

# Augmented reality (AR)-based sharia financial literacy system (AR-SFLS): a new approach to virtual sharia financial socialization for young learners

Virtual sharia  
financial  
socialization

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## Abstract

**Purpose** – This study aims to examine financial socialization based on augmented reality (AR) technology for elementary school students, which it is hoped will improve their sharia financial knowledge.

**Design/methodology/approach** – The experimental method with pre- and post-test and control groups was used to test the improvement in the young learners' sharia financial knowledge. This study used AR for sharia financial socialization on elementary school students and focused on sharia's basic concepts, which include earning money, balanced spending, borrowing, saving, investment, payment methods, financial technology and the concept of protection.

**Findings** – This study finds empirical evidence that the treatment group, who received sharia financial socialization via the AR media, increased their sharia financial knowledge to a greater extent than the control group did.

**Research limitations/implications** – This study provides encouraging evidence about the potential of sharia financial education for elementary school students using the appropriate learning strategies and media. The weakness in this study is that it was only carried out in one elementary school, with the children of



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middle- to upper-income parents. Further research should be undertaken at several schools with the children of parents with different income levels.

**Practical implications** – A shift in learning styles from verbal or visual to virtual encourages the use of AR-based learning media. Financial concepts can be abstract ones, and AR-based learning media is able to present intangible virtual elements so they become more concrete and tangible.

**Social implications** – The global COVID-19 pandemic has affected all aspects. One of the most severe and likely to be multiyear ahead is the financial aspect. Therefore, this research is expected to be a preparation for the younger generation as early as possible to strengthen social benefits in order to improve sharia financial literacy.

**Originality/value** – Research into the financial literacy, especially sharia financial literacy aimed at elementary school students, is still very limited. The teaching of financial literacy will be more effective if educators use the appropriate strategies and media. This study used financial socialization strategies and AR learning media that are aligned with the learning styles of young learners.

**Keywords** Augmented reality, Elementary students, Financial socialization, Sharia financial literacy

**Paper type** Research paper

## 1. Introduction

The Covid-19 pandemic has not only caused health issues but also has impacted multiple spheres of life. The economy is one of the most severely affected aspects in most nations. Both health and economic issues require rapid, proper and sustained intervention to ensure the survival of humanity. Surviving the Covid-19 pandemic is likely to require both physical and mental strength. In Muslim countries such as Indonesia, people's efforts to cope with the pandemic are shown in increasing social behaviour within Islamic movements. People tend to change their new normal behaviour with reference to Islamic guidance (Ali *et al.*, 2020a; Nawaz *et al.*, 2018; Widityani *et al.*, 2020). This pattern had been increasing several years prior to the pandemic with Indonesia showing potential to become center of excellence of sharia knowledge, including the halal movement, but the halal industry in Indonesia still lags behind other Asian countries (MIFC, 2015). A possible cause for the slow growth of halal industries, particularly in the financial services sector, is the low level of sharia financial literacy in Indonesia (8.11%) (OJK, 2016) and low awareness of Islamic financial products amongst Muslims in Indonesia (Latif, 2019).

Thus, the lack of Islamic (Sharia) financial knowledge is a critical determinant with regards to Islamic financial exclusion (Ali *et al.*, 2020a). Islamic financial literacy will increase awareness and knowledge of Islamic financial matters, which may influence people's attitudes to using sharia financial products (Jaffar and Musa, 2013; Yumna, 2019) and as a determining factor for people using financial services in their economic activities (Asyaton, 2018), especially with regards to economic survival during the Covid-19 pandemic. The success of Islamic finance requires the transformation of literacy and education through the provision of training and induction programs (Olorogun, 2018), especially for young learners (children), because it has a significant positive influence on the young learners' financial knowledge and competencies (Batty *et al.*, 2015; Gao *et al.*, 2010; Sari *et al.*, 2017). However, current information regarding financial literacy in young learners is very limited (Sherraden *et al.*, 2011). Financial literacy research, specifically Islamic financial literacy targeting young learners in elementary school students, is still very limited. The proper preparation of financial literacy, in particular with a basis in sharia, should take place as early as possible as part of efforts to prepare the next generation across nations and religions in facing the global changes owing to the Covid-19 pandemic.

Sharia, or Islamic, financial literacy is the level of knowledge, awareness and skills of understanding of financial information and Islamic financial services, which can influence a person's attitude to making financial decisions in accordance with Islamic law (Antara *et al.*, 2016). Most types of financial education are aimed at high school and college students, although experts have advised that financial literacy education should be provided for pre-school and elementary school students (Holden *et al.*, 2009; Sherraden *et al.*, 2011). Financial education must be provided in the early stages of a child's life (Mandell, 2008) because that knowledge will accumulate at the next grade level (Sosin *et al.*, 1997) and young learners have low levels of financial literacy (Lusardi and Mitchell, 2011). Therefore, this study targeted young learners in elementary school within the treatment of the usage of augmented reality (AR)-based sharia financial literacy system (AR-SFLS) as a new approach of virtual sharia financial socialization for young learners.

AR-SFLS has been proven to be effective in financial literacy learning. This is a strong argument with reference to educator's preferences to use appropriate strategies and media in financial literacy learning (Suiter and Meszaros, 2005). For young learners at elementary school age, financial socialization is the best strategy, which emphasizes the young learners' interactions with their parents and teachers for shaping their values, norms and financial attitudes (Drever *et al.*, 2015). The values, norms and financial attitudes in AR-SFLS shall contribute to preparing young learners for the post-Covid-19 pandemic world. In addition, young children will be engaged and able to learn more when the teaching technique adjusts to the students' learning styles (Sherraden *et al.*, 2011). The development of internet technology and games has encouraged educators to realize their implications for progressive changes to learning styles, from a verbal to a virtual approach (Proserpio and Gioia, 2007).

In addition, AR, as applied in AR-SFLS, could provide users with a technology-mediated immersive experience blending the real and virtual worlds (Klopfer and Sheldon, 2010) and augmenting the users' interactions and engagement (Dunleavy *et al.*, 2009). Based on the theory of interactive media effects, the characteristics of AR media are interactive and engagement ultimately impacts on affective, cognitive and behavioral responses (Sundar *et al.*, 2015). At elementary school level, AR has a significant impact on learning outcomes compared to other technologies (pictures, video conferencing and animation), traditional lecture methods and traditional pedagogical resources (Garzón *et al.*, 2019). However, research into the effectiveness of AR in the education of elementary school student schools is still limited (Garzón *et al.*, 2019). This study aims to fill the gap by implementing and testing the effectiveness of AR-based sharia financial education for elementary school students.

## 2. Literature review and hypothesis development

### 2.1 Sharia financial literacy

Financial literacy has two dimensions: financial knowledge and the implementation of knowledge (Huston, 2010). There are several conceptual definitions of financial literacy: 1) knowledge of financial concepts, 2) ability to communicate financial concepts, 3) skills in managing personal finances, 4) skills in making the right financial decisions and 5) confidence in effective planning for future financial needs (Remund, 2010). In the context of sharia finance, sharia financial literacy is defined as the ability of individuals to use their financial knowledge, skills and attitudes to manage financial resources in accordance with Islamic values (Rahim *et al.*, 2016). Antara *et al.* (2016) stated that sharia financial literacy is used to influence a person's attitude, in terms of his/her financial behavior, especially for distinguishing between conventional and sharia financing. Making this distinction is an important goal and requires as early an exposure as possible for young learners.

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AR-SFLS provides educators with a new approach for socializing sharia financial knowledge as an enjoyable learning experience for young learners.

In addition, the complex topics of sharia financial literacy can pose quite a challenge for both educators and young learners. [Biplob and Abdullah \(2019\)](#) defined sharia financial literacy as the ability to understand the concept of money, debt, saving, spending, *zakat* and other sharia-compliant and non-sharia compliant elements which are involved in transactions that are prohibited in Islam, including *gharar* (uncertainty), *riba* (interest) and *maysir* (gambling). Sharia financial literacy is related to understanding financial products or services in accordance with Islamic principles, Islamic law and Islamic moral codes ([Antara et al., 2016](#)). This study defines Islamic financial literacy as the knowledge and implementation of sharia financial knowledge including basic concepts (*gharar*, *usury* and *maysir*), earning money, balanced spending, borrowing, saving, investment, payment methods, financial technology and the concept of protection to make financial decisions according to Islamic values. Having strengthened the comprehensiveness of sharia financial literacy, AR-SFLS optimistically continues to contribute by not only enhancing literacy but also “immunizing” the next generation so they can cope with the shifting paradigms of the post-Covid-19 pandemic world.

Furthermore, the practice of AR-SFLS will expose young learners to the importance of sharia financial literacy early on in their lives. The level of Islamic financial literacy is a determining factor for people to use financial products, thereby increasing financial inclusion ([Widityani et al., 2020](#); [Ali et al., 2020b](#); [Yazdan and Hossein, 2012](#)). Financial literacy is also a driver of human capital development ([Huston, 2010](#)) and human capital investment which in turn encourages higher economic growth ([Affandi et al., 2019](#); [Yazdan and Hossein, 2012](#)). In the realm of personal finance, [Abdullah and Razak \(2015\)](#) found that financial literacy results in confidence in making any decisions about sharia-compliant investments, improving people’s financial management capabilities ([Setyowati et al., 2018](#)). [Salwa et al. \(2017\)](#) and [Mokhlis \(2006\)](#) showed that it has a negative impact on impulsive buying behavior.

### *2.2 Financial literacy education strategies for elementary school students*

It is important that AR-SFLS is targeted at young learners using the right strategies for each stage of age development for sharia-based financial literacy education. The age development refers to: 1) In early childhood, the right strategy is the executive function intervention; (2) at elementary school age it should be carried out through financial socialization; and 3) in adolescence, using the development of financial skills ([Drever et al., 2015](#)). For young learners in elementary school, financial socialization needs to be carried out in such a way that young learners acquire and develop values, attitudes, standards, norms and behavioral finance ([Drever et al., 2015](#)).

At this age, young learners observe the financial behavior of teachers, parents and other adults. Financial socialization will impact positively on financial well-being in the future ([Hibbert et al., 2004](#); [Jorgensen and Savla, 2010](#); [Smith and Barboza, 2013](#)) which ties in strongly with AR-SFLS’s aim of preparing the next generation in the post-Covid-19 pandemic world. Financial socialization takes place through various channels, including mass media, schools, parents, peers and learning media. Therefore, AR-SFLS shall constitute one of the AR-based learning media as a pathway for financial socialization, especially with regard to sharia financial literacy.

### *2.3 Augmented reality in education*

AR is a system that allows real and virtual objects to coexist in the same space and interact in real time ([Azuma, 1997](#)). AR can be used as a channel to unite virtual environments and

the real world (Bower *et al.*, 2014). The process of combining virtual data with real-world data allows users to access rich and meaningful multimedia content (Billinghurst *et al.*, 2001).

AR is a technology that is widely used during learning activities. The use of AR provides many benefits to the field of education (Cheng and Tsai, 2013) including AR helping students to explore the real world (Dunleavy *et al.*, 2009), and it makes it easy to observe events or objects that are not easily observed with the naked eye (Wu *et al.*, 2013). The main advantage of AR is its ability to form an immersive hybrid learning environment, namely, the ability to combine digital objects with physical objects, especially in the era of the Covid-19 pandemic where it is necessary to limit people's movement and daily interactions.

Based on the theory of interactive media, media characteristics have an effect on affective, cognitive and behavioral responses (Sundar *et al.*, 2015). The interactive process using AR can facilitate critical thinking skills, problem-solving and communicating through collaborative exercises (Akçayır *et al.*, 2016), improve learning performance (Chang *et al.*, 2014; Chiang *et al.*, 2014) as well as increase students' motivation and investigative skills (Sotiriou and Bogner, 2008).

In addition, based on these arguments, we predict that sharia financial literacy education through financial socialization strategies will increase the sharia financial knowledge of young learners in elementary school. In addition, there is a change in learning styles from a verbal approach to a virtual one, so it is expected that AR-based learning media can increase the effectiveness of the students' learning. This study draws certain overall conclusions from the discussion above and develops the tentative hypothesis as follows:

- H1.* There is a difference in sharia financial knowledge between groups who take AR-based Islamic financial socialization (by using AR-SFLS) compared to those who do not.

### 3. Method

This study examines the effect of AR-SFLS on sharia financial knowledge for young learners in elementary school. AR-SFLS was developed by the Yogyakarta State University Research Institute (Indonesia) and has been granted copyright no. 000150821 from the Ministry of Law and Human Rights. Furthermore, AR-SFLS is designed for young learners in elementary school students of grades five and six, for six weeks. The study was conducted for students at Muhammadiyah Sapen elementary school in Yogyakarta. Each student received this AR-SFLS and used it at home with their family or parents, because AR has a greater effect on student learning gains when the treatment is carried out in an informal setting (Garzón *et al.*, 2019).

A random assignment was used to determine the treatment group and the control group. There were a total of 66 students with 34 students in the control group and 32 in the treatment group. Table 1 shows the sample's characteristics. In addition, there seems to be no difference in the distribution of participants in the treatment and control groups, indicated by no difference in their mathematics and language scores, and the level of parental education.

#### *3.1 Sharia financial literacy measurement in the practice of augmented reality-based sharia financial literacy system for the young learners in elementary school grades five and six*

Previous researchers have developed a scale for the measurement of sharia financial literacy (Antara *et al.*, 2017; Rahim *et al.*, 2016; Setyawati and Suroso, 2016). Antara *et al.* (2017)

developed a sharia financial literacy measurement with five indicators, including the basic concepts (the prohibition of *riba*, *gharar* and *maysir*), borrowing concepts (*mudharabah*, *musyarakah*, *ijarah*, *murabahah*, *istisna*, *qard al-hassan* and *ujrah*), the concept of investment/savings (*wadiah* and *waqf*), as well as the concept of protection (*takaful*). Other sharia financial literacy research, by [Setyawati and Suroso \(2016\)](#), measured sharia financial literacy with questions related to financial knowledge, financial behavior and individual financial attitudes. However, the index for the measurement of young learners' sharia financial literacy is still not fully explored. This study developed the AR-SFLS's measurement for young learners in elementary school by modifying several of the categories of sharia financial literacy for adults developed by [Antara et al. \(2017\)](#) and [Biplob and Abdullah \(2019\)](#) as referred to in [Table 2](#).

### 3.2 Development of the augmented reality-based sharia financial literacy system

A research and development model was used in the development of the AR-SFLS. According to Dick and Carey ([Dick and Carey, 1996](#)), there are five steps in creating a research and development model, which are analysis, designing, development, implementation and evaluation (ADDIE) as referred to in [Figure 1](#), which presents the research and development model for AR-SFLS.

The steps for developing AR-SFLS using the ADDIE development method ([Branch, 2009](#)) are as follows: 1) analyze to determine the learning objectives based on sharia financial knowledge, identify the young learners' needs and determine the appropriate learning media of AR for sharia financial socialitation; 2) design is the process of creating a form of learning media that is suitable for the learning objectives based on sharia financial knowledge; 3) develop something which will validate the learning media being created. This media has been reviewed and validated by sharia finance experts, IT media professionals, education experts and teachers at an elementary school; 4) implementation involves the preparation and testing of the learning media on young learners; and 5) evaluations are carried out to analyze the suitability of the product for the young learners' needs and to improve/rectify any deficiencies in the product.

In addition, AR-SFLS is also equipped with a virtual assistant named "Bima" to help explain the material. The AR-based sharia finance literacy learning material includes basic concepts, earning money, balanced spending, borrowing, saving, investments, payment methods, financial technology and the concept of protection.

### 3.3 Hypothesis testing

Testing of hypothesis was carried out using analysis of variance (ANOVA). The model in [equation \(1\)](#), modified from [Francis et al. \(2020\)](#), is used to test the following hypothesis:

**Table 1.**

Sample characteristics of AR-SFLS's treatment and control group for the young learners in elementary school of grades five and six

Sample characteristics	Treatment		Control	
	Mean (mode)	SD	Mean (mode)	SD
GPA in math	92.45	3.99	90.22	5.48
GPA in language	90.39	6.16	91.92	4.10
Parents' education level **	(2)		(2)	
Number of samples observed	32		34	

**Notes:** \*\*Parents' education is measured by: 1 – if parents graduate from high school; 2 – if they have a bachelor's degree; 3 – a master's degree; 4 – a doctorate



Category	Item	Virtual sharia financial socialization
Basic concept	(1) Prohibition of <i>riba</i> (2) Prohibition of <i>gharar</i> (3) Prohibition of <i>maysir</i>	
Earning money Balanced spending	Earning money in a halal way (1) Consumption, saving, sharing (2) Halal, <i>mubadzir</i> and <i>qonaah</i> (3) The benefits of being a smart buyer	
Borrowing concept	(1) Debt management in Islam (2) Prohibition on <i>riba</i> in debt	
Saving	(1) Introduction of Islamic banks (2) Difference between Islamic banks and conventional banks	
Investment concept	(1) Introduction to investment (2) Benefits of investment (3) Variety of Islamic investment	
Payment method	(1) Payment instruments (2) The sharia e-money	
Fintech	(1) Understanding of financial technology (2) Islamic financial technology	
Protection concepts	(1) Takaful (2) Types of Takaful	

**Table 2.**  
Measurement of AR-SFLS's treatment and control group for the young learners in elementary school of grades five and six

$$Y_i = \alpha + \beta_1 \text{Treatment} + \beta_2 \text{Gender} + e \quad (1)$$

As identified in Table 3, Y represents the difference in the student's pre-test and post-test results. Treatment is a dummy variable which is one for students who obtained financial sharia socialization and zero if not. Gender is included as a control variable because previous research shows that there are differences in the level of financial literacy between males and females (Chen and Volpe, 1998; Sari et al., 2017).

The dependent variable was the result of the financial knowledge test, which consisted of 21 questions on sharia financial knowledge and was measured by the number of questions answered correctly. An example of the Islamic financial knowledge questionnaire is attached in Appendix.

## 4. Result and decision

### 4.1 Result

4.1.1 *Augmented reality-based sharia financial literacy learning media.* The following is the AR-based sharia financial literacy learning media.



**Figure 1.**  
Stages of research  
and development for  
the ADDIE model for  
AR-SFLS

**Table 3.**

Variables definition  
of AR-SFLS's  
treatment and control  
group for the young  
learners in  
elementary school of  
grades five and six

Variable	Definition
Y	Increased financial knowledge as measured by differences in the results of student's pre-test and post-test
Pre-test	Correct answers of the pre-test
Post-test	Correct answers of the post-test
Treatment	Dummy variable: one for students who obtain financial sharia socialization and zero if not
Gender	A dummy variable: one for a girl and zero for a boy

4.1.1.1 Application's working principle. The first step to using the application is to download the application, then scan the barcode and a 3D image will appear (Figure 2).

4.1.1.2 Main menu. In this section, there is a start menu, information, instructions and an exit menu (Figure 3).

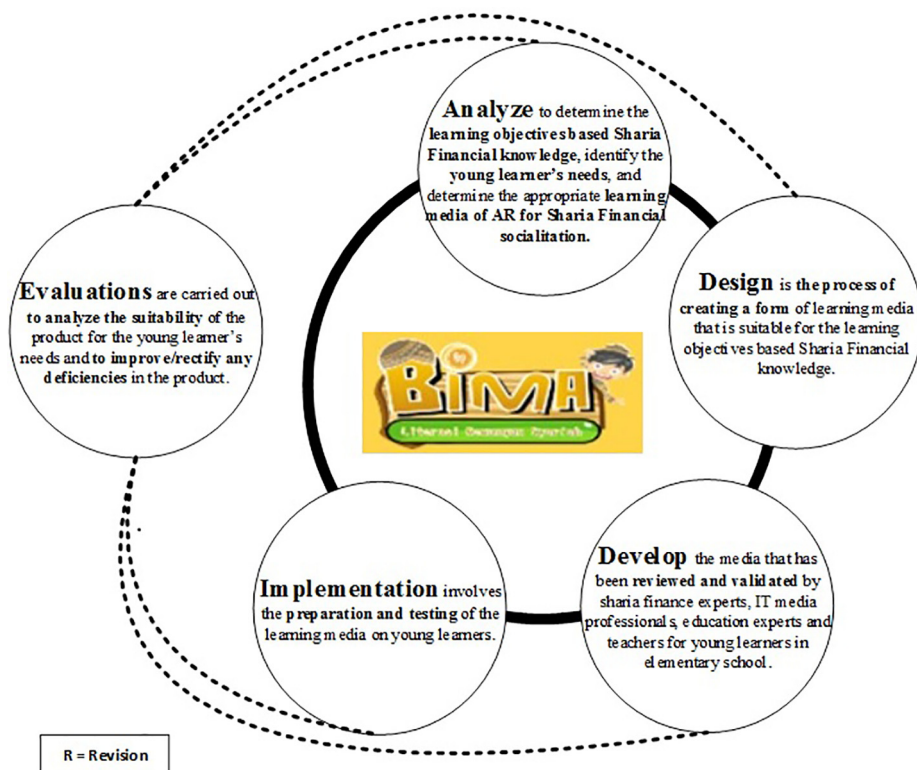
4.1.1.3 Display content. The display content functions to pop up a 3D image of the AR "Bima." In each chapter, there is a virtual assistant "Bima," to provide an explanation regarding the material and examples of a good financial attitude (Figure 4).

4.1.1.4 Display info menu. The "display info" menu function brings up the info menu that contains information about the application (Figure 5).

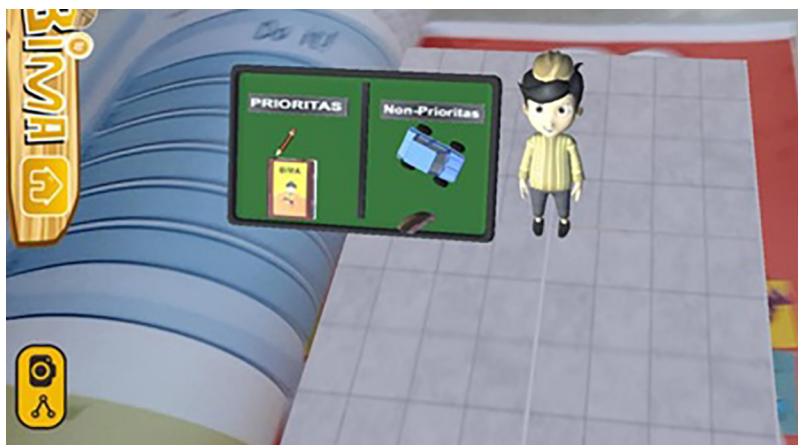
4.1.1.5 Display menu instructions. Its function is to bring up the guide menu and instructions on how to operate the application (Figure 6).

4.1.2 *Evaluation of augmented reality-based sharia financial literacy system by young learners in elementary school.* At this stage the students evaluated the system. They were asked to provide evaluations related to the aspects of the young learners motivation, the 3D images and the activities of the AR-based Islamic financial literacy learning media, and its 3D images. The results of the students' evaluations are presented in Table 4.





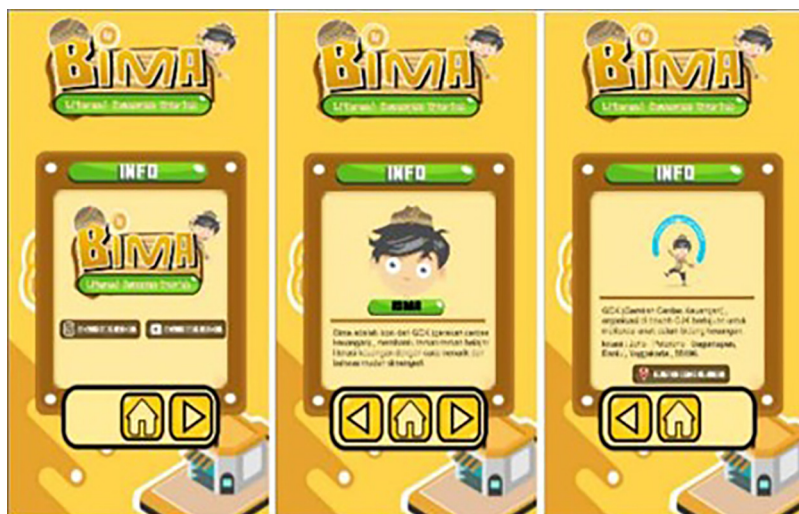
**Figure 2.**  
Block diagram, the  
principle of how the  
AR-SFLS application  
works



**Figure 3.**  
Display of the AR-  
SFLS main menu



**Figure 4.**  
Display of AR-SFLS'  
content



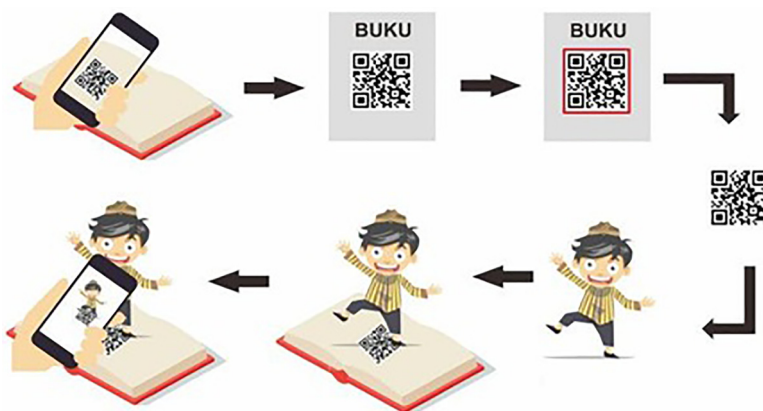
**Figure 5.**  
Display menu info of  
AR-SFLS' content

The students considered that the ability of the AR-based sharia financial literacy learning media to increase their motivation to learn was good, the 3D images were good and the AR-based activity was also good.

*4.1.3 Impact of sharia financial socialization on financial knowledge.* The outcomes we measured suggested there was an improvement over the study period. Based on the mean difference indicator, there was no significant difference in the pre-test scores between the sample group and the control group, so it can be said that the two groups are comparable.

Testing for increasing knowledge of *sharia* finance was carried out in two stages, the first stage used the total score of increasing sharia financial knowledge. The second stage was tested on each dimension of sharia financial knowledge.

After receiving sharia financial socialization, there is a difference in the mean total scores of financial knowledge in the treatment group compared to the control group. It meant that financial socialization increased sharia financial knowledge in the treatment group, relative



Virtual sharia  
financial  
socialization

**Figure 6.**  
Display instructions  
menu of AR-SFSL'  
content

Student's evaluation	Mean*	SD
Motivation	2.65	4.82
3D figures	2.90	2.96
AR-based activity	3	0

**Notes:** \*Score conversion: 3 = good, 2 = ordinary, 1 = not good

**Table 4.**  
Student's evaluation  
on AR-SFSL

to the control group (as shown in Table 5). Likewise, in testing each dimension, there is an increase in the understanding of Islamic financial knowledge except for the dimensions of financial technology and concept of protection.

Furthermore, hypothesis testing was carried out using ANOVA, the analyses are presented in Table 6. ANOVA testing was also carried out in two stages: the first stage used the total score of all the sharia financial knowledge dimensions and the second stage used the scores for each dimension. In testing using a total score, the treatment variable was

Variable	Treatment			Control			Difference
	Mean	SD	N	Mean	SD	N	
Total score	7.13	5.59	32	-2.71	5.65	34	-9.84***
Basic concept	0.34	0.70	32	-0.26	0.66	34	-0.60***
Earnings income	0.29	0.55	32	0.03	0.58	34	-0.26*
Balanced spending	-0.69	2.45	32	-3.15	2.40	34	-2.47***
Borrowing concept	3.25	2.17	32	0.71	2.56	34	-2.54***
Saving	2.50	3.11	32	0.00	2.75	34	-1.79**
Investment	1.03	1.95	32	-0.97	1.91	34	-2.00***
Payment method	0.67	0.47	32	0.09	0.69	34	-0.58***
Financial technology	0.28	1.59	32	0.24	2.64	34	-0.04
Protection concepts	0.09	0.53	32	0.03	0.39	34	-0.06

**Notes:** \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

**Table 5.**  
Improvement of  
sharia financial  
knowledge for each  
category by AR-  
SFSL use

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significant ( $F = 54.44$ ,  $p < 0.01$ ), indicating there is a difference in sharia financial knowledge among participants who received financial socialization using AR compared to participants who did not receive it. Therefore, *H1* is supported.

The gender variable was also significant ( $F = 6.48$ ,  $p < 0.05$ ). Males had a higher mean total score of increased financial knowledge (Mean: 10.67, SD: 5.85) than females (Mean: 6.30; SD: 5.30). This indicates that male participants experienced a higher increase in sharia financial knowledge than female participants. However, the interaction effect of treatment and gender is not significant. Furthermore, to see the impact of learning on improving each dimension, additional testing was carried out. The test results showed that there was a significant increase in the dimensions of the basic concepts, borrowing concept, saving, investment, payment concept, while the protection concept dimension is significant only in 10% and the dimensions of earnings income, balanced spending and financial technology were not significant.

### 4.2 Discussion of result

This study provides empirical evidence of the influence of sharia financial socialization using AR-SFLS. This study provided encouraging evidence about the potential of sharia financial education for elementary school students using the appropriate learning strategies and media.

In financial literacy education, age-appropriate media and strategies are needed (Khan and Abdullah, 2010). For elementary school students, the appropriate financial literacy learning strategy is financial socialization. Financial socialization will build and develop financial attitudes and behavior (Drever *et al.*, 2015). This research supports previous research (Drever *et al.*, 2015; Tang and Peter, 2015) which stated that financial socialization has a positive influence on financial knowledge. Financial socialization strategies can include several channels; one of them is through learning media.

Currently, there is a progressive shift in learning styles from verbal and visual, to virtual. AR-SFLS, appropriate for post-millennial students, which is able to present a virtual element so it becomes more concrete and tangible, thus increasing the students' motivation and helping them gain better investigation skills (Sotiriou and Bogner, 2008). Besides this, many financial concepts are intangible ideas, for example, investments or insurance, and AR technology is useful for visualizing these abstract or intangible concepts (Wu *et al.*, 2013). AR technology is very suitable for engaging young learners in elementary school (students),

Variable	Treatment (F)	Gender	Treatment X Gender
Total score	54.44***	6.48**	0.08
Basic concept	15.26***	6.28**	2.09
Earnings income	0.45	0.51	0.98
Balance spending	0.44	0.50	0.99
Borrowing concept	13.17***	0.69	0.51
Saving	23.554***	16.345***	0.004
Investment	33.79***	1.309	22.75***
Payment method	25.90***	12.95***	0.03
Financial technology	1.62	6.75**	0.83
Protection concepts	3.07*	4.69**	3.07*

**Table 6.**  
Result of ANOVA –  
the practice of AR-  
SFLS on sharia  
financial knowledge  
for each category

Notes: \* $p < 0.10$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

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because the students spend a great deal of time playing digital games (Lee, 2012). The AR-SFLS is equipped with a virtual assistant, “Bima,” which provides an explanation of the material in each chapter. This research supports previous research which stated that AR-SFLS can increase students’ learning motivation because it has interesting 3D images and engaging features.

In addition, this study also found that after receiving the sharia financial socialization using AR-SFLS, the students in the treatment group had more sharia financial knowledge than those in the control group. This finding supports Widityani *et al.* (2020) that the level of sharia financial literacy is higher for students who have taken an Islamic finance course. This implies that even though there are many educational channels such as social media, television and YouTube channels, intervention is still needed through financial socialization, education and courses related to sharia finance to increase knowledge of sharia finance. Of the control variables, gender appeared to be an important factor. This study supports previous research that there are differences in financial attitudes between men and women. Men have a stronger desire to have financial independence and earn their own income than women (Newcomb and Rabow, 1999).

Some elementary school students still find it difficult to understand items related to income, balanced spending, financial technology and protection concepts. This is indicated by the insignificant increase in knowledge for these categories. These findings support the cognitive learning theory that during pre-adolescence children can understand the concept of saving. However, an understanding of protection and interest rates can be understood in adolescence (Martin *et al.*, 2011). Having said that, the future impact created in increasing sharia financial knowledge should be consistent in preparing the next generation in facing the shifting paradigms in many aspects of life in the post-Covid-19 pandemic era.

In addition to future needs, AR-SFLS shall provide more exposure to fintech. Fintech is also difficult for children to understand. In addition, children do not have the necessary experience to use fintech. However, in fact, the demand for digital technology-based products among Muslims is expected to increase in the future (Hasan *et al.*, 2020) especially the post-Covid-19 pandemic era. According to Brodmann *et al.* (2018), the millennial generation stated that mobile banking is the most important aspect that banks need to have. Therefore, efforts are needed to introduce fintech in a way that is more fun and appropriate for children for a better next generation by using AR-SFLS.

## 5. Conclusion

The low level of financial literacy and sharia financial inclusion in countries with large Muslim populations raises awareness of the importance of a sharia financial literacy education especially in facing the multiple impacts of the Covid-19 pandemic era. Sharia finance has been growing significantly, not only in countries with Muslim majority populations like Malaysia, the UAE, Turkey and Pakistan but also in non-Islamic countries. Islamic financial literacy will increase Islamic financial knowledge, which in turn will encourage people to use sharia financial products. Increasing people’s financial education is a major effort to increase financial inclusion, especially in the use of Islamic financial services (Ginjar and Kassim, 2020).

In addition, in line with AR-SFLS’s aim, financial education must start at an early age because that knowledge will accumulate into adulthood. The current study examines the effectiveness of sharia financial socialization using AR technology. This study found that teaching sharia financial literacy using appropriate learning strategies and media will increase young learners’ sharia financial knowledge.



The study has implications for teaching practice and knowledge as well as policymaking. With regard to teaching practice, educators must be aware and adjust to changes in learning styles to stay connected with their students. AR-SFLS shows that effective learning occurs when the learning style matches the teaching style (Jagger *et al.*, 2016). The development of AR-SFLS shall contribute to the evolution of learning styles from verbal and visual to virtual. In addition, young learners in elementary schools seek information through the internet and other technology-based media. Therefore, increasing the effectiveness of learning through the adoption of technology should be the goal of educators.

With regard to teaching knowledge, the study of AR-SFLS adds to the literature by focusing on sharia financial literacy with the adoption of the technology. For policymaking, the findings of the practice of AR-SFLS shall guide the relevant authorities (the Ministry of Education and the Financial Services Authority) toward emphasizing the importance of sharia financial literacy education. Sharia financial literacy education is best applied at an early age to encourage the growth of the sharia finance industry. Besides updating the regulations, AR-SFLS's content shall be in-line with the provision of guidelines on sharia finance for the advancement of Islamic financial institutions.

The limitation in this study is that it was only carried out in one elementary school, with the children of middle- to upper-income parents. Further research shall be developed at several levels of young learners in schools with the children of parents with different income levels.

## References

- Abdullah, R. and Razak, L.A. (2015), "Exploratory research into Islamic financial literacy in Brunei Darussalam", *Faculty of Business and Management Sciences*, October, pp. 59-83.
- Affandi, Y., Anugrah, D.F. and Bary, P. (2019), "Human capital and economic growth across regions: a case study in Indonesia", *Eurasian Economic Review*, Vol. 9 No. 3, pp. 331-347.
- Akçayır, M., Akçayır, G., Pektaş, H.M. and Ocak, M.A. (2016), "Augmented reality in science laboratories: the effects of augmented reality on university students' laboratory skills and attitudes toward science laboratories", *Computers in Human Behavior*, Vol. 57, pp. 334-342.
- Ali, M.M., Devi, A. and Bustomi, H. (2020a), "Determinants of Islamic financial exclusion in Indonesia", *Journal of Islamic Monetary Economics and Finance*, Vol. 6 No. 2.
- Ali, M.M., Devi, A., Furqani, H. and Hamzah, H. (2020b), "Islamic financial inclusion determinants in Indonesia: an ANP approach", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 13 No. 4, pp. 727-747.
- Antara, P.M., Musa, R. and Hassan, F. (2016), "Bridging Islamic financial literacy and halal literacy: the way forward in halal ecosystem", *Procedia Economics and Finance*, Vol. 37, pp. 196-202.
- Antara, P.M., Musa, R. and Hassan, F. (2017), "Conceptualisation and operationalisation of Islamic financial literacy scale", *Pertanika Journals*, Vol. 25, pp. 251-260.
- Asyaton, I. (2018), "Regional and accessibility analysis of the banking system and their impacts toward regional financial inclusion in Indonesia", *Journal of Islamic Monetary Economics and Finance*, Vol. 4 No. 2, pp. 311-332.
- Azuma, R.T. (1997), "A survey of augmented reality", *Presence: Teleoperators and Virtual Environments*, Vol. 6 No. 4, pp. 355-385.
- Batty, M., Collins, J.M. and Odders-White, E. (2015), "Experimental evidence on the effects of financial education on elementary school students' knowledge, behavior, and attitudes", *Journal of Consumer Affairs*, Vol. 49 No. 1, pp. 69-96.














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- Billingshurst, M., Kato, H. and Poupyrev, I. (2001), "The MagicBook – moving seamlessly between reality and virtuality", *Computer Graphics and Applications, IEEE*, Vol. 21, pp. 6-8.
- Biplob, H. and Abdullah, F. (2019), "The importance of Islamic financial literacy for Muslims: a general review", *Islam and Civilisational Renewal*, Vol. 10 No. 1, pp. 106-117.
- Bower, M., Howe, C., McCredie, N., Robinson, A. and Grover, D. (2014), "Augmented reality in education – cases, places and potentials", *Educational Media International*, Vol. 51 No. 1, pp. 1-15.
- Branch, R. (2009), *Instructional Design: The ADDIE Approach*, Springer, New York, NY Dordrecht Heidelberg.
- Brodmann, J., Rayfield, B., Hassan, M.K. and Mai, A.T. (2018), "Banking characteristics of millennials", *Journal of Economic Cooperation and Development*, Vol. 39 No. 4, pp. 43-74.
- Chang, K.E., Chang, C.T., Hou, H.T., Sung, Y.T., Chao, H.L. and Lee, C.M. (2014), "Development and behavioral pattern analysis of a mobile guide system with augmented reality for painting appreciation instruction in an art museum", *Computers and Education*, Vol. 71, pp. 185-197.
- Chen, H. and Volpe, R.P. (1998), "An analysis of personal financial literacy among college students", *Financial Services Review*, Vol. 7 No. 2, pp. 107-128.
- Cheng, K.-H. and Tsai, C.-C. (2013), "Affordances of augmented reality in science learning: suggestions for future research", *Journal of Science Education and Technology*, Vol. 22 No. 4, pp. 449-462.
- Chiang, T.H.C., Yang, S.J.H. and Hwang, G.J. (2014), "An augmented reality-based mobile learning system to improve students' learning achievements and motivations in natural science inquiry activities", *Educational Technology and Society*, Vol. 17 No. 4, pp. 352-365.
- Dick, W. and Carey, L. (1996), *The Systematic Design of Instruction*, 4th ed., Pearson Education.
- Drever, A.I., Odders-White, E., Kalish, C.W., Else-Quest, N.M., Hoagland, E.M. and Nelms, E.N. (2015), "Foundations of financial well-being: insights into the role of executive function, financial socialization, and experience-based learning in childhood and youth", *Journal of Consumer Affairs*, Vol. 49 No. 1, pp. 13-38.
- Dunleavy, M., Dede, C. and Mitchell, R. (2009), "Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning", *Journal of Science Education and Technology*, Vol. 18 No. 1, pp. 7-22.
- Francis, E.R., Bernard, S., Nowak, M.L., Daniel, S. and Bernard, J.A. (2020), "Operating room virtual reality immersion improves self-efficacy amongst preclinical physician assistant students", *Journal of Surgical Education*, Vol. 77 No. 4, pp. 947-952.
- Gao, J., Wang, A. and Qian, M. (2010), "Differentiating shame and guilt from a relational perspective: a cross-cultural study", *Social Behavior and Personality: An International Journal*, Vol. 38 No. 10, pp. 1401-1407.
- Garzón, J., Pavón, J. and Baldiris, S. (2019), "Systematic review and meta-analysis of augmented reality in educational settings", *Virtual Reality*, Vol. 23 No. 4, pp. 447-459.
- Ginanjar, A. and Kassim, S. (2020), "Can Islamic microfinance alleviates poverty in Indonesia? An investigation from the perspective of the microfinance institutions", *Journal of Islamic Monetary Economics and Finance*, Vol. 6 No. 1, pp. 77-94.
- Hasan, R., Hassan, K. and Aliyu, S. (2020), "Fintech, blockchain and Islamic finance: literature review and research agenda", *International Journal of Islamic Economics and Finance*, Vol. 3 No. 1, pp. 75-94.
- Hibbert, J.R., Beutler, I.F. and Martin, T.M. (2004), "Financial prudence and next generation financial strain", *Journal of Financial Counseling and Planning*, Vol. 15 No. 2, pp. 51-59.
- Holden, K., Kalish, C., Scheinholtz, L., Dietrich, D. and Novak, B. (2009), "Financial literacy programs targeted on pre-school children: development and evaluation", *La Follette School Working Paper*.
- Huston, S.J. (2010), "Measuring financial literacy", *Journal of Consumer Affairs*, Vol. 44 No. 2, pp. 296-316.

- 
- Jaffar, M.A. and Musa, R. (2013), "Determinants of attitude towards Islamic financing among halal-certified micro and SMEs: a proposed conceptual framework", *International Journal of Education and Research*, Vol. 1 No. 8, pp. 1-10.
- Jagger, S., Siala, H. and Sloan, D. (2016), "It's all in the game: a 3D learning model for business ethics", *Journal of Business Ethics*, Vol. 137 No. 2, pp. 383-403.
- Jorgensen, B.L. and Savla, J. (2010), "Financial literacy of young adults: the importance of parental socialization", *Family Relations*, Vol. 59 No. 4, pp. 465-478.
- Khan, H.H.A. and Abdullah, H. (2010), "Saving determinants in Malaysia", *Jurnal Ekonomi Malaysia*, Vol. 44, pp. 23-34.
- Klopfer, E. and Sheldon, J. (2010), "Augmenting your own reality: student authoring of science-based augmented reality games", *New Directions for Youth Development*, Vol. 2010 No. 128, pp. 85-94.
- Latif, S.D.H. (2019), "Awareness and perceptions of Muslim society towards Islamic banking in the Philippines", *International Journal of Islamic Economics and Finance*, Vol. 1 No. 2, pp. 209-228.
- Lee, K. (2012), "Augmented reality in education and training", *TechTrends*, Vol. 56 No. 2, pp. 13-21.
- Lusardi, A. and Mitchell, O.S. (2011), "Financial literacy around the world: an overview", National Bureau of Economic Research Working Paper Series, (w17107).
- Mandell, L. (2008), "The financial literacy of young American adults", *Jumpstart*.
- Martin, S., Diaz, G., Sancristobal, E., Gil, R., Castro, M. and Peire, J. (2011), "New technology trends in education: Seven years of forecasts and convergence", *Computers and Education*, Vol. 57 No. 3, pp. 1893-1906.
- MIFC (2015), "Halal ecosystem prospects for global growth", MIFC, September.
- Mokhlis, S. (2006), "The effect of religiosity on shopping orientation: an exploratory study in the effect of religiosity on shopping orientation: an exploratory study in Malaysia", *Journal of American Academy of Business*, Vol. 9 No. 1, pp. 64-74.
- Nawaz, H., Bardai, B. and Alkhawlan, M. (2018), "The mediating effect of products and services on growth rate of Malaysian Islamic financial system", *Journal of Economic Cooperation and Development*, Vol. 39 No. 1, pp. 109-142.
- Newcomb, M.D. and Rabow, J. (1999), "Gender, socialization, and money", *Journal of Applied Social Psychology*, Vol. 29 No. 4, pp. 852-869.
- OJK (2016), "Survei nasional literasi dan inklusi keuangan 2016", *Otoritas Jasa Keuangan*.
- Olorogun, L.A. (2018), "Banking the unbanked a perceived recipes for poverty eradication program: induction of a new Islamic microfinance model in Nigeria", *Journal of Islamic Monetary Economics and Finance*, Vol. 3 No. 2, pp. 220-244.
- Proserpio, L. and Gioia, D.A. (2007), "Teaching the virtual generation", *Academy of Management Learning and Education*, Vol. 6 No. 1, pp. 69-80.
- Rahim, A., Rashid, R. and Hamed, A.B. (2016), "Factor analysis of Islamic financial literacy and its determinants: a pilot study", *The European Proceedings of Social and Behavioral Sciences*, pp. 413-418.
- Remund, D. (2010), "Financial literacy explicated: the case for a clearer definition in an increasingly complex economy", *Journal of Consumer Affairs*, Vol. 44 No. 2, pp. 276-295.
- Salwa, S., Musadik, A. and Azmi, I.A.G. (2017), "A conceptual paper: the effect of Islamic religiosity on impulse buying behavior", *Journal of Global Business and Social Entrepreneurship (GBSE)*, Vol. 1 No. 2, pp. 137-147.
- Sari, R.C., Fatimah, P.L.R. and Suyanto, (2017), "Bringing voluntary financial education in emerging economy: role of financial socialization during elementary years", *Asia-Pacific Education Researcher*, Vol. 26 Nos 3/4, pp. 183-192.
- Setyawati, I. and Suroso, S. (2016), "Sharia financial literacy and effect on social economic factors (survey on lecturer in Indonesia)", *International Journal of Scientific and Technology Research*, Vol. 5 No. 2.

- Setyowati, A., Harmadi, H. and Sunarjanto, S. (2018), "Islamic financial literacy and personal financial planning: a socio-demographic study", *Jurnal Keuangan Dan Perbankan*, Vol. 22 No. 1.
- Sherraden, M.S., Johnson, L., Guo, B. and Elliott, W. (2011), "Financial capability in children: effects of participation in a school-based financial education and savings program", *Journal of Family and Economic Issues*, Vol. 32 No. 3, pp. 385-399.
- Smith, C. and Barboza, G.A. (2013), "The role of trans-generational financial knowledge and self-reported financial literacy on borrowing practices and debt accumulation of college students", *SSRN Electronic Journal*.
- Sosin, K., Dick, J. and Reiser, M.L. (1997), "Determinants of achievement of economics concepts by elementary school students", *The Journal of Economic Education*, Vol. 28 No. 2, pp. 100-121.
- Sotiriou, S. and Bogner, F.X. (2008), "Visualizing the invisible: augmented reality as an innovative science education scheme", *Advanced Science Letters*, Vol. 1 No. 1, pp. 114-122.
- Suiter, M. and Meszaros, B.T. (2005), "Teaching about saving and investing in the elementary and middle school grades", *Social Education*, Vol. 69 No. 2, pp. 92-95.
- Sundar, S.S., Jia, H., Waddell, T.F. and Huang, Y. (2015), "Toward a theory of interactive media effects (TIME)", *The Handbook of the Psychology of Communication Technology*, John Wiley and Sons, pp. 47-86.
- Tang, N. and Peter, P.C. (2015), "Financial knowledge acquisition among the young: the role of financial education, financial experience, and parents' financial experience", *Financial Services Review*, Vol. 24 No. 2, p. 119.
- Widityani, S.F., Faturohman, T., Rahadi, R.A. and Yulianti, (2020), "Do socio-demographic characteristics and financial literacy matter for selecting Islamic financial products?", *Journal of Islamic Monetary Economics and Finance*, Vol. 6 No. 1, pp. 51-76.
- Wu, H., Lee, S.W., Chang, H. and Liang, J. (2013), "Computers and education current status, opportunities and challenges of augmented reality in education", *Computers and Education*, Vol. 62, pp. 41-49.
- Yazdan, G.F. and Hossein, S.M. (2012), "Analysis of Islamic Bank's financing and economic growth: case study Iran and Indonesia", *Journal of Economic Cooperation and Development*, Vol. 4 No. 33, pp. 1-24.
- Yumna, A. (2019), "Examining financial needs of banking customers for product development in Islamic banking in Indonesia a Maslahah pyramid approach", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 12 No. 5, pp. 721-735.

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Indicators	Example of item
<b>Basic concept</b>	<p>1. At school Bima forgot to bring a picture book, then Bima borrowed Rp. 5,000 from Ali to buy a picture book. Ali agreed to lend Bima the money on the condition that the Rp. 5,500 must be returned the next day. The additional Rp. 500 on the loan is prohibited in Islam because it is?</p> <p>a. <i>Riba</i>                      b. <i>Gharar</i>                      c. <i>Maysir</i>                      d. <i>Dzalim</i></p>
balanced spending	<p>2. Alika went to the store to buy her favorite doll. However, she remembered that her pencil case was broken. What should Alika buy?</p> <div style="display: flex; justify-content: space-around; align-items: center;">     </div> <p>A. Book      B. Ice Cream      C. Doll      D. Pencil Case</p> <p>3. Which of the following items does a student need?</p> <div style="display: flex; justify-content: space-around; align-items: center;">     </div> <p>A. Book      B. Doll      C. Toy Robot      D. Toy Car</p>
<b>Saving</b>	<p>4. Banks that conduct business activities based on Islamic legal principles are called ...</p> <p>a. Conventional banks                      b. <i>Sharia</i> banks                      c. Rural credit banks                      d. Leasing banks</p>
<b>Investment</b>	<p>5. What do you know about stocks?</p> <p>a. Type of security that signifies ownership in a corporation                      b. Type of loan                      c. Money transfer                      d. Credit</p> <p>6. Which one is an investment product?</p> <p>a. Food                      b. Bag                      c. Shoes                      d. Stock</p>
<b>Students' Evaluation on AR-based</b>	<p>7. I like learning to use AR-based <i>sharia</i> finance learning media</p> <div style="display: flex; justify-content: space-around; align-items: center;">    </div> <p>Yes                      ordinary                      No</p>

**Figure A1.**  
 Sharia financial  
 knowledge  
 questionnaires  
 (overview)