Educational Futures Investment Game Based on Augmented Reality

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Abstract— Investments are an important aspect of the financial lives of individuals and society as a whole. One example is futures investment, Investment education is crucial because there are still many people who do not understand the concepts of investment, risk, and financial management, which can result in less wise financial decisions. However, conventional investment education methods such as textbooks are often limited in their effectiveness. Lack of interactivity and lack of practical experience can make learning less interesting and difficult to understand for most participants. In this context, Augmented Reality (AR) technology emerges as a promising solution. AR enables the integration of physical objects with digital information, creating a more interactive and immersive learning experience. The method used in this study was to test the "Invesi" game on several users and collect data through questionnaire.
The results of this research show that the "Invesi" game is able to provide new experiences and have a positive impact on investment literacy.

Keywords— augmented reality, educational, game, investment.

I. INTRODUCTION

Investment is an activity carried out by individuals or business entities with the aim of obtaining profits in the future[1]. Investments are an important aspect of the financial lives of individuals and society as a whole. One example is futures investment,

Investment education is crucial because there are still many people who do not understand the concepts of investment, risk, and financial management, which can result in less wise financial decisions. Several instances of investment fraud have taken place in recent years, resulting in significant financial losses for hundreds of people. One such example includes trading robots, which tricked people into fraudulent investments worth 1.4 T. Similarly, many people fell for illegal investments through binary options, which targeted even the ultra-rich. Therefore, investment in education is crucial to prevent such incidents and reduce the number of victims. However, conventional investment education methods such as textbooks are often limited in their effectiveness. Lack of interactivity and lack of practical experience can make learning less interesting and difficult to understand for most participants. In addition, the low interest in reading among Indonesian people is around 0.001%, which means that out of 1000 Indonesian people, only 1 person is an avid reader. Meanwhile, investor demographics in Indonesia are dominated by men under 30 years of age and only high school education. For young Indonesians (Gen Z) with 17,000 respondents, their interest in reading is not higher than 11%, which means less than 2,000 young people are interested in reading. reading.[2][3][4] In this context, Augmented Reality (AR) technology emerges as a promising solution. AR

enables the integration of physical objects with digital information, creating a more interactive and immersive learning experience[5][6][7]. Therefore, this thesis aims to explore further the design, development and evaluation of investment educational games that use Augmented Reality (AR) technology, with a focus on measuring its effectiveness in increasing investment understanding and skills among learning participants.

II. METHOD

2.1 Source of Data

2.1.1Population

Population is an area where research will be carried out. Population is a group of objects, people, or circumstances that are of concern to researchers and will be used by researchers to generalize the results of their research [8]. The population that will be used in this research is young adults with an age range from 17 years to 25 years.

The location that will be used in this research is the city of Semarang, Central Java.

Data sources were taken from questionnaire with 52 young adults aged around 17 to 25 who have tried the game

2.1.2 Sample

The sample is part of the population to be studied. The sample is a fraction of the number and characteristics possessed by a population [8]. So the sample is part of the population to be studied and is considered to describe the characteristics of the population. Therefore, sampling needs to use a certain method which is based on certain considerations. The technique used in this research is purposive sampling technique. This technique is used due to special provisions, namely the age range from 17 years to 25 years. If population less than a hundred, all taken until the research constitutes the entire population. However, if the number of subjects is large, it can be taken between 10-15% or 15-25% or more."[9].

2.2 Data Collecting

1. Questionnaire

This method was carried out by asking atleast 50 people to try the game and answer questions from researchers.

2. Observation

Observe the behavior of the resource person with the problem being studied.

2.3 Hypothesis

Hypothesis comes from the words hypo (hypo) and thesis (thesis). Hypo means less than, and thesis means opinion. So a hypothesis is a conclusion or opinion that is still lacking or temporary [10].

H1: Perceived Usefulness of Investment Educational Games with AR is correlated with Intention to use Investment Educational Games with AR.

H2: Perceived ease of using investment education games with AR is correlated with intention to use investment education games with AR.

H3: Perception of pleasure/enjoyment in using investment educational games with AR is correlated with intention to use investment educational games with AR.

H4: Devices and support in using Investment Educational Games with AR Humans are correlated with Intention to use Investment Educational Games with AR

III. RESULTS AND DISCUSSION

3.1 Game Design

This “invesi” game was created using Unity software. Unity is an application used to develop games on various types of platforms that are easy to operate for ordinary people [11]. Meanwhile, to create investment games, you can use augmented reality using Vuforia, Vuforia is an Augmented Reality Software Development Kit (SDK) that allows the creation of AR applications for mobile devices[12]. And later this game will be made for the Android platform, Android is an operating system (OS) that is often used on mobile devices such as tablets and cellphones [13]. This game is made with 2 modes, namely story

and game mode. and for details as in the flowchart below

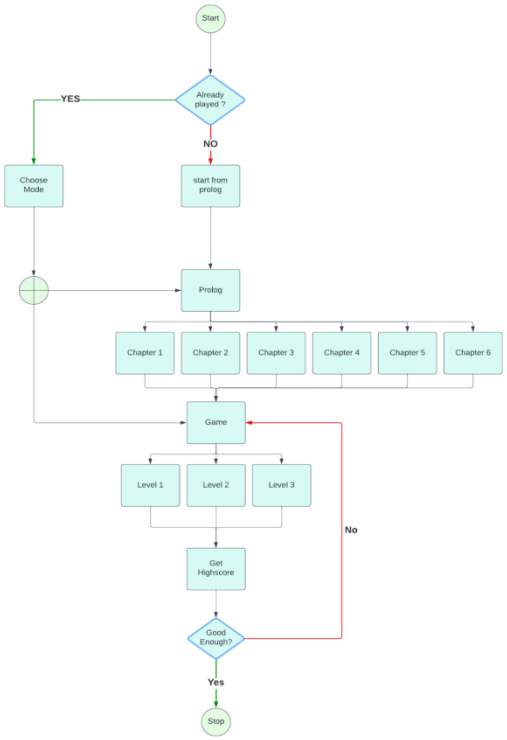

Figure 3.1 Game Flow

Investment education is found in each chapter (level) in story mode, in total there are 7 story chapters with different themes for each chapter. Investment education is integrated into each chapter or level of the story mode, and there are a total of 7 story chapters, each with a different theme. In addition to the story mode, there is a game mode that includes tests or examinations based on the educational material that the player has successfully completed.then the game mode contains tests or examinations from educational material that the player has passed.

3.2 Game Result

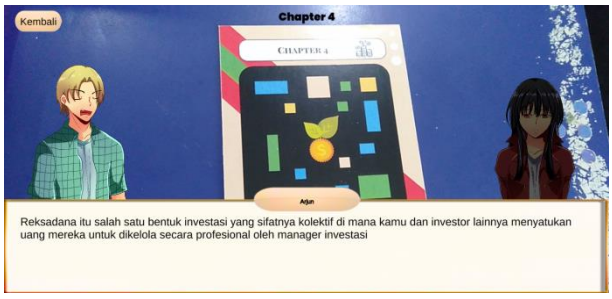

Figure 3.2 Story mode

Figure 3.2 is an example of a game display in story mode. The picture shows how the gameplay of chapter 4 looks like. Chapter 4 tells the story of Sekar, who is a student who wants to learn about investment, asks Arjun, who has studied investment before, Sekar asks about mutual fund instruments and Arjun will explain about “reksadana”, starting from what “reksadana” are, what kinds and types they are, how to manage risk, how to analyze it, and also investment strategies for “reksadana” instruments. "reksadana" are one of the easiest types of investment to start and carry out because they do not require a large amount of capital and investors are not directly involved in managing investment risks [14]. In addition from providing educational material on mutual funds as in Figure 3.1, material on other investment instruments such as basic investment education, then also “saham”, “obligasi”, and “pasar uang” is provided in this story mode. For example "pasar uang" is an integral part of the financial market used for trading financial instruments over a short period of time, usually less than one year [15].

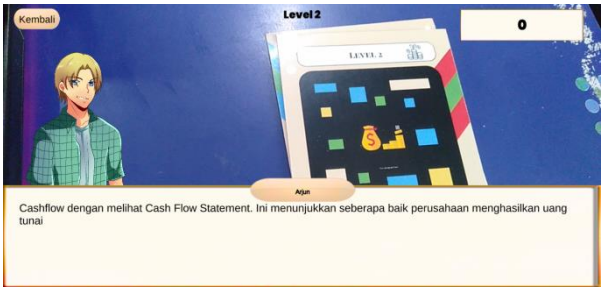

Figure 3.3 Game mode

Figure 3.3, there is a game mode display at level 2 which provides more in-depth education regarding fundamental analysis, for example as in figure 4.26 which explains what a company's cash flow is.

Figure 3.4 Sample case

Figure 3.4 Example question

After the education process is provided in figure 3.2, the players will be tested, an example of the questions given is in Figure 3.3. Players will be given company data and players will analyze it according to the method previously taught. Then after analysis, the display will change as in Figure 4.3. The player will choose whether to invest in the company or not according to the player's analysis

Figure 3.5 test participants (a)

Figure 3.6 test participants (b)

The examples of test participants can be seen in Figures 3.5 and 3.6. This test is conducted prior to answering the questionnaire that will be given later on. The questionnaire includes variables such as effort expectancy, performance expectancy, hedonic motivation, facilitating conditions, and behavioral intention.

3.3 Test Result

After completing the development of the "invesi" game, then after distribute questionnaires and test games to questionnaire participants. Questionnaire data will be processed to obtain answers to the hypotheses that have been prepared. The following are the results of data processing:

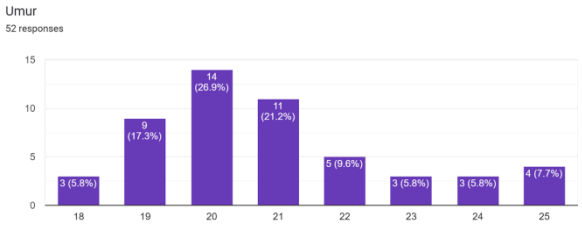

Figure 3.7 Age statistics

From Figure 3.5 it can be seen that the age of the 52 test game participants is that majority of respondents with a percentage of 28.9% or 14 respondents are 20 years old, while 21 year olds have a percentage of 21.2% or 11 respondents, then with an age range of 19 years, the percentage is 17.3%. or as many as 9 respondents, then with the age of 22 years having a percentage of 9.6% or as many as 5 respondents, then with the age of 25 years having a percentage of 7.7% or as many as 4 respondents, and finally with the age of 18, 23 and 24 years having the same percentage, namely 5.8% or 3 respondents.

Rotated Component Matrix[a]

	Component		
	1	2	3
EE1	.050	**.838**	.178
EE2	.033	**.817**	.296
EE3	.336	**.789**	-.035
HM1	**.699**	.558	-.054
HM2	**.733**	.325	-.002
HM3	**.738**	.086	.072
PE1	.231	.023	**.824**
PE2	.525	.167	**.612**
PE3	-.020	.313	**.800**
FC1	**.751**	.002	.269
FC2	**.623**	.014	.488
FC3	**.903**	-.086	.098
BI1	**.858**	.147	.158
BI2	**.795**	.281	.224
BI3	**.754**	.371	.289

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 6 iterations.

Figure 3.8 Validation test

Figure 3.6 is a validity test image that confirms the validity of data because the existing variables have values above 0.4.

Cronbach's alpha	Internal consistency
α ≥ 0.9	Excellent
0.9 > α ≥ 0.8	Good
0.8 > α ≥ 0.7	Acceptable
0.7 > α ≥ 0.6	Questionable
0.6 > α ≥ 0.5	Poor
0.5 > α	Unacceptable

Figure 3.8 Reliability test value range

Variabel	Cronbach's Alpha	Internal Consistency
EE	0.815	Good
HM	0.844	Good
PE	0.757	Acceptable
FC	0.854	Good
BI	0.931	Excellent

Figure 3.10 Reliability test results

From the picture above it can be seen that the reliability test results are as follows :

- Variable EE has a Cronbach alpha value of 0.815, which means it has a good standard as in figure 3.7
- Variable HM has a Cronbach alpha value of 0.844, which means it has a good standard as in figure 3.7
- Variable PE has a Cronbach alpha value of 0.8757, which means it has a acceptable standard as in figure 3.7
- Variable FC has a Cronbach alpha value of 0.854, which means it has a good standard as in figure 3.7
- Variable BI has a Cronbach alpha value of 0.931, which means it has a excellent standard as in figure 3.7

and finally the correlation test is carried out after testing the validity and reliability of the variables

Correlations

		AverageEE	AverageHM	AveragePE	AverageFC	AverageBI
AverageEE	Pearson Correlation	1	.441**	.375**	.221	.432**
	Sig. (2-tailed)		.001	.006	.116	.001
	N	52	52	52	52	52
AverageHM	Pearson Correlation	.441**	1	.385**	.631**	.732**
	Sig. (2-tailed)	.001		.005	.000	.000
	N	52	52	52	52	52
AveragePE	Pearson Correlation	.375**	.385**	1	.478**	.536**
	Sig. (2-tailed)	.006	.005		.000	.000
	N	52	52	52	52	52
AverageFC	Pearson Correlation	.221	.631**	.478**	1	.752**
	Sig. (2-tailed)	.116	.000	.000		.000
	N	52	52	52	52	52
AverageBI	Pearson Correlation	.432**	.732**	.536**	.752**	1
	Sig. (2-tailed)	.001	.000	.000	.000	
	N	52	52	52	52	52

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

Figure 3.11 Correlation test

As can be seen in Figure 3.9, the correlation test results show a good relationship between the variables, denoted by an asterisk indicating a strong correlation. To make it easier to understand, the average variables EE, HM, PE, FC, and BI have been renamed as AverageEE, AverageHM, AveragePE, AverageFC, and AverageBI.

H1 is proven as the EE and BI variables have a strong correlation with a correlation value above 0.4 (0.432). The positive correlation indicates a significant relationship between these two variables.

H2 is proven as the HM and BI variables have a strong correlation with a correlation value above 0.4 (0.732) and have an asterisk. The high correlation indicates a strong relationship between these two variables.

H3 is proven as the PE and BI variables have a strong correlation with a correlation value above 0.4 (0.536). The positive correlation indicates a strong relationship between these two variables.

H4 is proven as the FC and BI variables have a strong correlation with a correlation value above 0.4 (0.752). The positive correlation indicates a strong relationship between these two variables. as can be seen in the picture the results obtained from the correlation test have a good relationship with an asterisk as an indication that the correlation between variables is strong.

IV. CONCLUSION

Based on research findings, it can be concluded that the "Invesi" game effectively utilizes Augmented Reality (AR) technology to facilitate investment education. The game provides investment-related stories, followed by tests or questions about the material. The AR technology used in the game creates an immersive and interactive learning experience. This enables participants to directly engage with investment concepts, leading to an increase in their investment understanding and skills.

The successful design, development, and evaluation of investment games, which incorporate interactive elements such as stock trading simulations, risk analysis, and investment decision-making, have helped overcome challenges in investment education.

AR-based investment education games (Invesi) have a positive impact on investment literacy. They provide participants with direct experience in dealing with complex investment scenarios, leading to an increase in their understanding of risk, investment strategies, and financial concepts. This, in turn, enhances their investment literacy. After conducting research and getting the results, it can be concluded that:

The "Invesi" game uses Augmented Reality (AR) technology as a learning medium about investment by providing stories about investment material and then giving tests or questions about the previous material. Apart from that, the AR technology used can create an in-depth and interactive learning experience, this allows learning participants to directly interact with investment concepts. This succeeded in increasing investment understanding and skills among learning participants

Design, development, and evaluation of “Invesi” games that integrate with interactive elements in an investment context, such as stock trading simulations, risk analysis, and investment decision-making. Successfully helped overcome challenges in investment education

AR-based investment education games (Invesi) have a positive impact on investment literacy by providing direct experience in dealing with complex investment scenarios. Participants who engage in these games tend to increase their understanding of risk, investment strategies, and financial concepts, which in turn increases their investment literacy.

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