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Virtual Reality-Based Media for Islamic Financial Literacy: A Shift in the New Anti-Usury Educational Strategy

Sari, Ratna Candra[1*], Sholihin, Mahfud[2], Putritama, Afrida[3], Ratna Sari, Annisa[4], & Dwi Hermawan, Hardika[5]

[1,3]Department of Accounting, Faculty of Economics, Universitas Negeri Yogyakarta,
Jl. Colombo No. 1, Caturtunggal, Depok, Sleman, Daerah Istimewa Yogyakarta, 55281, INDONESIA

[2]Department of Accounting, Faculty of Economics and Business, Universitas Gadjah Mada,
Jl. Sosio Humaniora No. 1, Bulaksumur, Daerah Istimewa Yogyakarta, 55281, INDONESIA

[4]Instructional Systems Technology Department, Indiana University Bloomington,
201 N. Rose Avenue Bloomington, IN, 47405, UNITED STATES

[5]Department of Informatics Engineering Education, Faculty of Teacher Training and Education,
Universitas Muhammadiyah Surakarta, Sukoharjo, 57162, INDONESIA

*Corresponding author email: ratna_candrasari@uny.ac.id

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Abstract: A digital generation is growing up surrounded by virtual technology; they prefer learning in a virtual world by using technology. Educational strategies must respond to this generation's learning preferences and change to provide them with sufficient knowledge. This study aims to examine the effectiveness of VR-based learning media for improving knowledge about Islamic finance, specifically about usury. The experiment was conducted at Muhammadiyah Sapen Indonesia Elementary School, with 20 students as the treatment group and 20 students as the control group. On average the students agree that VR-based Islamic financial learning media is easy to use, it makes the learning process more motivating and increases their understanding. The results show there is a significant difference in the increase knowledge of usury between the treatment and control groups. This research contributes to the learning of Islamic financial literacy by developing and testing the effectiveness of VR-based learning media to improve students' knowledge about usury.

Keywords: virtual reality, digital generation, Islamic financial literacy, usury

1. Introduction

Technology is revolutionizing the creation of new financing systems and products, such as crowdfunding, peer-to-peer lending, digital currency, online investment, and new payment systems. Islamic financial literacy is needed to increase people's awareness and their ability to choose financial products that are in accordance with sharia regulations (Abdullah *et al*., 2017). Financial education must be provided during the early stages of a child's life (Sari, Fatimah, and Suyanto, 2017) because these days children need the ability to make financial decisions in an increasingly complex economic environment (Lucey and Giannangelo, 2006). Technological developments that lead to better financial education must adapt to changes in the students' learning preferences. Today, Generation Z or the digital generation has entered the world of education. Generation Z is the first generation to grow up in a world of advanced information and communications technology (ICT), and they like to interact through a virtual world (Mládková, 2017). The current teachers and education strategies are unlikely to be able to respond adequately to the learning preferences of Generation Z (Fernández *et al*., 2017). The inability to respond to changes in learning style preferences raises concerns about the education system's ability to provide students with adequate skills to prepare them for the future demands they could face in their lives.

**Corresponding author: ratna_candrasari@uny.ac.id*

Currently, awareness regarding the importance of Islamic financial literacy and its application in a Muslim's daily life is growing (Abdullah *et al*., 2017). Islamic financial literacy research is important because of the obligation of Muslims to comply with Islamic financial laws. Financial education has a significant positive effect on students' financial knowledge and competency (Batty, Collins, and Odders-White, 2015; Gao, Wang, and Qian, 2010; Sari, Fatimah, and Suyanto, 2017; Sherraden *et al*., 2011). The creation of a generation of Muslims who are globally financially literate is very important to empower the economic well-being of the *society*, which will ultimately lead to an empowered Islamic civilization (Hashim, 2014). Indonesia is a country with a majority Muslim population, but the level of Islamic financial literacy in Indonesia is unfortunately still low at 8.93% (OJK, 2019).

Technological developments influence the evolution of learning style from verbal, visual to virtual (Proserpio and Gioia, 2007). To engage the digital generation's students, educators must adapt their teaching strategies to meet new learning preferences (Adamson *et al*., 2018). The digital generation like to interact through media, and the virtual world is a natural environment for them, they are aware of the latest trends, tech-savvy and early adaptors of technology (Mládková, 2017). Virtual reality (VR) technology is used to respond to the challenges of the shifting learning styles of this digital generation. VR will give its users the capability to engage in 3D content or situations that mimic actual interactions in real life (Chirico *et al*., 2018). Several studies have indicated that the use of VR in digital generation settings was successfull in improving the students' attitude and knowledge behavior (Adamson *et al*., 2018; Cho and Lim, 2017; Valenti, Lund, and Wang, 2020; Yang *et al*., 2020). However, at the present time, information and instructional media for financial education, especially for Islamic financial literacy, is still very limited (Sari et al., 2017; Sherraden *et al*., 2011). Considering this limitation, the purpose of this study is to test the effectiveness of VR-based learning media in improving the knowledge of Islamic finance, especially about usury, in elementary school students.

2 Illustrations

2.1 Islamic Financial Literacy

Islamic financial literacy refers to the ability to understand a financial system based on sharia compliance (Abdullah *et al.*, 2017). Biplob and Abdullah (2019) define Islamic financial literacy as the ability to understand the concepts of money, debt, savings, expenditure, zakat, and other elements that are involved in certain transactions that are prohibited in Islam, including gharar (uncertainty), usury (interest), and maysir (gambling). Islamic financial literacy is related to understanding financial products or services by following Islamic principles, Islamic law, and moral codes (Antara, Musa, and Hassan, 2016).

Some research has shown the importance of Islamic financial literacy. Hashim (2014) and Setyowati, Harmadi, and Sunarjanto (2018) believe that Islamic financial literacy increases one's financial management capabilities, while Abdullah and Razak (2015) found empirical evidence that poor financial literacy has an impact on one's lack of confidence in making sharia investment decisions. Hamid and Nordin (2001) conducted a study on Islamic finance, the results showed that nearly 100 percent of the Muslim population knew about the existence of Islamic banking, but only 27.3 percent understood the difference between Islamic banks and conventional banks; and only 38.7 percent used the services of Islamic banks because of their adherence to religion. Mokhlis (2006) and Salwa, Musadik, and Azmi (2017) found Islamic financial literacy has a negative impact on impulsive buying behavior. Islamic financial education and education about halal products can increase the literacy of Islamic finance and halal literacy (Wahyuny, Murtini, and Hakim, 2018).

At each stage of a child's age development, an appropriate financial literacy learning strategy is needed. VR technology is one of the example of strategies that can be used to assist learning. Lee, Wong, and Fung (2010) state that learning tasks and task supports are required for students to actively participate during the instruction, and comprehend the learning contents. At the elementary school age, the right strategy for financial literacy education is through financial socialization (Drever *et al*., 2015). Financial socialization is the process by which children obtain the standards, values, norms, skills, knowledge, and attitudes needed to act as consumers. Sari et al. (2017) examined the effect of financial education through financial socialization for elementary school students. The treatment group that was given financial education had a higher level of financial knowledge compared to the control group. Batty *et al*. (2015) and Sherraden *et al*. (2011) found similar results, in that financial education increased the financial knowledge of elementary school students.

2.2 Virtual Reality in Education

According to Burdea and Coiffet (1994), VR is a high-class user interface that involves real-time simulation and interaction through various sensory channels. Lee and Wong (2015) argued that VR is a way to simulate or replicate an environment that can be explored and interacted with someone. Renninger and Hidi (2016) & Wentzel and Miele (2016) showed that understanding how to utilize emotional attraction with e-learning tools is a major issue in learning and teaching because research shows that initial situational interest is an important factor in promoting learning (Renninger and Hidi, 2016). Furthermore, students' emotional reactions to teaching have a large influence on their academic achievement (Pekrun, 2016).

VR is an e-learning tool with a higher level of immersion, thereby increasing the students' motivation and learning (Bodekaer, 2016). VR can provide visualization and real-time interaction in a virtual world, which is a simulation of the real world (Chuang and Chen, 2007). Previous research with student participants provided supporting evidence that VR technology has a positive influence on academic performance and students' motivation (Gutiérrez and Fernández, 2014; Ibáñez *et al.*, 2014; Meneses Fernández *et al.*, 2017; Sotiriou and Bogner, 2008). In the field of teaching mathematics, Demitriadou, Stavroulia, and Lanitis (2020) found that the use of VR and augmented reality technologies increased the students' interactivity and interest in understanding mathematical concepts, compared to traditional teaching methods. VR stimulates students to develop their communication and team-building skills and motivates them to actively develop their practical skills to a greater extent (Lee and Shvetsova, 2019). VR technology-based learning media enhances the overall learning experience and increases access to educational opportunities (Madathil *et al*., 2017). VR has a positive effect on students' performance (Akbulut, Catal, and Yıldız, 2018).

2.3 Education Strategy for the Digital Generation to Improve Their Knowledge

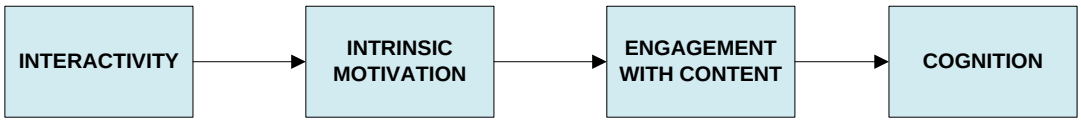
Now educators must educate people who were born and raised in an era when the use of technology exploded. This generation incorporates ICT in their daily activities. Many terms have been designed for this generation including the digital generation, digital natives (Prensky, 2001), Generation Z, the V (Virtual) Generation, the C (Content or Community), the Internet Generation, or even the Google Generation (Meneses Fernández *et al*., 2017).

The expeditious transformation of ICT changed people's habits and learning styles (Pérez-Escoda, Castro-Zubizarreta, and Fandos-Igado, 2016; Tapscott, 2008). Educators must not only deal with these changes but also offer an educational response. This fact underlines the importance of knowing the characteristics of Generation Z (Schroer, 2008). Generation Z is the group of people who were born between 1995 and 2014. Most of this generation has entered the education system. This generation has a high level of integrated ICT use in everyday life, so a higher level of digital skills must be reflected in the teaching-learning process in the classroom.

Generation Z considers itself skilled and competent in ICT, has high expectations for technology, and has a tendency to learn independently or in an autodidactic manner (Pérez-Escoda, Castro-Zubizarreta, and Fandos-Igado, 2016). Another important characteristic is the preference for visual information. They find it easy to multitask in digital and visual environments (Cassany and Ayala, 2008; Reig and Vilchez, 2013). These characteristics force formal educational bodies to adapt their educational strategies to the needs of Generation Z.

Technological developments raise concerns about the effectiveness of the use of technology in persuading Generation Z. Interactive information technology that is designed to intentionally change the attitudes and/or behavior of its users is known as persuasive technology (PT), and has been used in several fields, including in education for the digital generation. Previous studies support that interactive technologies such as video games and virtual reality can be used on Generation Z in various fields of education, such as geography (Cho and Lim, 2017), teaching English (Yang *et al*., 2020), or as a type of therapy for Generation Z who suffer from mood disorders (Adamson *et al*,. 2018), library simulation (Valenti, Lund, and Wang, 2020).

Based on the interactive media effect, interactivity leads to greater user engagement with content which ultimately affects the user's cognition, attitude, and behavior. Interactivity can also provide a level of user control through the interface (Jensen, 1998; Newman, 1991). There are three types of interactivity: modality, message and source interactivity. Modality interactivity is the various interaction methods offered by an interface, such as clicking, scrollin, dragging, and hovering the cursor over something. Xu & Sundar (2011) stated that the interactivity mode increases the user's cognitive processing. Message interactivity is related to the nature of the exchange between the user and the system (or other users). Interactivity effect models suggest that a critical mechanism of message interactivity is considered to be a contingency. When users feel that the system responds to themes in a contingent manner, they are more likely to engage with media which has an impact on their attitude. Source interactivity is the degree to which an interface allows the user to function as a source of communication. Source interactivity allows the user to change the attractiveness of the interface, and modify the task-centered utility tools of the interface. The ability to express oneself is very important for user engagement.



Source: Modified from Model of Interactivity Effect (Sundar et al., 2015)

Fig. 1: Research Model

2.4 The Use of VR Increases the Students' Interactivity

The use of VR increases the students' interactivity (Demitriadou, Stavroulia, and Lanitis, 2020). This activity will increase their intrinsic motivation. Greater motivation will have a positive impact on the user's engagement with the content offered by the technology (Sundar et al., 2002), and ultimately the involvement of the students with the content will influence their cognition, attitude and behavior (Sundar, 2007).

In summary, the digital generation prefers visual presentations, and they are skilled and competent in ICT's use; they like to interact through a virtual world. For effective learning, education strategies must adapt to their learning preferences. Some research supports the idea that VR-based, technology-based learning media increases the students' interactivity. Greater interactivity will increase their intrinsic motivation. Intrinsic motivation will increase the users' engagement with the content, resulting in increases in the users' cognitive processes. Therefore, we hypothesize:

H1: There is a difference in their knowledge about usury between groups who are exposed to VR-based Islamic financial education versus those who are not.

3. Method

3.1 The Study's Instruments

The purpose of this study was to test the effectiveness of VR-based learning media at improving the knowledge of Islamic finance in elementary school students, especially for the topic of usury. An evaluation was conducted to discover the increase in the students' knowledge of usury. Usury is the basic concept in Islamic financial literacy (Antara *et al*., 2016) that needs to be taught early. The increase in the students' usury knowledge was measured by pre-tests given before the start of the program, and post-tests after the completion of the program. There were three multiple choice questions to measure their knowledge of usury. The tests used pictures because this matches the ability of the elementary school students. The questions to find out the students' knowledge of usury were: What is usury? Does usury hurt the borrower? Does usury benefit the community? Then the treatment group was also asked questions related to their experience using VR. An example of the users' experience questions is: Does VR motivate you to learn? The users' experiences were scored on a seven-point Likert scale ranging from (1) strongly disagree to (7) strongly agree.

This study used learning media developed by the Research and Development Institute of the Yogyakarta State University. This innovative technology has obtained a copyright from the Ministry of Law and Human Rights of the Republic of Indonesia, with the copyright number being No. 000147189. The development of VR-based learning media using the research and development method consists of five steps: analysis, designing, development, implementation, and evaluation (Dick and Carey, 1996).

3.2 The Sampling Approach

The implementation was carried out at Muhammadiyah Sapen Elementary School at grade 5, using 40 students. The treatment group and the control group were randomly determined. The treatment and control group respectively 20 students. Table 1 shows the sample's characteristics.

The Sample's Characteristics

Table 1: Sample characteristics and the pre-test results

	Treatment		**Control**		
	Mean	**SD**	**Mean**	**SD**	**Mean difference (p-value)**
GPA Language	88.83	4.17	87.44	7.32	0.45
GPA Mathematics	88.33	6.41	87	7.83	0.54
Parent Education Level	1.40	0.89	1.22	0.67	0.44
Pre-Test	0.65	0.23	0.52	0.39	0.18

The table shows there were no significant different characteristics between the treatment group and the control group. More importantly, there was no significant difference in the pre-test scores of the treatment group and the control group. This indicates that the two groups are homogeneous.

3.3 The protocol of the Experiment

Subjects were randomly selected for the treatment and control groups. In the treatment group, the participants were given VR-based Islamic financial education, while the control group's participants were not. Before the experiment was conducted, each participant filled out the pre- survey. In the pre-survey, participants were tested on their knowledge of usury. After participating in the lesson, each participant filled out the post-survey. The measurement of the effectiveness of VR-based Islamic financial education was calculated by comparing the increase in scores (post-test to pre-test), between the two groups.

3.4 Development of VR-based Media for the Islamic Financial Literacy

Development of VR-based media consists of five stages, namely analysis, design, development, implementation, and evaluation.

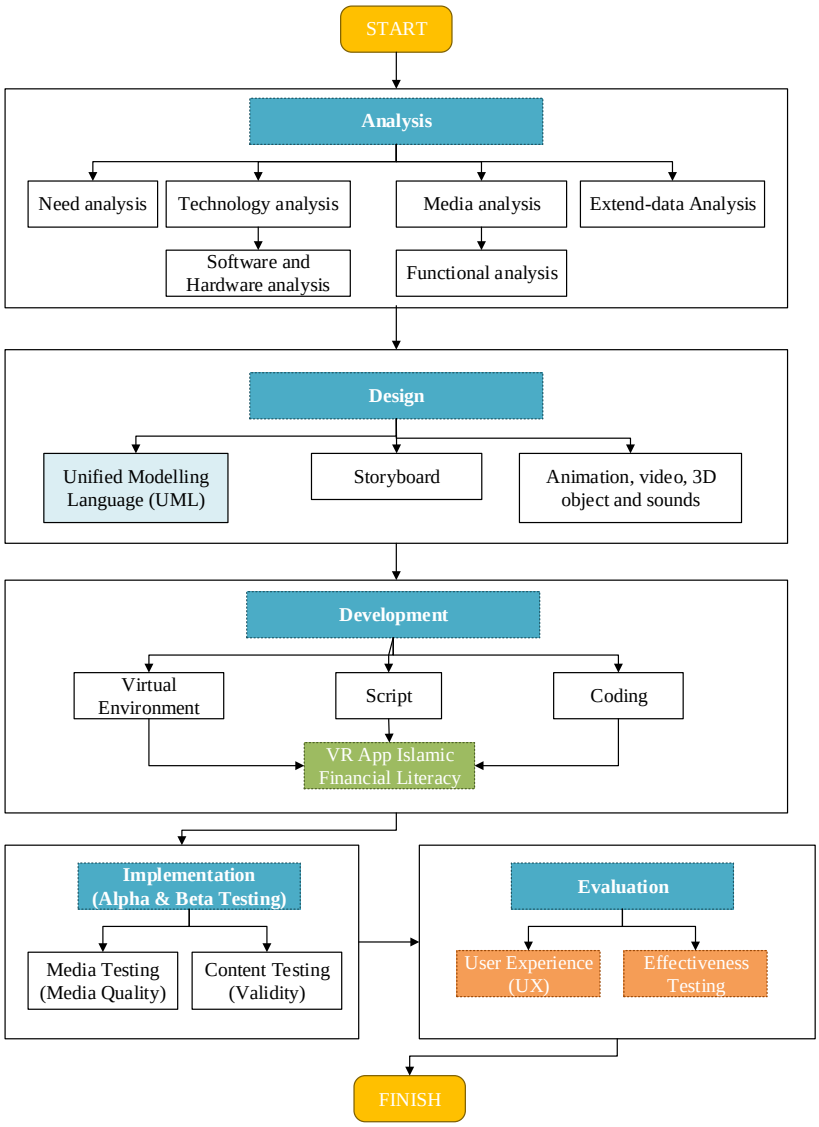


Fig. 2: VR Financial Literacy Development Cycle

Figure 2 provides information about VR's financial literacy development cycle. The first stage of the development process is analysis. At this stage, several types of analysis need to be carried out to determine the development needs, from an analysis of the technology, the specifications, and functions analysis to content analysis. The Android 6.0 Marshmallow operating system is the minimum operating system (OS) that can run the application. This OS was chosen because more than 92% of smartphone users in Indonesia use the Android OS (Stats Counterk, 2020). In the second stage, or the design stage, the Unified Modeling Language (UML) was used to provide an overview of the system's design through several diagrams that describe the flow of functions (use case diagrams), and the activity flow between the system and the user (activity diagrams) to the storyboard of the application.

The third stage was the development stage, the application started to develop based on the project design made in the previous stage. The application was developed using Unity 3D software, Android SDK, Mono Develop, and Android Studio. The virtual environment, the animation and 3D objects were developed using Blender 3D graphics software, supported by other graphics software such as Adobe Photoshop Pro, Premier, and Adobe Illustrator (AI). The output of this stage was the VR Financial Literacy app.

After the application had been developed, the fourth stage was its implementation. Implementation was carried out by installing the software into an android device, then content and media experts tested the application to validate the content and assess the quality of the media. Testing was undertaken by developers, media experts, and material experts. The developers tested the performance using Testdroid to find out the performance from the memory and the Central Processing Unit (CPU) usage's aspects. The test results showed the VR Financial Literacy app ran smoothly and the CPU usage showed normal results. The result of content testing by a media expert showed that the content was valid. After the implementation, the alpha and beta testing stages were completed, so the final stage was evaluation. The evaluation was conducted to determine the user experience (UX) and the effectiveness of the media. The evaluation was carried out at Muhammadiyah Sapen Elementary School, where the instrument was used to determine a student's experience. An ANOVA test was used to determine the effectiveness of the application.

4. Result

4.1 Virtual Reality-based Learning Media for Islamic Financial Literacy

The development of VR-based Islamic financial learning media is intended to provide a convenient and attractive method for students to increase their knowledge of Islamic finance. The development of VR-based Islamic financial literacy using the research and development method (Dick and Carey 1996). In the analysis phase, several conditions were found: (1) There was a limited amount of Islamic financial literacy learning media for elementary school students; (2) Most teachers and parents have an Android smartphone to access VR technology; (3) The digital generation has different learning preferences. To achieve effective learning, learning strategies must be adjusted to match these preferences. The design phase uses the Unified Modeling Language (UML) to simplify the explanation of the system's design contained in the application. In the development stages several tools were used, such Unity, and Corel Draw and Blender 3D.

The VR-based Islamic financial learning media contains simulation scenarios about usury. The participants will conduct simulations as the character Bima. Bima is a child who needs money for his mother's medical expenses. Figure 3 shows screenshots from inside Bima's VR house.

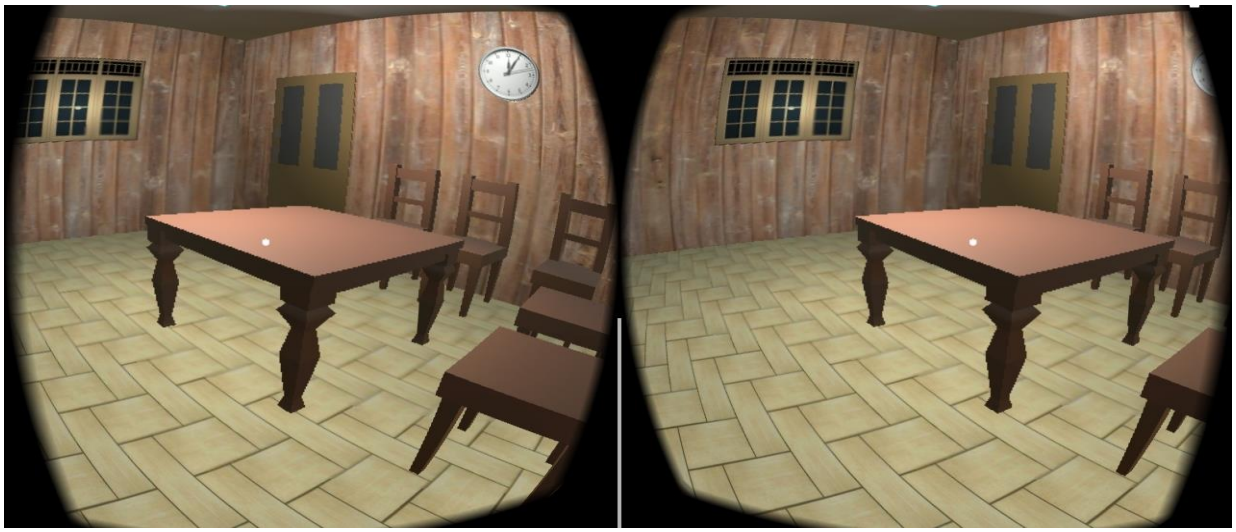


Fig. 3: The screenshots of the VR environment inside Bima's house

Upon entering the house, Bima finds his mother lying in bed due to illness (Figure 4). Then Bima goes to the city to borrow money to pay for his mother's medical expenses (Figure 5). In the city, Bima sees several banks offering attractive loans (Figure 6).

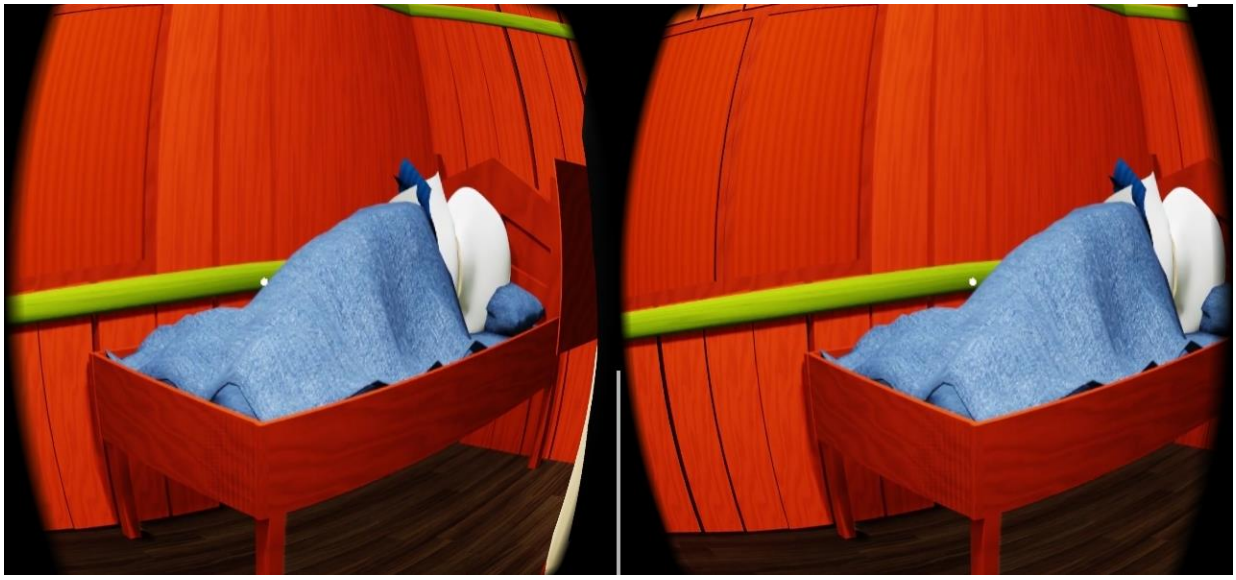


Fig. 4: The screenshots of the VR environment when Bima finds his mother lying sick in bed

Fig. 5: Virtual environment in the city

Then Bima chooses the bank that offers the most attractive loan. After entering the bank (Figure 6), Bima is faced with a dilemma as to whether he will sign a loan involving usury or leave the bank. If Bima chooses to sign a loan with usury, Bima will see a virtual representation of the impact of usury, which is a person who has difficulty repaying their debt due to the high interest rate. However, if he chooses to leave the bank and refuses the loan, Bima will get an offer to work with his partner with a profit-sharing system.

Fig. 6: Virtual environment at the bank

The implementation of this learning media is carried out at Muhammadiyah Sapen ES, Yogyakarta, Indonesia. At the evaluation stage, the students are asked to assess their experience of VR-based learning media and their increased knowledge about usury. The results of the students' user experiences are presented in Table 2.
The results of the students' user experiences

Table 2: Students' experience of using VR based learning media

	Students' Assessments	
	Mean	Standard Deviation
Easy to use	6.83	0.71
Increase motivation	6.72	0.75
Improve understanding	6.84	0.70

Table 2 shows that, on average, the students agree that VR-based Islamic financial learning media is easy to use; they also agree that using VR makes the learning process more motivating and increases their understanding. This is indicated by the high average values for these variables.

The next step is testing the effectiveness of the media at increasing the students' knowledge about usury. This effectiveness test was carried out by testing the increase in knowledge about usury between the treatment group and the control group. The following Table 3 shows a comparison of the average improvement in understanding about usury between the treatment group and the control group.

The average improvement in understanding about usury between the treatment group and the control group.

Tabel 3: The Pre-Test and Post-Test Result of knowledge about usury

	Treatment		**Control**	
	Mean*)	**SD**	**Mean*)**	**SD**
Definition of usury	0.10	0.31	-0.05	0.22
Impact of usury	0.60	0.50	0.00	0.01
Danger of usury	0.10	0.31	0.00	0.33
Number of Samples Observed	20		20	

*) the average difference between pre-test post-test

An ANOVA test was used to test whether there were significant differences in the increase of the knowledge about usury between the group using VR-based Islamic financial literacy learning media and the group that did not. ANOVA tests were first performed using the overall average score for knowledge about usury. This variable was used as a single measure. The results showed there was a significant difference in knowledge about usury between the treatment and control groups ($F = 7.34$, $p = 0.01$), H1 is supported. The results of our analysis are presented in Table 4.
The results of our analysis

Table 4. ANOVA and MANOVA test results

Effect	**F-value**	**Sign**
Knowledge of Usury	27.05	0.00
Definition of usury	3.11	0.08
Impact of usury	28.55	0.00
Danger of usury	1.00	0.32

We also used MANOVA to test the three dimensions of the knowledge of usury together i.e the definition of usury, the impact of usury, and the danger of usury. The MANOVA results showed that there was a significant difference in the understanding of the definition of usury in the treatment and control groups at the level of $p \leq 10\%$. For understanding the impact of usury, there was a significant difference in the treatment group compared to the control group ($p < 0.01$). Regarding the aspects of understanding the danger of usury, although there was an increase in understanding relative to the control group, the increase was not significant.

5. Discussion

The digital generation is growing up surrounded by technology, they prefer learning through using technology (Seemiller and Grace, 2016). Educational strategies must respond to the changes in learning styles and demands to provide adequate skills for them. This research provides a subtle contribution, based on the theory of persuasive behavior, that the use of VR-based learning media can increase students' understanding of usury by improving their knowledge of the danger of usury.

This VR is intended to help students in learning the concept of usury by taking into account the students' characteristics as digital natives. Convenience and attractiveness are among the consideration factors of this VR design. Based on the users' responses, on average the students agree that VR-based Islamic financial learning media is easy to use, makes the learning process more motivating and increases their understanding. The increase in intrinsic motivation will increase their cognitive processing; this is evidenced by the fact that there is a significant difference in the knowledge of usury between the treatment and control groups. This supports the interactivity effects model, which shows that interactivity leads to intrinsic motivation which will increase the students' engagement with any content offered by technology (Sundar et al., 2012), which in turn will increase their understanding. The finding related to the increase of student's understanding is align with the finding of several studies which stated that VR can enhance motivation in learning and increase students' understanding (Abulburub, Attridge, & Williamms, 2011; Lee, Wong, & Fung, 2010).

However, not all the dimensions of the knowledge of usury increased significantly. The dimensions of the definition of usury and the danger of usury did not increase significantly, relative to the control group. The possible explanation is that we did not examine differences in individual learning styles among the participants. Jafari and Abdollahzade (2019) found that an individual's learning style (active/reflective, sensing/intuitive, sequential/global, and visual/verbal) will affect their preference about the type of educational game he/she uses.

The findings of this study have policy implications. First, Islamic financial education needs to be done early to improve students' Islamic financial knowledge. Second, the shift in the learning preferences of the digital generation encourages the need for an education strategy that is appropriate to increase the effectiveness of learning. Third, VR can be considered as a tool for distance education programs that will be useful for students when they have to study at home in a pandemic

6. Conclusion

This research contributes to the limited body of rigorous evidence about VR-based Islamic financial learning media. This study examines the effectiveness of VR based Islamic financial learning media when used to teach students about usury. On average, the students agree that VR-based Islamic financial learning media is easy to use; it makes the learning process more motivating and increases their understanding. Using an experimental method with a pre- & post-test control group design, this result provides evidence that Islamic financial education for elementary school students using VR technology can increase the students' knowledge about usury. Specifically, VR become the learning media for these elementary students to better understand the definition, impact, and danger of usury.through visualization and simulation scenario.
Despite this study being intended to test the effectiveness of VR-based Islamic financial education learning media, there is a limitation to this study due to the small class size. The sample size for the investigation was small, especially since the investigation divided the sample's students into treatment and control groups.

Suggestions for future research

For future studies, we encourages the investigation of VR-based learning media for other concepts of Islamic finance beyond usury. Additionally, further testing can be done by comparing the effectiveness of VR with other educational games to better understand the most effective education strategy for the digital generation.

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