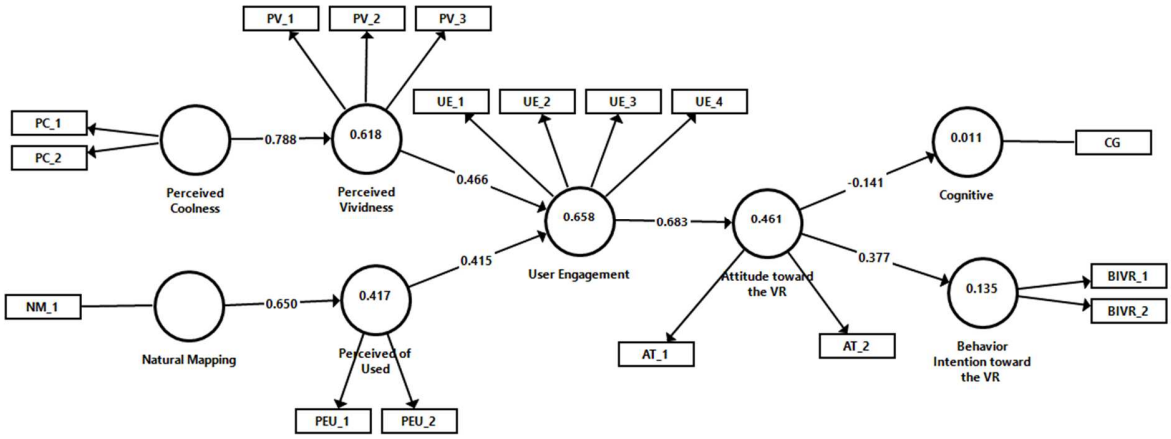

Figure 9. Structural model estimates

Table 7. Structural Model's Results

Hypotheses	β	T Statistics	p Values	R^2	Result
Perceived coolness ->perceived vividness	0.788***	19.234	0.000	0.618	Supported
Natural mapping ->perception of use	0.650***	12.804	0.000	0.417	Supported
ATVR ->cognitive	-0.141	1.545	0.122	0.011	Not supported
ATVR ->behavior intention toward the VR	0.377***	4.102	0.000	0.135	Supported

Table 8. Results of Indirect Effects

Path analysis	*B*	T Values	P Values	BC 95% CI		Results
				Lower	*Upper*	
PC ->PV ->UE	0.369***	5.28	0.000	0.23	0.504	Sig
NM ->POU ->UE	0.270***	4.571	0.000	0.164	0.387	Sig

UE ->ATVR ->BIVR	0.258**	3.474	0.001	0.118	0.399	Sig
UE ->ATVR -> Cog	-0.097	1.592	0.111	-0.215	0.028	n.s

Notes: Significance of estimates; ***p< 0.001, **p< 0.01, *p< 0.05; Sig = Significant; n.s = Not Significant; β = Beta; BC=Bias Corrected, CI= Confidence Interval; NM= Natural Mapping; POU = Perception of Use; UE = User Engagement; PC = Perceived Coolness; PV= Perceived Vividness; ATVR = Attitude toward the VR; BIVR = Behaviour Intention toward the VR; Cog = Cognitive

Based on the structural model's results (tables 7 and 8), the test results indicated that perceived coolness had a significant impact on perceived vividness ($\beta = 0.788$, $p < 0.001$), supporting H1. The indirect effect of perceived coolness on the user's engagement through perceived vividness was also significant ($\beta = 0.369$, $p < 0.001$), supporting H2. Likewise, H3 and H4 were also supported. Natural mapping had a significant impact on the perceived ease of use ($\beta = 0.650$, $p < 0.001$), and there was an indirect relationship between natural mapping and the user's engagement through the perceived ease of use ($\beta = 0.270$, $p < 0.001$). As predicted by the TIME, the user's engagement had an impact on behavior toward VR media, mediated by the attitude toward VR media ($\beta = 0.258$, $p < 0.01$), supporting H5. While VR-BS did not improve the students' sharia financial literacy, the results indicated that the attitude toward VR did not affect the cognitive aspects ($\beta = -0.141$, $p > 0.05$). As with the indirect effect, the user's engagement had no impact on his/her cognition through his/her attitude toward VR media ($\beta = -0.097$, $p > 0.05$).

Discussion

The main characteristics of VR are that it is immersive, interactive and of a high quality, which are components of perceived coolness. This study found that using VR-BS creates a perceived coolness and perceived vividness, which in turn has an impact on increasing the user's engagement (H1). This is because coolness and vividness are heuristics that have a positive halo effect on the user's engagement (Sundar et al., 2015). The results of this study show that the users of VR-BS can clearly see a scene in a market setting, including the activities happening in the market (e.g. vendors offering various products). In such a setting, the users feel they are interacting or engaging with the sellers in a real market, and have a variety of products to choose from. This engagement enables the users to think about the products offered (e.g. pork [*haram*] vs beef [*halal*]) and decide to buy products which meet sharia principles. The users can also make

transactions which do not include usury, *maisyir* and *gharar*. The decisions to buy and do transactions in line with sharia principles, reflect that VR-BS can provide some clear information to users as a basis for making these decisions, highlighting that a higher level of users' engagement through VR-BS (coolness) leads to a higher level of the perception of vividness (Yim et al., 2017).

The statistical results further reveal that perceived coolness influences the users' engagement through the perception of vividness (H2). A possible explanation for this finding is that the users' emotional experiences in virtual settings are influenced by their understanding of the simulations provided in the application (vividness) (see (Aljukhadar et al., 2020; Fiore et al., 2005; Jung et al., 2018). Due to this influence, they are motivated to get involved in the activities, interact with the sellers in the virtual market, and apply their knowledge to conduct sharia-based transactions.

Another finding is the significant impact of natural mapping on the perceived ease of use (H3). It appears from the results that the users interact well with VR-BS and the app's interface controls match the users' actual physical behavior. This suggests that natural mapping is achieved (see Norman, 1988). The users' good interaction with VR-BS signals that the app is user-friendly, indicating that the users can use it with little effort (see Davis et al., 1989). As the users can use the app with little effort, they can focus on their involvement in the activities happening in the app's virtual market, resulting in a higher level of user engagement with the media content (see (Wang and Sundar, 2018).

The relationship between natural mapping and the users' engagement, which is presented through the perceived ease of use of VR-BS (H4), is also statistically proven in the hypotheses testing. Naturally mapped controls improve usability because users don't have to learn new mental models to use the media effectively (Wang and Sundar, 2018). In line with the TIME's behavioral pathway, users who interact with VR-BS are more engaged with the activities in the app because it is user-friendly. Users can operate the app without spending too much time learning the menus in the application, so that they can focus on their engagement in the activities simulated by the app. As noted in (Baraka and Murimi, 2019), user-friendliness is one of the indicators of ease of use.

As predicted, the users' engagement was found to have an impact on their VR behavior, mediated by their attitude toward VR media (H5). This finding is in agreement with (Sundar et al., 2015; Wang and Sundar, 2018), who said that an affordable technology is able to increase the

user's engagement, which is ultimately associated with positive attitudes and behavioral intentions toward VR. This study also supports Moreno and Mayer (2002), in that VR offers a more realistic experience and results in a higher sense of immersion (Slater and Wilbur, 1997).

VR's interactivity, however, does not improve sharia financial literacy (cognition). A possible argument is that VR results in a higher presence, but less learning, as immersive VR increases the cognitive load (Hussain et al., 2018). This state of cognitive overload may have been exacerbated by the fact that the majority of this study's participants, despite being digital natives, had never tried VR, which is a limitation of this study. Since research into the use of VR technology in education is still in its infancy, a promising direction for the future is to replicate the results in fresh research with participants who are accustomed to using VR, and it should also consider the factors that influence learning when designing the learning content for immersive VR.

Conclusion

Although there has been an increase in Islamic financial assets, the market share of Islamic banking still lags behind conventional banking, even though Indonesia has the largest Muslim population in the world. The preparation of proper sharia-based financial literacy is required, as part of the effort to change the mindset and prepare future generations for a better and more sustainable Islamic economy and financial future. The approach used in this research is to develop and investigate whether immersion through VR-BS has an impact on non-cognitive and cognitive outcomes. The results of this study mostly support the theory of interactive media effects (TIME), in that the affordability of technology influences the user's psychology.

Using VR-BS creates a perceived coolness and perceived vividness, which in turn has an impact on increasing the user's engagement. Also, the use of VR has an impact on natural mapping, which increases the user's engagement through the perceived ease of use. As predicted, the user's engagement affects his/her VR behavior, mediated by his/her attitude toward VR media. VR's interactivity, however, does not impact on the cognitive aspect (sharia financial literacy).

This study provides practical and theoretical implications. First, it is implied from the findings that Islamic financial business actors and relevant government agencies (e.g., the Indonesian Financial Services Authority [OJK], the Ministry of Education, Culture, Research and Technology, and the Ministry of Religious Affairs) should collaborate in best preparing the future generation of *ummah* by using VR-BS in their joint promotion and education programs. At present,

the Indonesian government expects Islamic finance to be employed to foster the economy, including developing small and medium enterprises (Kementerian Keuangan Republik Indonesia, 2022). Without effective promotion and education programs, awareness about Islamic finance cannot be increased. If this is the case, the government's expectations can never be met. The results of the current study reveal that the use of VR-BS may attract people to engage in learning Islamic financial activities. By engaging in such activities, or at least engaging in real-life simulations/classes/workshops, people may gradually acquire more knowledge about Islamic finance. According to Gibbs (1988), learning by doing is an effective way of educating people. Learning Islamic financial activities by "doing" in a real market may not always be easily undertaken because such a learning method needs a person's time and commitment to be involved in a real activity. Moreover, it is not easy to find a real market offering both *halal* and *haram* products (e.g. beef and pork respectively), particularly in Indonesia, as this country is mostly populated by Muslims. In this condition, VR-BS can help people learn by doing, by facilitating them to engage in Islamic financial activities in a virtual market.

Second, this study implies that the theory of interactive media effects (TIME) fails to explain the possible impact of the use of VR-BS on the participants' sharia financial literacy. People using VR-BS in the current study might be aware of Islamic finance from their activities in the virtual market, but they probably do not understand the details of the Islamic financial system, as well as the overall benefits of it. This might be because the participants are still too young and are not frequently involved in Islamic business transactions. Their mindset might still be strongly influenced by conventional business practices, which in fact dominate the market. In addition, the participants in this study had never used VR-BS before, indicating that they did not experience a pleasurable emotional state when using the app (see Verkijika and De Wet, 2019). Emotional factors that emerge during the first-time use of VR-BS may contribute to the users' understanding of financial literacy. To best predict the impact of the use of VR-BS on sharia financial literacy, the TIME may need to be complemented by other theories, such as the pleasure-arousal-dominance (PAD) model, a theoretical framework which can explain the emotional state of an individual during his/her first-time interaction with a mobile application (see (Verkijika and De Wet, 2019). As noted in the literature (see for example Jacobson et al., 2022), "human behavior is complex" and, therefore, a more nuanced analysis is needed to examine the factors driving it. A

more nuanced analysis itself can be provided if multiple theories are employed (see Hagger and Hamilton, 2022).

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Appendix

Table 1A. Indicators of the Measurement of Sharia Financial Literacy

Indicator	Item
Basic concept	1. Prohibition of *riba* 2. Prohibition of *gharar* 3. Prohibition of *maysir* 4. *Halal/ Haram*
Need and Want	1. Distinguishing needs and wants 2. Make a scale of priorities
Borrowing concept	1. Debt management in Islam. 2. Prohibition on *riba* in debt.
Saving and Sharing	1. Introduction of Islamic banks. 2. Difference between Islamic banks and conventional banks. 3. The importance of sharing

Source: modification from Sari et al. (2021a)

Table 2A. The instruments for measuring variables

Attitude toward VR	This VR is very useful
	This VR is interesting
Behavioral intentions toward VR	It is very likely that I will return to this VR
	I will recommend to my friend to use this VR if he wants to learn literacy
Perceived coolness	VR is cool
	It is cool how VR works
Perceived vividness	The VR that I just used to interact with was very interesting
	The VR that I just used was entertaining
	The VR that I just used was really enjoyable

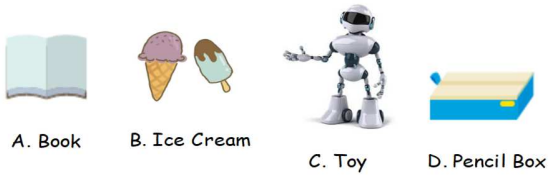
Perceived ease of use	VR is clear and understandable
	This VR is easy to learn
User engagement	Time seemed to go by really fast when I was using VR
	I had fun interacting with VR
	Using VR aroused my imagination
	Using VR excited my curiosity
Natural mapping	My interactions with VR felt natural

Note: We adopted the measurement of the perceived coolness variable from Wang et al (2018), including "using VR is cool" and "It's cool how VR works" items. While these two items look similar, they are essentially different. "VR is cool" refers more to product presentations that are higher quality VR in terms of images, videos and 3D assets. On the other hand, "It is cool how VR works" focuses on the flow and performance of VR so that it provides a more realistic representation.

Table 3A. Syariah Financial Knowledge Questionnaires (Overview)

Indicators	Example of item
Basic concept	1. **Which meat is not allowed to be consumed or is "*haram*"? (You can choose more than one option)** a. Beef b. Pork c. Bat d. Lamb e. Snake f. Frog 2. **Which meat should not be consumed? (Choose one option)** a. Chicken b. Chicken carcasses c. Lamb d. Beef 3. **When you are shopping for fruit, which fruit can you buy? (Choose one option)** a. Fruit that has been placed in a black plastic bag, therefore the buyer does not see the contents b. Fruit that is placed in an open basket and you can choose by yourself c. Fruit scales dubious

	4. **What does "*Gharar*" mean? (Choose one option)** a. Buying and selling that is not clear, so it contains an element of fraud b. Buying and selling goods that are not allowed in Islam ("*haram*" goods) c. Buying and selling goods that are permitted in Islam ("*halal*" goods) 5. **What does "Usury" mean? (Choose one option)** a. Exemplary good behavior b. The act of eating *halal* food such as chicken, lamb, and beef c. Fraudulent behavior. For example, fruit sellers hide the scales so they can cheat d. The act of exaggerating the amount of the loan that must be repaid. For example, Ani borrows IDR10,000 of your money and she must return IDR14,000 6. **What is a "*Maysir*" transaction? (Choose one option)** a. The act of exaggerating the amount of a loan that must be repaid b. A game transaction in which there are conditions in the form of the winner taking a number of items from the losing party c. Buying and selling that is not clear, so it contains an element of fraud d. Exemplary good behavior
Borrowing concept	7. **At school Bima forgot to bring a picture book, then Bima borrowed IDR5,000 from Ali to buy a picture book. Ali agreed to lend Bima the money on condition that tomorrow IDR5,500 must be returned. The additional Rp500 on the loan is prohibited in Islam because it is?** *a. Riba* *b. Gharar* *c. Maysir* *d. Dzalim*
Need and want	8. **Alika went to the store to buy her favorite doll. However, she remembered that her pencil case was broken. What should Alika buy?**

<table>
<tr><td rowspan="2">Need and want</td><td> 
</td></tr>
<tr><td>9. Of the following items, which one is needed by a student?
 
A. Book B. Doll C. Toy Robot D. Toy Car</td></tr>
<tr><td>Saving & Sharing</td><td>10. Banks that conduct business activities based on Islamic legal principles are called …

a. Conventional banks
b. Sharia banks
c. Rural credit banks
d. Leasing banks

11. Syira has IDR100,000 from her mother to buy a bag. The bag’s price is IDR 80,000. What should the excess money be used for?

a. Put aside for sharing and the rest for buying ice cream or toys
b. To buy ice cream
c. To buy toys</td></tr>
</table>

Table 4A. Results of model’s fit

Measure	Estimate	Threshold	Interpretation
χ^2	903.461	--	--
RMS_{theta}	0.111	<0.12	Acceptable
NFI	0.944	>0.90	Acceptable
SRMR	0.057	<0.08	Excellent

Notes: χ^2 = *chi-square*; RMS_{theta} = *root mean square residual covariance*; NFI = *Normed Fit Index*; SRMR = *Standardized Root Mean Square Residual*.

Table 5.A. Results of the pilot test

Variable		Factor loadings
Attitude toward the VR	AT_1	0,899
	AT_2	0,858
Behavior intention toward the VR	BIVR_1	0,956
	BIVR_2	0,759
	BIVR_3	0.591
Perceived coolness	PC_1	0,889
	PC_2	0,871
Perceived vividness	PV_1	0,642
	PV_2	0,885
	PV_3	0,897
Perception of use	PEU_1	0,77
	PEU_2	0,885
User engagement	UE_1	0,769
	UE_2	0,618
	UE_3	0,849
	UE_4	0,801