ISSN 2964-5387 (online)
Vol. 2, No. 1
2023

International Journal of Educational Technology and Artificial Intelligence

TOPAZART

International Journal of Educational Technology and Artificial Intelligence

ISSN 2964-5387 (online)
Vol 2, No 1, 2023

Developing Digital Greetings using Adobe Animate

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Abstract

Greeting is an act of communication in which human beings intentionally make their presence known to each other, to show attention to, and to suggest a type of relationship. Expressing best wishes for someone, sending gifts or even sending a special message. However, the current life style in the IT era may shift sending message style. For them, smartphones and other digital media are more interesting than mail. This paper is intended to create a mobile-based greeting which contains a small game. Developing the application, the researcher conducts qualitative approaches of Multimedia Development Life Cycle (MDLC) that contains 6 stages, concept, design, obtaining content material, assembly, testing, and distribution. It is the utmost hope that the new IT-based greetings model could facilitate easier, more fun and interesting especially for children and youth. This research is still on going and the researcher would like to present a smartphone-based greetings model. Research findings show that mobile-based greetings including games is the most feasible model to send as a greeting message through WhatsApp and WeChat.

Keywords: mobile, multimedia, greetings, game, interactive

I. Introduction

Greeting is an act of communication in which human beings intentionally make their presence known to each other, to show attention to, and to suggest a type of relationship (usually cordial) or social status (formal or informal) between individuals or groups of people coming in contact with each other. Greetings are sometimes used just prior to a conversation or to greet in passing, such as on a sidewalk or trail. While greeting customs are highly culture and specific situation and may change within a culture depending on social status and relationship [1], they exist in all known human cultures. Greetings can be expressed both audibly and physically, and often involve a combination of the two. A greeting, or salutation, can also be expressed in written communications, such as letters and emails. People from all walks of life have occasions they value and celebrate, unique to either their culture or religion. However, there are those moments in life that are valued in high esteem across all cultures and religions: one such is a person's birthday. Celebrating one birthday is practically the celebration of one's life. People tend to feel very moved when their loved ones recognize and celebrate their birthday. Expressing best wishes for birthday by organizing a birthday party, sending gifts or even sending a special birthday message; makes people feel appreciated and loved [2].

On a global scale, we read in an incredible pace like never before. We spend a great deal of time glued to a screen, reading digital media, social networks and other discussion forums. [3]. Although the internet is considered a crucial part of contemporary life, it also represents the state of emergency in risky behaviour. Many studies show that people can be addicted to internet, resulting harmful effects on social behaviour, habits and abilities [4]. Young children need to expe-

Received 31 October 2022, Revised 9 November 2022, Accepted 2 December 2022, Available online 28 February 2023, Version of Record 11 December 2022.

ISSN 2964-5387 (online)
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rience a wide range of pedagogical approaches including play in all its forms, to ask their questions, to initiate, to investigate and move beyond the 'religion lesson circle' into, in, through, across and around the environment. There are still many identified and unidentified challenges awaiting. The ongoing research into the theory and practice of early childhood religious education is imperative [5]. The urge of quality improvement of Bible learning and teaching drives institutions and family to transform education. The concept of quality in education is complex and multidimensional and has been defined in a variety of ways in different contexts by different stakeholders. Defining what quality means in higher education is hindered by the complexity of educational theory and practice. Different stakeholders, from practitioners and students to professional bodies and society in general have broad and competing views as to how they perceive quality to be [6]. These provide the impetus for the need to have continued quality improvements in the different educational processes.

The profile of youth changes over time, and the nature of parenting and community involvement deviates as well. However, the teaching methods in schools and universities is just about the same, with little understanding of how big the generation gap is. [6]. How young people learn is arguably linked to their future opportunities and well-being. For this reason, it is critical to identify each generation in how they process the world around them, how they engage with authority, how this impacts the family and the community, and what should be done to maximize the likelihood of them achieving their goals. A number of concepts have be brought together in an attempt to find teaching opportunities in the diverse and complex influences on the learning processes of the 21st century learner. We shall focus on three generations: Generation X (Gen X, 1965–1985); Generation Y (Gen Y, 1978–2000), also known as the Millennials; and Generation Z (Gen Z, 1995–2012) [7].

A. Digital Greetings

With technology growing to be an ever more important component of our day to day lives over the last few decades and the fact that it's continuing to do so, the advent of electronic greetings became inevitable. E-cards was used in the late 1990s when everyone in the US was just starting to have a personal computer at home – those may seem so dated now, with their low-resolution graphics and all, but in their day, it was quite an exciting thing to get an animated greeting card in the email. Electronic greetings can be delivered through several ways as attachment of message. [8]

Why game is used for greeting

The greatest take away from technology has become a valuable lesson in how to deliver a more powerful, memorable message. While these principles came out of hearing people speak, nowadays they apply across many mediums [9]. People want to hear positive, life-affirming things. They want optimism, hope, belief. They want the art of possibility. Give people an idea or dream of how life COULD be, if only we took action, or changed a behavior. Rally people around a common vision.

An estimated 62.9 percent of the population worldwide already owned a mobile phone in 2016. The number of mobile phone users in the world is expected to pass the five billion people by 2019. The mobile phone penetration is forecasted to continue to grow, rounding up to 67 percent by 2019 [10].

Easter Greeting

If one were to search for the word "Easter" you could find its mention only in the King James Verson of Holy Bible, Acts 12:1-4. [11] "Now about that time Herod the king stretched forth his hands to vex certain of the church. And he killed James the brother of John with the sword. And because he saw it pleased the Jews, he proceeded further to take Peter also. (Then were the days of unleavened bread.) And when he had apprehended him, he put him in prison, and delivered him to four quaternions of soldiers to keep him; intending after Easter to bring him forth to the people."

Well, we must first look in-depth at the history of Easter and the details mentioned above to gain some understanding. Herod Agrippa I who ruled from 37 AD to 44 AD put James to death in the last year of his reign. When one thinks of Easter throughout history and in the 21st century, what day do we think of? Sunday, most likely. However, what day did Easter fall on in 44 AD?

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Thursday.

Let's look at the Bible to find the meaning of Easter and how it relates to the resurrection of Jesus. Romans shows us that baptism instead of Easter was given as a symbol of Christ's death, burial, and resurrection. Romans 6:3-5 says, "Or do you not know that as many of us as were baptized into Christ Jesus were baptized into His death? Therefore we were buried with Him through baptism into death, that just as Christ was raised from the dead by the glory of the Father, even so we also should walk in newness of life. For if we have been united together in the likeness of His death, certainly we also shall be in the likeness of His resurrection"

What we see is that the true meaning is more than just a memorial for the resurrection one day a year with a church service. We can even celebrate the resurrection as we allow Christ's resurrection to become a reality in our lives as we live anew victoriously. Christ's death and resurrection is a daily hope of how the good will of God can overcome the forces of evil, of how truth will prevail and unmask the lie, of how love will triumph over sin, and how the blessed hope of eternal life will even put an end to death one day.

Many Christians celebrate Easter Sunday as the day of Jesus Christ's resurrection, which is written in the New Testament of the Christian bible. According to the Gospel of John in the New Testament, Mary Magdalene came to the tomb where Jesus was buried and found it empty. An angel told her that Jesus had risen. Easter is the day on which Christians celebrate the resurrection of Jesus Christ. The resurrection of Jesus Christ is the foundation of the Christian faith. Therefore, Easter Sunday is a holy day for Christians. Many Christians view that Easter Sunday is a day of new birth. [12]

II. Research Method

This study uses Multimedia Development Life Cycle (MDLC), a multimrdisa development method with stages that are carried out systematically to build a digital game, and consists of several stages as in Figure 1. Development is carried out by game developers, who are usually between one person to a large game industry [13].

Multimedia Development Life Cycle covers six phases, including: (1) Concept. The developer determines the type of game to be made; (2) Design. Before a game is actually produced, it needs to be made: (a) Game Design Document. The document covers all aspects that are close to reality, so the making of the game includes aspects of prototype; (b) First prototype. At this stage a prototype is created that allows you to develop a method which fully implements your ideas; (c) Bug fixing and balancing. Identify bugs and overcome them in programming; (3) Obtaining Content Material. In this stage, collecting that wilbe used in the assembly phase, from marketplace or third party;(4) Assembly. In this stage, making game assets and source code is made. The results of this stage are games that can be played in the form of: (a) Formal Details prototype - a game that can be played with win-lose rules, the relationship between views, and works well; (b) Refinement prototypes - most mature prototypes only require beautifying work and are almost perfect to market; (4) Testing. Thorough evaluation of the game in seeing its suitability in appearance, values, concepts, and design. Testing is done to determine whether the game can run well, after programming. The result of this stage is that all bugs must be removed, or changes made in the programming. Many developers do this testing by distributing their products widely through online, so that more input is obtained. The result of this stage is the readiness of the game to be marketed; (6) Distributin. In this stage several things are done namely bug fixes, special show premiere, marketing, community management.

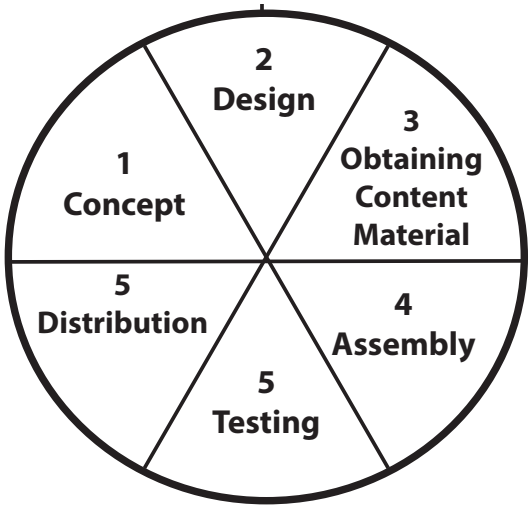

Figure 1 Multimedia Development Life Cycle [13]

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A. Research Object

The object of the research is digital greetings application, and the research locations are conducted in Jakarta and some cities in Indonesia. Respondents consist of youth and Subject Matter Expert (SME) in communication, theology, multimedia and information technology.

B. Data Analysis

The The data is analyzed using the analytical descriptive method and interpreted in a narrative way based on the research findings. Analyzing and data processing carry out with six stages including data gathering, preparing data for analysis, careful reading, developing the code, presenting the data and analyzing the data [14]. The data is collected from interviews and questionnaires with details: (1) Questionnaires with open-ended questions are used to find useful information that supports the theory, the information is needed for model development, information on whether a student can perform the command to play the mobile mathematics game, as well as assessing the quality of the learning model that is developed, (2) Interviews with open-ended questions are used, hence respondents can give information that is not limited from different perspective. Depth interviews are necessary to obtain data about the product and the learning process to play the game. All interview transcripts are stored in text documents; (3) Observations are conducted to obtain data about the learning process while playing the game.

III. Results and Discussion

A. Concept

The first phase of Multimedia Development Life Cycle data collection was conducted using open-ended questionnaire and interview in three cities. The respondents were mostly young people with smartphones gave answers to these questions.

Questionnaires used in the first phase

1. If you compare digital greetings with printed one, could you explain which one is interesting and easy to use?
2. How do you greet your friends? There are many methods as shake hands, mail a greeting card, send messages using smartphones?
3. People need interactive media using smartphones, playing augmented reality, and games, but some people still like printed greeting card. How about you?
4. According to your opinion, which parts of text greeting message is interested to you?
5. According to your opinion, which parts of text greeting message is not interested to you?

Data was collected from 34 young people. After processing the data using NVivo qualitative data processing software, the greeting model may be designed. In answering the the above questions, majority of the respondents stated the following statements.

1. Most of the respondents prefer internet and social media over book and printed media.
2. Most respondents prefer sending message through smartphones.
3. Most of respondents always use smartphone for everyday activities, getting information for enhancing their knowledge, and sending massage.
4. Almost all respondents agreed that the image of message is interesting.
5. Many respondents are not fond of the long text in the message.

B. Design

The second phase Pre-production would be to decide the concept of applications developed and storyboard design.

Game design document

Based on the research findings and discussion of the researchers and clients, the Easter greetings model would be formed as described in Table I.

Table I. The concept of Easter greetings application

Object	Description
User	Children, Youth
Topics	Easter: - Introducing eggs - Counting eggs - Maze - Arithmetic operation of eggs - Happy Easter
Application	Mobile game - Mobile game will be able to be download from Play Store
Multimedia object	image, animation, text
Interactivity	Games, using button, touch screen
Character style	Created based on a children book published by Indonesian Bible Society

ISSN 2964-5387 (online)
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First Prototype

Storyboards was used to present the whole stories of the application. An example of storyboard can be seen in Table II.

Table II. Storyboards

Image Storyboard	**Start:** Drawing a girl and eggs with landscape background. **Button**: Start and Exit **Description**: Player should click Start button to start playing.
Image Storyboard	**Numbers of eggs:** Six eggs including two blue eggs. **Symbol**: Number 1 … number 5 **Description**: Player should search the number symbol that corresponds to blue eggs.
Image Storyboard	**Collecting Eggs:** There are 5 color eggs with many kinds of fruits. **Button**: Check button **Description**: Player should collect the eggs, and press button after he has collected five eggs.
Image Storyboard	**Color of Egg:** There are five color eggs including one is blue. **Button**: Blue egg button **Description**: Player should select the blue egg, and a message appears that it is right.
Image Storyboard	**Arithmetic operation:** There are four color eggs. **Button** and symbol Symbol +, 1, … 5 including button 2 **Description**: Player should select number symbol and if it is right, a message appears that it is OK.
Image Storyboard	**Maze:** There is a road with bordered by wall, with many hushes and crocodile. The destination is a castle **Player**: A girl. **Description**: The player should go to the destination. If she makes a collision with crocodiles, the game will restart. If she succeeds in getting the castle, she wins, and the game is over with a picture of Jesus.

C. Obtaining Content Material

The third phase was the stage that assets were collected for use in the next phase.

D. Assembly

The third phase Production was the stage that the preliminary game was produced. Adobe Animate was used to produce the game, that the display can be seen in Figure 2.

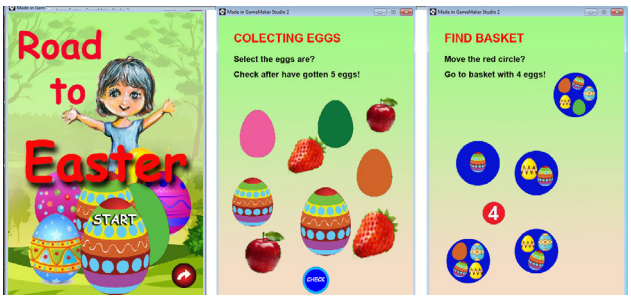

Figure 2 Display of the beginning of the game

F. Testing

The fourth phase Testing was the stage that the preliminary game was tested. The evaluation of the game conducted by expert in theology, communication, and information technology. The evaluation of preliminary product was conducted by subject matter expert in education, information technology, and social science, individual testing, and testing of small groups, then the product was revised. Below are the questionaires that should be used by subject matter expert to evaluate the application.

Questionnaires used in the fourth phase

1. Is the content organized well in order completing the topic?
2. Does the graphic interface meet the principle of graphic design?
3. Does the flow of information meet the general user requirement?
4. Can user access the scene his/her need in proper time without an error?
5. Can the application run on variety of mobile device?
6. Can the application run on mobile device anywhere?
7. What is the feature to be improved?

As a result of answering the above questions, the expert of three kinds of fields namely educa-

ISSN 2964-5387 (online)
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tion, information technology, they stated the following statements.

1. Most of respondents stated that the content was organized well and it should be enriched with the new subject.
2. Most of respondents stated that the backgrounds and text looked good. It would be better if the resolution of images could be improved.
3. Most of respondents stated that the flow of information was moderate.
4. Most of respondents stated that the user can access the application moderately. The application could not be accessed using internet network. One of the experts was not sure if it would run on mobile phone using internet well without delay. Audio and image should be synchronized.
5. Unfortunately the application cannot run on mobile device easily. Some users do not know how to install the file with APK format on their mobile device.
6. The application can be accessed anywhere using internet network, unless the bandwidth is too low. But it is good including the multimedia content access.
7. The application could be built in the APK format and published at Play Store and AppStore, so audience can download using their mobile phone easily.

As a result of the Testing phase, the application should be revised and fix the problem based on the evaluation. .

IV. Research Limitation

Limitations of research in model development: (1) The research and development that consists of 5 phases is still in progress, and only the first until fourth phase was conducted: and (2) The fifth and sixth phase will be conducted after the application will have been revised.

V. Conclusion

Based on the objectives and the results obtained in this initial study, it can be concluded as follows:

(1) The information derived from the initial research is used as a guideline for developing mobile learning;
(2) The Developing of Digital Greeting based on Game Development Life Cycle that consists six phases.
(3) The first until fourth phase has been conducted. The research findings show that digital greeting is a model of message that can be developed.

For future work, the Digital Greeting model needs to be developed in the next phases.

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ISSN 2964-5387 (online)
Vol 2, No 1, 2023

Literature Review on the Most Popular of NFTs Types

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Abstract

Non-fungible tokens (NFTs) are transferrable rights to digital assets, such as art, in-game items, collectibles, or music. The phenomenon and its markets have grown significantly since early 2021. This study aims to find the most popular NFT type. This study uses a qualitative research method processing data using NVivo with four steps: Gathering information, Coding, running queries and Reporting. We investigate the interrelationships between NFT sales, NFT users (unique active blockchain wallets), and the pricing of Bitcoin and Ethereum. The results reveal that there are 26 published articles in the targeted journals and websites, and they are mainly focused on the popularity area. The research findings show that Collectibles trigger an increase in NFT sales. Also, ether price shocks reduce the number of active NFT wallets. The results show that Collectibles markets affect the growth and development of the NFT marketplace since they are the most popular among NFTs.

Keywords: Blockchain, Tokenization, Non-Fungible Token, NFT Type

I. Introduction

Non-Fungible Token or NFT, are digital assets representative of physical or digital creative work or intellectual property, including music, digital art, games, gifs, video clips, and more. "Non-fungible" in NFT means that each token is not exchangeable with another token, making each token a unique entity representing a specific object. These tokens consist of digital information in the form of media (music, video, image), the value of which can be calculated in terms of cryptocurrencies. The NFTs are part of the Ethereum blockchain in particular but differ from Ethereum coins which are fungible and exchangeable with similar types of assets [1].

In the 2021 bull market, a new asset class is gaining considerable attention from the crypto community. This asset is an art collection of unique images that utilize a crypto technology called NFT. NFT is a digital asset based on crypto technology. NFT collections can cost hundreds of thousands of US dollars, so why it is widespread, and how we can buy one?[2], and many other industries such as music, sports and fashion are also experimenting with this emerging technology [3].

NFTs are often compared to digital certificates of ownership. The certificate, in the form of data recorded on a blockchain, signifies ownership of an associated digital item not contained the data itself. A blockchain is a digital database that records data on a decentralized computer network without a central authority. [1][4] There are two parts to an NFT):

- NFT item. The digital item associated with an NFT is described in an NFT's metadata. These items are typically stored off-chain, meaning they item is not directly stored on a blockchain.
- NFT metadata (called a token). NFT meta-

Received 14 September 2022, Revised 7 November 2022, Accepted 28 December 2022, Available online 28 February 2023, Version of Record 11 January 2023.

ISSN 2964-5387 (online)
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data1 is stored on a blockchain and typically includes information identifying the underlying NFT item, its online location, ownership, and transaction information.

Blockchains have limited storage space and high network traffic, so storing an NFT's underlying digital asset on a blockchain might be expensive and inefficient. Instead, digital assets are typically stored on a separate hosted website or a decentralized peer-to-peer file storage system.

A. Types of NFTs

There are endless potential applications for non-fungible tokens (NFTs). However, since we're still in the early stages of the non-fungible era, it might be some time before we see large-scale projects that aren't related to art in one way or another. To this end, NFT projects these days typically fall into one of ten categories. Here's everything you need to know about them. [5]

1. PFPs and Avatars

This format is what most internet users outside the NFT sphere think of when they think of NFTs. And that's by design, a quick search of 'NFTs' on Twitter will net you a sea of tweets from users with avatars consisting of Bored Apes, CryptoPunks, Cool Cats, Doodles, and all their offshoots and spinoffs.

2. One-of-one (1/1) artwork

During the minting phase of NFTs, creators can split up their work into multiple editions that may only differ on the blockchain. This means different editions of the same piece may appear identical to each other visually but possess different edition numbers or token IDs.

3. Generative art

Generative art is precisely what it sounds like, art that a computer has generated in some way. While often created by a generative algorithm or artificial intelligence (AI), some works created by physical robots also fall under this definition.

4. Collectibles

The recent boom of the sports trading card and memorabilia market hasn't just happened IRL. It's also taking place online, as evidenced by projects like NBA Top Shot.Despite that project's well-documented rise and fall, collectibles remain a viable format for NFT projects, especially related to already-popular IP.

Figure 1 Colletible NFTs [5]

5. Photography NFTs

Photography NFTs are growing in popularity and are poised to see continued growth in 2022 as more established photographers hop aboard the platform.

6. Music NFTs

At this point, most people are aware of the music industry's failure to provide artists with sustainable ways to make a living off of their work. So while streaming services take most of the revenue, the musicians struggle.

7. Gamified NFTs

With NFT-driven play-to-earn (P2E) games, also known simply as "crypto games", players can own in-game assets like skins, weapons, digital accessories, characters, and virtual land in the metaverse and trade these digital assets to earn financial rewards. Some popular games include Axie Infinity, Gods Unchained, and Decentraland.

8. NFT event tickets

As the Web3 ecosystem grows, NFT use cases evolve beyond digital art and avatar NFTs. For example, event tickets have become a way to build music and other event presence tallies on the blockchain. NFT ticketing enables holders to use tokens as access passes for live and virtual events.

9. Membership passes

Although NFT-based memberships are their unique sector of the NFT space, for the most part, they've grown and developed alongside PFPs to

ISSN 2964-5387 (online)
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provide incentives to holders. These exclusive programs use NFTs as access keys to unlock several services and rewards, including virtual and real-life experiences.

10. Domain names

Domain name NFTs have been a prominent part of the NFT ecosystem since before the term "NFT" was even coined. Nowadays, prominent platforms like Ethereum Name Service and Unstoppable Domains have made it extremely simple for users to purchase and manage domain names for their websites, wallets, NFTs, and other digital assets.

The popularity of the Non-Fungible Token (NFT) has risen rapidly since 2020, becoming one of the most popular applications in the Fintech field. However, there has yet to be an attempt to perform a systematic review in this new area. Therefore, this study aims to find the most popular NFT type.

There are few prior studies on the financial aspects of NFT markets. Nadini et al. map the NFT ecosystem based on sales and traded volume across different projects, stakeholders, and other relevant characteristics [6]. While Dowling examines the pricing behavior of a particular NFT project, Decentraland, which enables the trading of digital plots of land in a blockchain-based multiverse [7]. He uses wavelet coherence analysis to identify any co-movement between the cryptocurrency and the NFT markets. He examines three major NFT submarkets (Decentraland, CryptoPunks, and AxieInfinity) and the prices of Bitcoin and Ether. The results suggest that cryptocurrency pricing behavior can help understand NFT pricing patterns. We found macro data on the Ethereum-based NFT market, specifically the trading volume of all NFTs in USD and the number of blockchain wallets. It allows us to identify to what extent these markets influence each other or co-move.

II. Method

This study uses a qualitative research method [8], processing data using NVivo. We define qualitative research as an iterative process in which an improved understanding of the scientific community is achieved by making new significant distinctions resulting from getting closer to the phenomenon studied. This formulation is developed as a tool to help improve research designs. Additionally, it can facilitate teaching, and communication between researchers, diminish the gap between researchers, help to address critiques of qualitative methods and be used as a standard of evaluation of qualitative research.

NVivo is a software program used for qualitative and mixed-methods research. Specifically, it is used for the analysis of unstructured text, audio, video, and image data, including (but not limited to) interviews, focus groups, surveys, social media, and journal articles. It is produced by QSR International. As of July 2014, it is available for both Windows and Macintosh operating systems.

Here the steps of the processing:

Step 1: Gather information

The first step towards conducting qualitative data analysis is gathering all the comments and feedback you want to analyze. This data might be captured in different formats, such as on paper, post-it notes, online forums, and surveys, so it's essential to get all your content into a single place.

Step 2: Coding

The next step in this process is coding the comments and, most importantly, reading and deciding how each should be organised.

Step 3: Run queries

Once you have coded all the data, it is time to run the queries. In essence, this means looking for insights into the data. The reporting requirements will determine the extent and type of the queries during this step.

Step 4: Reporting

The final step is reporting on the findings, a critical step as the opportunity to tell the story of the learning from the consultation. If it fails to do this step well, the community will lose faith in the process and might even face potential community outrage. Being transparent and timely is the best way to avoid this situation.

III. Discussion

Literature review in NVivo can be done in several stages, namely Import Literature, Im-

ISSN 2964-5387 (online)
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port data, Classify Sources, Code and Annotate, Memo, and Query and Visualyze, which can be explained as follows.

A. Import data

The first step is importing sources or information used in the literature review. References can be imported manually, for example, pdf documents, reports, journal articles, and websites. There are 26 published articles in the targeted journals and websites, mainly focused on the popularity area.

B. Coding

On There are several types of codes in NVivo. One type is theme nodes are codes that represent the themes or topics that you find in your data. It is based on the ten types of FNTs, as shown in Figure 2.

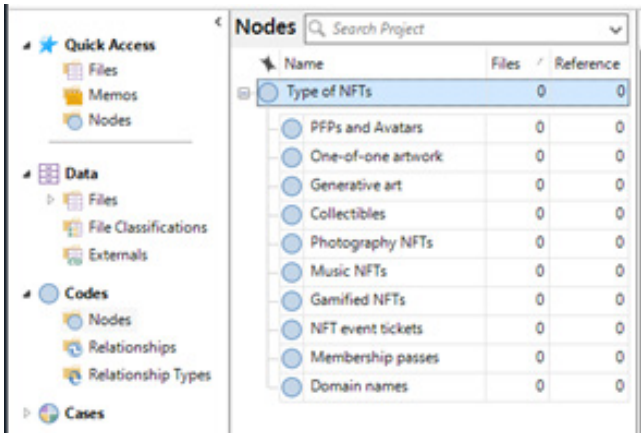

Figure 2 Nodes

C. Run query

Word Frequency Query allows us to find out the number of times the selected item appears. Seeing how many words appear can help us identify themes and concepts. Word Frequency Query can be run for specific sources, such as files, folders, and externals, as can be seen in Figure 3.

The Word Cloud, how the most frequent word appears, is collectible comparing artwork, music, game, and generative. The apparance of collectible is the biggst one. Therefore, the most popular is the collectible NFTs.

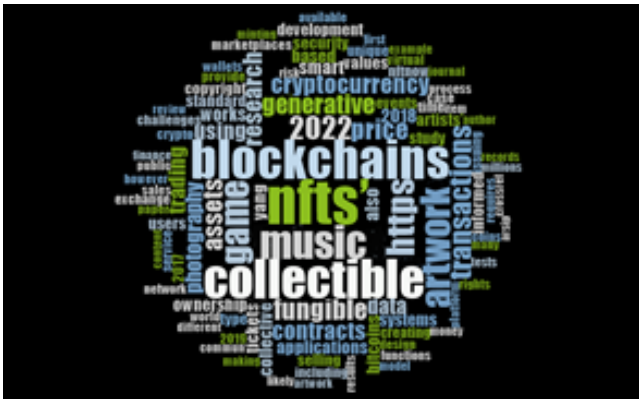

Figure 3 Word Cloud of Word Frequency Query

IV. Conclusion

This study examines the to find the most popular NFT type using qualitative method. The research findings show that Collectibles trigger an increase in NFT sales [9]. Also, ether price shocks reduce the number of active NFT wallets. Finally, the results show that Collectibles markets affect the growth and development of the NFT marketplace since they are the most popular among NFTs.

Future research is suggested to collect the data from interviews and open-ended surveys.

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ISSN 2964-5387 (online)
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Development of an Android Based First Person Shooter Math Educational Game Application

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Abstract

This study aims to develop an Android-based math education game with the Unity game engine as a learning medium for elementary school children. The formulation of the problem of this research is how to build an Android-based first-person shooter (FPS) math educational game as a learning medium for elementary school students. The researcher only took the material model that was applied to a limited game for the calculation model for the addition and subtraction of integers. The type of game used is a first-person shooter (FPS). The method used by the researcher is the Game Development Life Cycle (GDLC) method with stages: initiation, pre-production, production, game testing, beta, and release. The benefit of this research is to provide exciting and interactive alternative mathematics learning media. The final result of this research is an educational game entitled "Pistol Math" which can be played on Android devices. Based on user trial interviews with 20 respondents, 18 of 20 children became more interested and enthusiastic about learning with the learning method while playing the educational game "Pistol Math".

Keywords: Educational Games, Android, FPS, GDLC, Math

I. Introduction

Elementary school children will be more interested in fun learning styles that do not cause boredom when learning, which can cause interest in learning from elementary school children to quickly decrease as if they are fixated on learning only from textbooks. This can be concluded according to data from the Program for International Student Assessment (PISA) in 2018 [1], which shows the ranking of students in Indonesia in the reading section is still far below the average in the Organization for Economic Co-operation and Development (OECD) countries. This is due to the influence of technological developments and learning in Indonesia, which still cannot match the OECD countries. This research aims to develop an Android-based math educational game application as a learning medium for elementary school children.

According to research by Friantini and Winata [2], learning mathematics requires various methods, such as learning using games or role-playing. Meanwhile, research by Prayuga and Abadi [3] states that student interest in learning is related to the characteristics of interest in learning, types of interest in learning, factors that influence interest in learning, and efforts that can increase interest in learning. From the work results, indicators of interest in learning can be identified: feelings of pleasure, interest, acceptance, and student involvement.

Received 21 January 2023, Revised 27 January 2023, Accepted 31 January 2023, Available online 28 February 2023, Version of Record 31 January 2023.

ISSN 2964-5387 (online)
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Previously a marginal application, mobile gaming has become something familiar or mainstream [4]. All other devices and platforms that can be used to play games, such as computers, consoles, or websites, are far behind in popularity compared to mobile gaming [5]. Games in the First Person Shooter (FPS) genre can be a means of connecting players.

This research starts with a survey conducted on five elementary school children as representatives of their elementary school to find out what subjects they found challenging and what kinds of games they liked, and the results were as follows: they felt bored with textbook learning, and they expressed interest in using learning with educational games. FPS is their favorite type of game, and the android platform is their preferred platform to play games. Therefore, an android-based math educational game in the First Person Shooter genre was developed, which is expected to increase enthusiasm for learning mathematics. The benefit of this research is to provide exciting and interactive alternative mathematics learning media.

II. Literature Review

A. Game

The game is a form of play that often involves conflict, both with other players and the game system itself [6]. The game itself is always based on a conflict situation. A conflict situation is when the interests of two or more parties are confronted. The outcome of the game is a direct consequence of the actions taken by all game players. The game is defined by sets of rules and agreements that players must abide by, which define the structure of some conflict situations. These rules become the alternatives for the users. At each stage of the game, information is provided when choosing alternatives and the rewards that motivate the user to complete the game successfully.

Meanwhile, according to Salen & Zimmerman [7] quoted in Dirgantara & Septanto [8], a game is a formal interaction that occurs when players follow the rules of the game and gain experience through the game.

B. Educational Game

Educational games are games as learning media. Games can provoke the players' interest in learning, resulting in new experiences such as feelings of pleasure which, in the end, game players can easily accept the material to be conveyed. Various studies have proven the effectiveness of games in influencing players. Players easily understand the content or content in the game. This is due to the game's interactivity and immersion in the game, putting players in the most relaxed and open conditions in receiving material [9].

According to Noemi and Maximo [10], cited by Wahyudinata and Dirgantara [11], educational games are games or interactive applications to provide entertainment media and training and learning in specific fields. Whereas Hssina, et al. [12], educational games introduce interactive learning activities. Educational games can complement conventional learning methods that can impact the learning experience and improve other abilities such as: following rules, adapting, solving problems, interaction, creativity, critical thinking, and working together in teams. Educational games have the following goals and objectives: to build student/student enthusiasm, motivate and focus students, reduce monotonous learning methods, and improve memory [13].

C. First-Person Shooter Game

A first-person shooter (FPS) game is a shooter game with a first-person (self) perspective. Whenever the player interacts with the FPS virtual environment, the player observes all the actions as if he were observing everything through the character's eyes. Images are viewed from a first-person perspective because a simulation is as realistic as possible [14]. According to Voorhees, et al. [15], FPS games feature a first-person perspective, with the player seeing the action through the eyes of the player character, unlike a third-person perspective that is seen from behind or from the side, which allows the player to see the character they are controlling.

D. Game Development Life Cycle

GDLC (Game Development Life Cycle) is a cycle of game development stages [16][17]. The GDLC phases can be seen in Figure 1. GDLC consists of 6 phases as follows.

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1. Initiation Phase

The initiation phase is the stage where game development begins. At this stage, the design and preparation of the game concept are carried out. These include: determining game settings, themes, game objectives, target audience, and game platforms.

2. Pre-Production Phase

The pre-production phase is the design and prototype stage of the game being built. At this stage, follow-up is carried out from the concept made in the initiation phase by making game designs and mockups.

3. Production Phase

In this production phase, the development stage is carried out. From the design that has been designed, the coding is done to build the game that has been defined.

4. Testing Phase

The testing phase is carried out if all programming code and assets have been completed and can be operated. Stages of testing carried out by internal parties. This phase includes formal detail testing and refinement testing. Testing is done using playtest to assess the game's feature functionality and difficulty. Accessibility in the game can be tested by observing the tester's behaviour. The testing phase results are bug reports, change requests, and development decisions.

5. Beta Phase

A third party or external party carries out the beta testing stage. In addition to testing errors or bugs, users are also required to provide criticism and suggestions regarding the accessibility and attractiveness of the game. The results of the beta testing phase are bug reports and user feedback.

6. Release Phase

The release phase is the final stage in game development. The application is ready to be released to all users at this release stage. The release phase results in documentation, maintenance planning, and the game's expansion.

III. Methodology

A. Previous Research

Several studies form the foundation of this research. These studies have similarities regarding the methods used and the types of applications produced, but there are differences in the cases. Research by Dirgantara et al. [17], Research on building an educational-adventure game about mixed math calculations using Unity with the Game Development Life Cycle framework. The result is an educational game with features to train one of the cognitive abilities, namely remembering, understanding, and evaluating.

Research by Randiani [18], Development of an android-based educational game about odd-even traffic rules in Jakarta using Unity with the Game Development Life Cycle framework. The result is an educational game that the people of Jakarta can target. Another research by Amirulloh et al. [19], Development of an android-based educational game targeting students of grades IV and V SD to learn fractions. The research uses the ADDIE model. The result is a game worthy of being an educational medium in elementary schools—another research by Rofiqoh et al. [20], Development of an educational game targeting fourth-grade elementary school students to learn fractions. The research uses the RnD (Research and Development) method. Obtained results can improve student learning outcomes by as much as 32.79%.

B. Thinking Framework

The thinking framework is based on an observation showing the interest of elementary school children. This research originated from researchers' interest in developing educational games for elementary school children, so they can learn by playing while learning. From that came the idea to make an educational game about a math game combined with a First-Person Shooter (FPS) type game. In developing this game application using the game development life cycle (GDLC) method. GDLC is a cycle similar to the Software development life cycle (SDLC), but additional stages focus on GDLC. The thinking framework is shown in Figure 1.

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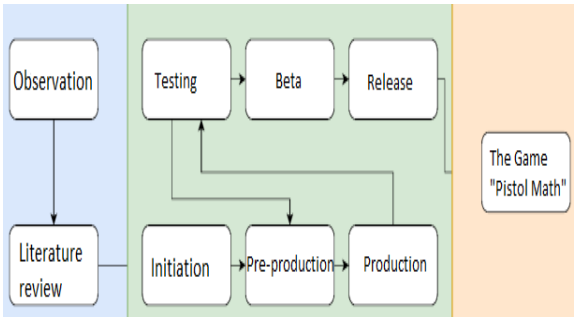

Figure 1. Thinking framework

This research originated from researchers' interest in developing educational games for elementary school children, so they can learn by playing while learning. From that came the idea to make an educational game about a math game combined with a First Person Shooter (FPS) type game. In developing this game application using the game development life cycle (GDLC) method. GDLC is a cycle similar to the Software development life cycle (SDLC), but additional stages focus on GDLC.

In implementing the GDLC method, there are six stages. The first is the initiation stage, which is to create the initial basic concept of the game. The second stage is Pre Production, which is for assembling assets that will later be used in the game, such as game characters, SFX, music, and other assets.

The third stage is the production stage, the production stage, namely the development stage. The results from the initiation and pre-production stages will be included in the programming. The fourth stage is stage trial, which is helpful as a test of game applications to get the test results, whether all the functions of the game work properly or there are errors and bugs.

The fifth stage is the beta stage. At this stage, the game has started to be released and can be played by people who meet these requirements. The last stage is the release stage, where the game has been officially released and can be played by all general users. The results of this study are to foster the enthusiasm of elementary school children in learning mathematics with learning media using this educational game.

The advantage of this research is using a framework with an iteration procedure, so it can be easily adapted if there is a feature change. The advantage of the built educational game is that it provides a sensation of a challenge to the players to motivate students. The limitation of this research is that it only produces 2D educational games.

C. Initiation Phase

The concept of this game is that players can answer the addition and subtraction of math integers by shooting targets until the target's blood runs out. The aim of this game is that the players must aim and shoot the target correctly. The target is integer numbers, and the answers to questions that will be displayed on the screen board, the questions given are integer calculations.

The rules of this game are that players will be given 50 seconds in one game; if the player aims at the wrong target, then the player's time will be reduced by 10 seconds, and if the player runs out of time, then the game will end, and if the player aims at the target correctly then the player's points will increase by one, will also increase the time of 5 seconds each aiming at the target correctly. If the player runs out of time, the game will end. It is just that the longer the player answers the question correctly, the more time the player has. Players must try to survive long and collect the highest score to be a challenge for players. The game is titled " Pistol Math ". The functional requirements of this video game are the features provided by the system when it receives specific inputs.

D. Pre-production Phase

In the pre-production stage, game design is carried out. The game design includes making game mockups, creating assets for games, analyzing material embedded in games, and making components related to game creation, such as sound effects, music, and events. The game navigation structure is shown in Figure 2.

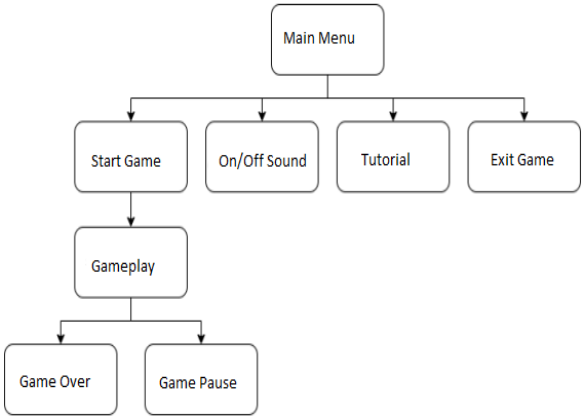

Figure 2. The game's navigational structure

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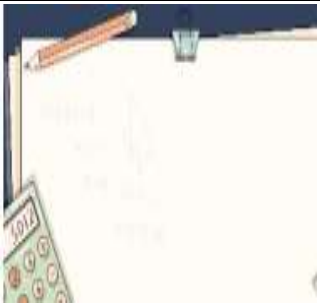
Figure 2 shows the design of the navigation structure starting from the main menu scene followed by four choices, namely:

1. Start. Players will be directed to the main game; then, players can already interact with the game, such as shooting, pausing to get scores and game over.
2. On/Off Music and Sound. Players can enable or disable music and sound.
3. Guide. Players will be directed to the guide menu containing rules and how to play.
4. Exit. The player will exit the game.

The assets used are free. The assets used in this study are shown in Table 1.

Table 1. The game's assets

Image	Description
	1 (kg)
	Main Menu background
	Tutorial background
	This gun image is used as a complement to the main menu to make it look attractive
	Health point bar

E. Production Phase

During the production stage, the coding of the Pistol Math educational game was carried out. Coding is built into the following script functions: main menu, pause menu, question settings, timer, target, health bar, wanderai (random target movement), and player movement.

F. Testing Phase

At this stage, a black box testing was carried out to ensure the functionality of the Pistol Math game complies with the expected needs and goals. The black box testing scenario for this educational game is shown in Table 2.

Table 2. Testing phase

Components tested	Description
"Play" button	To enter the game
"Exit game" button	To exit the game
"Music on/off" button	To enable/disable music
"Voice on/off" button	To activate/deactivate the sound
"Question mark" button	To display the manual menu
Tap the "back" button	To return to the main menu
Question UI	Text showing the question to the player
Score UI	Text showing the player's score
time UI	Text showing the remaining time the player has
Pause button	To pause the game
Analog	To move the character
View	To set the direction of the character's view
Fire button	To shoot
Jump button	To jump
answer UI	Text showing the player's answer
blood UI	An object that displays the target's blood
AI Patrols	To make the target move continuously
"continue" button	To resume a paused game
"main menu" button	To return to the main menu
"play again" button	To repeat the game
"main menu" button	To return to the main menu

G. Beta Phase

At this beta stage, use a type of open beta testing. In this stage, elementary school children

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act as external testers. This stage aims to test the game application and provide feedback on the game being created. The tester will play the game to test whether the functionality can run adequately, whether it can convey educational information about this game well and whether it can make elementary school children more interested in learning to use the game and increase the enthusiasm of elementary school children to learn mathematics.

H. Release Phase

At this stage, the entire development process for the game «Pistol Math» has been completed. The game is released in the .apk format. The game application is uploaded on tch.io and can be downloaded via the link http://lidiys.itch.io/pistolmath.

IV. Result and Discussion

A. The Game Screenshot

The result of this research is an educational game application called "Pistol Math. The following images (Figure 3 to Figure 7) show some game screenshots.

Figure 3. Main menu

Figure 3 displays the main menu. On the main menu, several buttons have different functions, such as the «Start», «Guide», «Exit», «Music», and «Sound» buttons.

Figure 4 displays the guide page. After the user presses the guide button, it will display the guide menu, and the game will display text showing how to play Pistol Math; the guide menu page also has a back button that functions to return to the main menu.

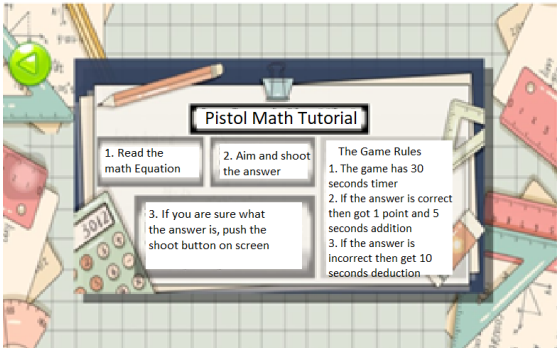

Figure 4. Tutorial menu

Figure 5 displays the game arena. When the user presses the «Play» button, he will enter a game where all systems and rules can work in this game, such as character control, the pause button, UI score and questions, as well as target movement with answers.

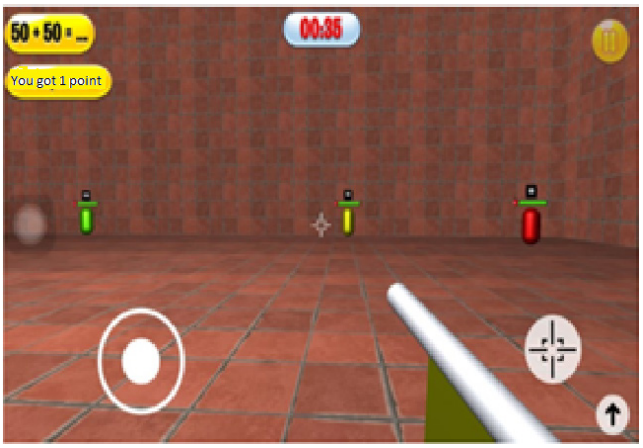

Figure 5. The gameplay screen

Figure 6 shows what the game looks like when paused. After the user presses the pause button, it will pause the game and display a «continue button please» and «just leave the game», which has the function of continuing and exiting the game.

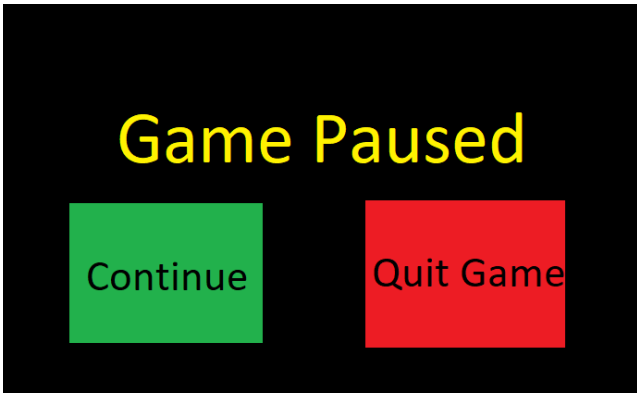

Figure 6. Game when paused screen

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Figure 7 displays the game over page. When the player has run out of time, the game will end and display the game over menu; this page has a «play again» button to restart the game and a «Just go back to the main menu» button which functions to return to the main menu in the game.

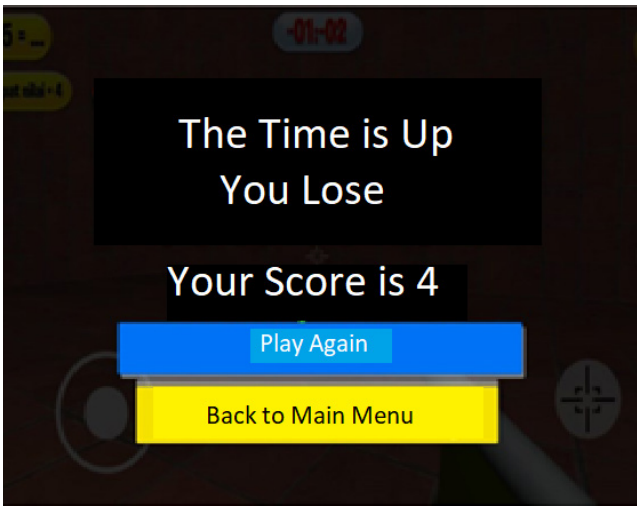

Figure 7. Game over screen

B. Black Box Testing Result

The results of black box testing are shown in Table 3.

Table 3. Black box testing result

Components tested	Description	Result
"Play" button	To enter the game	Succeed
"Exit game" button	To exit the game	Succeed
"Music on/off" button	To enable/disable music	Succeed
"Voice on/off" button	To activate/deactivate the sound	Succeed
"Question mark" button	To display the manual menu	Succeed
Tap the "back" button	To return to the main menu	Succeed
Question UI	Text showing the question to the player	Succeed
Score UI	Text showing the player's score	Succeed
time UI	Text showing the remaining time the player has	Succeed
Pause button	To pause the game	Succeed
Analog	To move the character	Succeed
View	To set the direction of the character's view	Succeed
Fire button	To shoot	Succeed
Jump button	To jump	Succeed
answer UI	Text showing the player's answer	Succeed
blood UI	An object that displays the target's blood	Succeed
AI Patrols	To make the target move continuously	Succeed
"continue" button	To resume a paused game	Succeed
"main menu" button	To return to the main menu	Succeed
"play again" button	To repeat the game	Succeed
"main menu" button	To return to the main menu	Succeed

C. Beta Testing Result

Twenty elementary school children respondents conducted the beta trial. The results of the beta trial are shown in Table 4.

Table 4. Beta testing result

Question	Result
Have you ever played educational games?	7 out of 20 children have played educational games.
Is this Pistol Math game easy to play?	16 out of 20 children said it was easy to play.
Is the text in the game easy to read?	20 of the 20 children answered that the text in the game is easy to read.
Do you like the look of this Pistol Math game?	18 out of 20 kids liked the look of the Pistol Math game.
After playing the Pistol Math game, are you more excited to learn math?	18 out of 20 children said they were more excited to learn math.

V. Conclusion

From this research, it can be concluded the following things:

- From the beta test results, it was found that 18 out of 20 elementary school children stated that they became more enthusiastic about learning mathematics after using the Pistol Math educational game.
- From the black box testing results, every function and feature of the Pistol Math educational game can run as it should.

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- Based on the beta testing results, 16 children stated that the educational game Pistol Math was easy to play, while four other children stated that it was not easy because they were not used to playing games with the first-person shooter (FPS) genre.

VI. Future Research

The plan for further research is to add other features, such as power-ups, and build a 3D version. Developing the gameplay is made more varied and interactive by making characters that have an animation to make it more exciting and interactive for players. Added a more varied map. It added versus mode so the players can feel competitive between friends.

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ISSN 2964-5387 (online)
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Development of an Inquiry-Transactional Based Learning Model for Historical Aspects of Moral Education in Junior High Schools

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Abstract

The purpose of this research is to develop a model of learning material for the history of the development of culture in the world and China. The study uses research and development methods. Learning materials are developed based on an inquiry approach - transactional. The research was conducted at a junior high school, involving 8 experts, 26 students and 2 teachers, 2 education officers, and parents. The results of the study are: (1) a conceptual model of learning design for historical material on the development of culture in the world; (2) learning design procedural models to develop learning materials; (3) a set of models of learning materials for the history of cultural development in the world, consisting of printed materials, interactive multimedia, teacher guides, and teaching aids.

Keywords: learning model, transactional inquiry, learning design, research and development

I. Introduction

Character education is one part of the path of efforts to improve the quality of human beings. Character education in schools is a conscious effort to prepare students to understand, be skilled at carrying out, and practice character through educational activities. This educational activity is to form students into human beings who have a noble character, have a noble character, and can experience a process of increasing spiritual potential.

Character education as one of the subjects has a very strategic role in the formation of students' morals and ethics. At present, the need for improvement in character education is more prominent. For example, the emergence of youth gangs among students is seen as a failure of character education to create students with character or cultural personalities. This phenomenon is also difficult to escape from the weakness of the leading actor in the moral education process in the classroom, namely the moral education teacher.

This study developed an inquiry-transactional-based learning model for the historical aspect of the Moral Education [1] subject in junior high schools. This study produced 3 learning models, namely conceptual models, procedural models, and physical models. The conceptual model explains the meaning of learning, the principles of research and learning, schools of psychology, and their application to the inquiry-transactional ap-

Received 11 January 2023, Revised 29 January 2023, Accepted 15 February 2023, Available online 28 February 2023, Version of Record 15 February 2023.

ISSN 2964-5387 (online)
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proach. The procedural model explains the purpose of learning design; various types of learning design models; and produces a learning design model, a research and development model used in this research. Finally, the physical model explains the learning materials; the position of developing learning materials in educational technology; material arrangement; the anatomy of a book; learning material assessment criteria; as well as supporting facilities for learning materials; and the form of learning materials as the final product of this research and development.

A. Learning

Learn

Learning is a processing activity and a fundamental element in every type and level of education. Educators need to correctly understand the meaning of learning in all its aspects, forms, and manifestations. Based on several definition of learning from the expert, it can be concluded that learning has the following main characteristics: (1) A change in human character and abilities in the form of knowledge or cognitive, skills or psychomotor, and or student behavioral or affective attitudes due to learning experiences; persist over a while and not simply because of a process of growth. Changes that fade after a few hours do not reflect learning; (2) The approach is multidimensional within the individual and occurs when experiencing complex difficulties; and (3) the Human experience rarely understands what something that has been learned means, but other people can see it more. [2]

Learning is a relatively permanent and meaningful change in knowledge, skills, and or behavioral attitudes in students' lives as a result of a process of experience in interacting with the environment [3].

The principle of learning falls into 12 principles [4]. Three of them are suitable for use in the development of the historical aspect of the Moral Education learning model, which is the focus of this research. First, the inquiry-transactional learning process is a learning experience process for students. Experiential learning refers to interactions between students and external conditions in the environment that he can react to referring to student interactions. It is also supported by Krathwohl and Bloom, who stated that experience in learning is the best category in achieving goals [5] [6]

Learning

Learning is a planned interaction process between students and learning resources to achieve specific changes in behavior permanently. The source of learning can be in the form of a teacher or in the form of learning media. At the same time, changes in behavior can take the form of additional knowledge, skills, and or behavioral attitudes. [7] In addition, from various learning principles, it can be concluded that transactional inquiry learning is carried out by applying various psychological schools in combination.

Learning materials are learning materials that are based on learning objectives. The learning materials developed in this study are textbooks, interactive multimedia, teacher guides, and student guides. Teachers can write the learning materials to be used in the learning process. However, teachers can also use textbooks or other materials and information that are already on the market to be repackaged or arranged so that they can become learning materials.

To produce learning materials considered to be of good quality and relevant to students in carrying out the formative evaluation process. This study uses several assessment criteria that combine several learning material assessment criteria [8]. The learning material assessment criteria used in the study were goal-centered, student-centered, and learning-centered. Until now, the availability of learning materials in the form of textbooks for junior high school students, especially for moral education subjects, is still limited. The teacher's method in conveying learning material, especially material on the history of the development of culture in the world, still focuses on ways that do not motivate students to be more active, creative, innovative, and have fun learning.

This condition shows that there is a gap between expectations and reality. Therefore, this research is focused on several things, namely, describing the implementation of ethical research on the historical aspects of cultural development in the world that have been going on so far.

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B. Behaviorism

Learning is a process of changing behavior that others, including the teacher, must observe. Students are called successful in learning if they can solve problems by demonstrating visible behavior, for example, correctly answering math questions and economics knowledge, analyzing social cases, or working on certain physical skills, worshiping according to their religion, and so on. All of those behavioral changes are predetermined as learning goals. Practice in teaching is that students are declared successful when they show the expected behavior in plain view and do not hide it [9].

This condition shows that there is a gap between expectations and reality. Therefore, this research is focused on several things, namely, describing the implementation of ethical research on the historical aspects of cultural development in the world that have been going on so far.

This research aims to develop a learning model for world cultural history as part of the Moral Education subject for junior high schools. In more detail, the specific objectives of this research can:

1. Develop a conceptual model of ideal learning materials.
2. We are developing a learning design procedural model used in developing learning materials.
3. Produce a physical model of new learning materials that meet all the criteria, namely goal-oriented, student-centered, learning process, and context, and following the technical standards of learning materials.

II. Method

A. Location and Time of Research

This research was conducted in junior high schools in Guangdong, China, from February 2017 to July 2017, involving experts, students, teachers and education officials.

B. Characteristics of the Developed Model

The features of the learning model developed in this study are:

(1) This study targets students and teachers (a) Teachers already have the essential ability to make a simple learning design. (b) Students have studied the history of the development of crocodiles and human behavior, as well as various subjects that develop reasoning, such as Mathematics, Language, Physics, and others. They can be assumed to have analytical or reasoning skills to study human behavior. In addition, they have access to the internet so that it is possible to take part in learning in this study which requires searching for sources;

(2) Material on historical aspects of cultural development on five continents: Asia, Africa, America, Australia, and Europe; (3) learning materials for ethics-historical elements that are developed based on relevant learning theory and learning to the inquiry-transactional approach. This approach was created specifically as a new approach to be used in this study through a conceptual study of its suitability to achieve the goals of learning history in the world. This approach combines inquiry learning methods and transactional interaction activities such as those that occur in the business world.

The inquiry method has the main characteristics of learning activities that emphasize students' critical and analytical thinking processes to seek and find answers to a problem discussed or information in question. What is meant by buying and selling transactions in this study is the exchange of information about historical events in the development of culture in the world, not limited to the discussion of facts and knowledge, but more importantly, understanding and appreciating the values of human struggle on every continent. Thus the inquiry-transactional approach is a complex learning process, and resource and requires the involvement of learning materials, intensive interaction with colleagues, and the teacher as a facilitator; (4) the model of learning material developed refers to good technical quality to better guarantee its attractiveness, effectiveness, and efficiency.

C. Research methods

This study uses a research and development (R&D) approach Borg and Gall [10]. The R&D approach, as shown in Figure 1 used in this study consists of ten steps as follows: (1) Research and Preliminary Information Collecting; (2) Planning; (3) Developing Preliminary Product; (4) Preliminary Testing; (5) Preliminary Product Revision; (6) Main Testing; (7) Operational Product Revision; (8) Operational Testing; (9) Final Product

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Revision; and (10) Dissemination and Implementation.

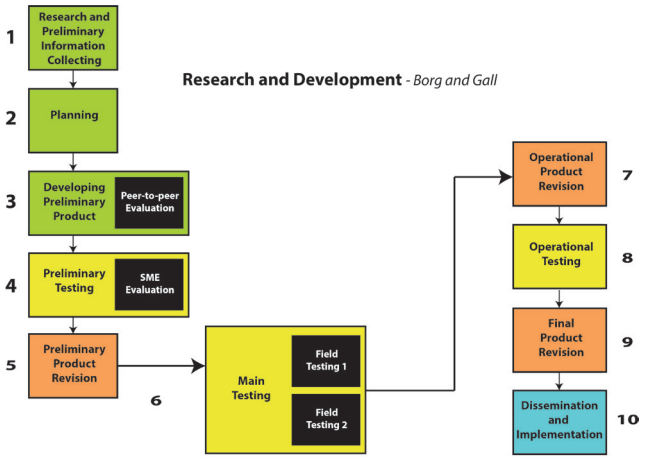

Figure 1. Research and Development according Borg and Gall

Research data was collected using interview guidelines, questionnaires, and checklists for field observations. The criteria used in compiling this data centered on goals, students, learning, context, and technical.

III. Result and Discussion

The learning materials produced in this study were designed according to the learning design. Learning design is a systematic process in planning learning to achieve relevant and effective learning objectives. This process includes selecting material or content, determining the sequence of student activities, selecting appropriate methods, media, and tools, making learning materials, evaluating, and revising.

The learning model is designed using learning principles so that the material in it is arranged systematically like the systematics of the activities of people who are teaching. The inquiry-transactional learning approach is a learning process that combines inquiry methods with market strategies. Within the market strategy, there are information transaction activities. The information transactions referred to are conditions like information trading in a market-like atmosphere. The formulation of the problems in this study are:

1. What is the ideal conceptual model of learning materials?
2. How is the learning design procedural model used in developing learning materials?
3. How is the physical model of new learning materials that meet all the criteria of learning materials, namely goal-oriented, student-centered, learning process, and context?

A. Model

Conceptual Model

The conceptual model embodies the synthesis of several concepts about the meaning of learning; the principles of study and learning, schools of psychology, and their application to the inquiry-transactional approach; and explain the importance of learning.

Procedural Model

The procedural model is a series of stages in the process of developing an inquiry-transactional learning model.

The procedural model explains the meaning of learning design; various types of learning design models; and produces a learning design model, which is also a research and development model.

Physical Model

The physical model is in the form of a physical model of new learning materials, namely printed learning materials already integrated with student guides, interactive multimedia, and teacher guidelines.

B. Preliminary Research

The results of the initial research are information about the implementation of learning the history of cultural development in the World that has been going on so far and expectations for improvement from respondents including stakeholders. The information and data are about the use of textbooks in schools, learning objectives, media or learning tools used, teacher guidelines in teaching, learning methods or models used, and time used in the learning process.

C. Analysis

Formulation of Learning Objectives

The formulation of terminal learning objectives and specific learning objectives was created

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through research and development after involving various stakeholders, namely teachers, and local government officials, including city and provincial education offices. Therefore, when listening to the thoughts of Dick, Carey, and Carey, who say that learning objectives can come from a list of goals, performance analysis, needs assessment, practical experience of student learning difficulties, analysis of people doing work, or from several other requirements for new learning. Therefore, the formulation of learning objectives as a result of this research includes those derived from a list of objectives, needs assessment, practical experience, and student learning difficulties.

Learning Analysis

The results of the analysis of learning on the material history of human development in the world are a series of learning processes that use seven stages of inquiry-transactional approach to achieving learning objectives. Such learning analysis, according to Borg, Gall, and Gall [10], includes learning analysis which is carried out to identify specific skills, procedures, and at the same time, learning tasks involved in achieving learning objectives.

Student and Context Analysis

Students studying historical material for the development of culture in this world are primarily virtuous. They will be better able to absorb cultural values when learning the history of cultural development in the world than if there are students who could be more virtuous. This characteristic allows teachers further to instill cultural values through an inquiry-transactional learning approach.

They are around 12-15 years old. At this age, students can already develop their reasoning by studying the history of cultural development in the world. Students over 12 years of age are sufficiently mature in thinking and can use their reason to be categorized as capable of studying historical development and cultural values. In the theory of cognitive development, according to Piaget, the characteristics of students at the age of 12 and over are said to be that "the ability to handle multifactor situations logically begins to emerge. Individuals can deduce various possibilities and systematically rule them out. Reasoning moves from a hypothetical situation to a concrete one. In Piaget's opinion above, it can be understood that students over the age of 14 have enough maturity in thinking and can use their reasoning to be categorized as capable in studying the history of cultural development in the world.

Students have learned and know about the history of cultural development during the Roman period. They have also studied several subjects that support creative reasoning, such as mathematics and physics, to allow students to absorb abstract material such as history, which aims to instill cultural values through learning analysis of the history of panda development in China.

Students have various competencies, namely smart, moderate, and not smart. This characteristic indicates the need for learning that involves discussion, group work, and learning from students in other groups, as it is one of the main characteristics of the inquiry-transactional approach. Student ability These generally have been able to operate the computer and can access the internet. It resulted from the existence of practical subjects in computer laboratories. At the same time, students still use mobile phones and internet access at school. Based on these characteristics, this study used learning materials from various sources, such as textbooks, general books on the history of cultural development, the internet, newspapers, and magazines.

This condition is supported by Benjamin S. Bloom, who said that "there are good students and there are bad students, there are students faster, and there are students slower, and most students are very similar concerning learning abilities, learning levels, and motivation to be more learning- when provided with favorable learning conditions" [11]. It means that the learning process, which is formed in groups, doing work together, can merge the characteristics of students who are smart and not smart because, in the end, they will complement each other with their respective weaknesses and strengths to produce shared values.

Another factor, according to Jerrold E. Kemp [12] is the social factor. These social factors include age, maturity, attention span, unique talents, physical and emotional disabilities, student relationships, and socioeconomic situations. These students tend to get bored and sleepy quickly when participating in lessons with bor-

ISSN 2964-5387 (online)
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ing presentations. Through the learning process using the inquiry-transactional approach, they can follow the learning process that will not be haunted by drowsiness because they are actively moving, talking, reading, writing, walking, working, seeing, asking, answering, individually and in groups. Thus the learning material becomes more enjoyable.

Bruce [13] said that the learning model provides teachers with practical applications that become models that present classroom settings between the fictional world and the natural world. The inquiry-transactional learning model embodies the words of the experts above. Where in this model, the teacher makes the class like a market. Classes are arranged like a market in which there are merchandise, there are sellers, there are buyers, and there are buying and selling transactions. Students interact with each other since pre-learning (preparing data and group division in stage 1), and they work together in their respective group teams. Within their respective groups, they interact with each other. In that interaction, they write, see, hear, talk, watch, move, be creative, and have fun. The results of this interaction certainly will not make students feel bored or sleepy.

D. Learning Outcomes Assessment Instrument

Assessment of learning outcomes for the history of cultural development in the world material for students produced in this study differs from the assessment of learning outcomes for subjects in general. This research succeeded in formulating assessment components based on group collaborative learning processes and individual learning outcomes in the form of written works and cognitive test items. The value of the group collaborative learning process is only sometimes carried out in subjects in general, both CIVILITY and other topics. The assessment itself is very comprehensive, requires teacher involvement during the learning process, and displays creativity, togetherness, fun, motivation, graphics, and student enjoyment in groups and individually.

Based on the recapitulation of the assessment of learning outcomes for the field trial group above, it can be seen that the average value obtained by the field trial group as a whole is 85.02 out of the range of the highest score of 100. Therefore, the value of 85.02 above belongs to the category of value A, which means that the group field trials have a very good average value

Table 1. Elements of Learning Process Assessment

No	Elements that rated	Weight	Skill	
			Individual	Group
1	Presence	5 %	×	×
2	Creativity in creating and displaying attributes	30 %	×	×
3	Liveliness they at the time of the transaction information	10 %	×	×
4	Choice Tests	15 %	×	×
5	Article	40 %	×	×
	Total	**100%**		

E. Inquiry-Based Learning

Inquiry-Based Learning Strategies - Transactional

The learning strategy for the history of cultural development in the world material for students produced in this study displays a systematic sequence of learning activities according to the syntax of the approach used, topics and sub-topics of learning material/content, transactional inquiry approaches, and allocation of study time for each stage of activity. The inquiry-transactional approach created in this study contains deductive, inductive thinking processes, demonstration activities, exhibitions, and information transactions [14].

Besides that, this approach also displays tools and media as well as learning facilities in the form of attributes of cultural development on five continents and five continent booths as creations of students and teachers. Students are involved in preparing and using all the tools and facilities used throughout the lesson. This activity involving students and teachers is a form of innovation

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in learning in Indonesia. It is also following what is expected of the teacher, one of which states that knowledge is designed with the characteristics of developing a balance between spiritual and social attitudes, curiosity, creativity, cooperation with intellectual and psychomotor abilities.

Inquiry-Based Learning Materials - Transactional

Ready-to-use learning materials for the history of cultural development in the world for students are in the form of printed materials for students and teachers and videos. Learning materials refer to any pre-existing materials specifically developed to learn the history of the development of culture in the world. These materials can also include information students will use to spur their progress through learning, just as Banathy said that the material contained in learning materials must have a purpose. Without clear goals, those who choose learning materials do not know what books are relevant [7]. Learning materials used by students direct students to achieve learning objectives.

The materials in this study were revised at the end of each evaluation stage, namely after one-to-one expert evaluations, one-to-one student evaluations, small group evaluations, and field trial evaluations. So, four revisions were carried out in stages. The result is a new physical model of learning materials.

IV. Conclusion

From this research, it can be concluded the following things:

- The conceptual model embodies the synthesis of several concepts about the meaning of learning; the principles of study and learning, schools of psychology, and their application to the inquiry-transactional approach; and explain the importance of learning.[15]
- The procedural model is a series of stages in the process of developing an inquiry-transactional based learning model, using the R&D Cycle model from Borg and Gall consisting of 10 steps to developing world cultural history learning materials, namely Research and Preliminary Information Collecting. Planning, Developing Preliminary Product, Preliminary Testing, Preliminary Product Revision, Main Testing, Operational Product Revision, Operational Testing, Final Product Revision, and Dissemination and Implementation.
- The physical model is a set of learning material models for learning world cultural history consisting of printed materials, interactive multimedia, teaching guides, and teaching aids consisting of historical symbols of cultural development on five continents.

V. Future Research

The plan for further research is to implement and at all the school in Guangdong province.

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ISSN 2964-5387 (online)
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Communication Model of Real-time Interactive Avatar: Virtual Public Figure

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Abstract

This paper discusses the widespread use of avatars beyond gaming, which has led to significant changes in the entertainment industry with the emergence of various virtual public figures. Avatars have evolved beyond static forms or limited movements and can now interact with users in a more human-like manner. The author utilizes a self-designed avatar named Crystagella to showcase the potential of avatars as a medium for communication beyond their current applications. To address communication issues between actors, avatars, and audiences, the author employs the design thinking method, resulting in innovation in real-time interaction schematic modeling with avatars. This study provides valuable insights into the potential applications of avatars in various fields, including entertainment, education, and virtual reality. It also highlights the significance of motion capture technology in creating lifelike avatars, with an emphasis on the importance of low latency and detail-oriented motion capture. Overall, this paper contributes to the growing body of research on avatars and their potential in modern communication. The insights gained from this study can serve as a basis for the development of advanced interaction modeling and the design of more intuitive and effective avatar communication tools in the future.

Keywords: communication model, real-time interactive avatar, virtual public figure, Crystagella

I. Encounter a Virtual Public Figure: Avatar That Can Interaction in a Real-time

Originally developed from the gaming world, the concept of avatars has evolved beyond the context of games. As we know, avatars can take the form of humans or non-humans, be realistic or stylized, and can be customized with desired attributes and appearances. In the world of gaming, avatars represent players projected into an immersive digital environment, which is a crucial element that enhances interactivity, especially in MMORPG games, where players interact with each other through their avatars. [1]

The concept of avatars has come a long way since its origin in the gaming industry. Avatars have evolved to become a popular means of interaction in various industries, especially in the entertainment industry [2]. With the emergence of virtual bands like Gorillaz and virtual idols like Hatsune Miku, avatars have become an integral part of the music industry [3], [4]. Public figures also use avatars to connect with their audience in a more immersive and interactive way. Avatars have also been used in streaming activities, such as with Kizuna Ai (Figure 1) and Lil Miquela, where communication modeling is critical for successful interaction.

Received 18 February 2023, Revised 21 February 2023, Accepted 24 February 2023, Available online 28 February 2023, Version of Record 24 February 2023.

ISSN 2964-5387 (online)
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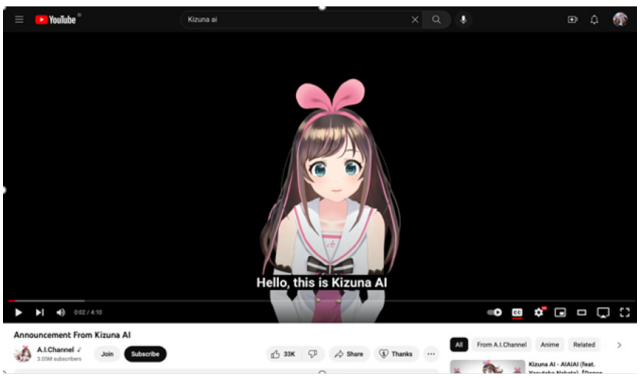

Figure 1 shows a virtual public figure as a new model of avatar, with Kizuna Ai live streaming on YouTube [5].

However, the concept of avatar is not limited to the realm of human-computer interaction. Avatars can be associated with various things such as cosplay or even amusement park clowns. Avatars represent one form of simulation, where something that is thought of virtually by each user can be materialized and simulated in digital form on a computer screen [6]. The term "avatarism" characterizes the recent manifestation of technology applications applied to the creation and usage of personal virtual representations for various purposes. [2]

In his book "Posrealitas, Realitas Kebudayaan dalam Era Posmetafisika," Yasraf Piliang equates television to an interface that creates a virtual world called Fantasmagoria space. This space entices humans to enter a network of speed, madness, hysteria, and lifestyle that it creates [7]. Avatars represent one aspect of this virtual world, allowing users to materialize and simulate their thoughts virtually. This signifies a significant development in various fields, pushing the boundaries of human communication through technology.

A. Avatar as a Communication Medium

Communication is a process of interaction between a communicator and a recipient, aimed at exchanging messages or information. According to Lasswell, communication succeeds if the communicator can effectively transmit the message through the right channel and to the right recipient. This concept emphasizes the communicator's ability to choose the right words, images, and gestures to ensure the message is well-received and understood by the recipient. However, Schramm argues that communication is more complex as it involves the exchange of messages between two or more individuals or groups using symbols that have the same meaning for all parties involved. Schramm also emphasizes the importance of feedback in communication, so that all parties involved can respond to the received message. [8]

In Schramm's model, communication is illustrated as a circle that involves three essential elements: the communicator, message, and recipient, which are interconnected and interact with each other. Therefore, the success of communication depends not only on the communicator's ability but also on the recipient's ability to understand and provide feedback on the received message. [9]

Schramm proposed a model of the communication process that includes several essential elements to ensure effective communication involves a source creating a message that must have the same meaning for both the communicator and recipient. Encoding and decoding are the processes of converting and breaking down symbols or language, respectively. Channels such as speech, writing, or images are used to convey the message from the communicator to the recipient. The recipient is the individual or group who receives the message and gives feedback to the communicator. Noise can disrupt the communication process. By paying attention to each of these elements, communicators can ensure that their message can be well-received by the recipient. In this state, communication can be seen as transactional model. This model emphasizes the importance of interpersonal aspects in the communication process and that the communication process is not just about sending messages, but also involves active responses from both parties. [9]

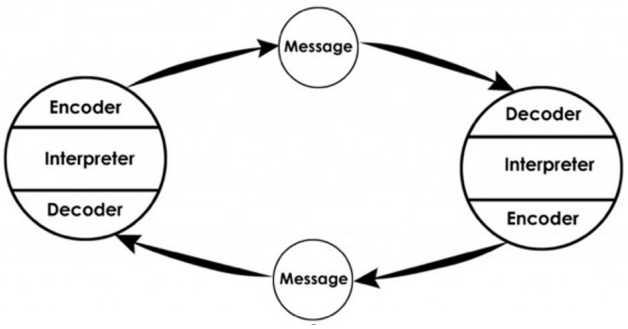

Figure 2 depicts Schramm's communication model. [10]

ISSN 2964-5387 (online)
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In the context of real-time avatar interaction, the avatar can serve as a communication medium [1]. According to Yasraf, simulation is a part of language processing [7]. The communicator sends a message through the simulated avatar medium, which represents them to interact with the recipient. The avatar as a communication medium has two components, namely, the character design of the built character and the movement of the communicator resulting from the animation of body movement, expression, and voice. In semantic terms, these two aspects can be defined as a sign. However, the movement of the communicator resulting from the movement of the body, expression, and voice can be defined as the content of the message.

The success of communication that occurs through the avatar medium depends on how both of these components can be elaborated and decoded by the user acting as the recipient. Thus, the avatar can become an effective medium in conveying messages and establishing interactions between the communicator and recipient.

Communication through avatars has the potential to create a feeling of „social presence," which refers to the sense of being together with others in a shared space, despite physical distance. According to Biocca and Harms, social presence refers to „the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationship." Avatars can enhance social presence by providing users with visual and auditory cues that help them perceive the presence of others, as well as opportunities for interaction and feedback. [11]

The effectiveness of communication depends on the richness of the medium used. Media richness is defined by the ability of the medium to convey information and enable feedback. Avatars are relatively rich as a medium since they can convey nonverbal cues, such as facial expressions and body language, and enable synchronous interaction. However, their richness may be limited by technological constraints or users' ability to control their avatars effectively. This theory was originally proposed by Daft and Lengel. [12]

Avatars can be used by people to manage their self-presentation in online environments. Users have the option to create avatars that reflect their idealized selves or express their identity in different ways. This theory was first proposed by Goffman [3], and has been applied to online environments by scholars like Yee. [13]

People derive their self-concept from their membership in social groups, and online environments can create new or altered social identities. Avatars can facilitate this process by enabling users to visually represent themselves as members of different groups or communities. Social identity theory was first proposed by Tajfel and Turner [14] and has been applied to online environments by scholars such as Postmes and Spears. [15]

B. The Objective of Study

The purpose of this study is to simulate a real-time avatar interaction process. In this case, the researchers will simulate an actor who will act as a communicator and an avatar named *Crystagella*, which will act as a virtual public figure built by the researchers themselves. Therefore, the objectives of this simulation include two things:

- To gain an understanding of the communication process involved in real-time interactive avatar,
- To construct a schematic of the interaction process that occurs between communicators and recipients in real-time avatar interaction.

By achieving these objectives, this study aims to provide insights into the potential of avatars as a communication medium and contribute to the existing literature on avatar-mediated communication. The insights gained from this study may have practical implications for researchers, developers, and practitioners interested in designing and implementing avatar-mediated communication systems in various domains.

II. Simulating Crystagella to get Her Interaction Model

The avatar that the researchers have built since 2012, named *Crystagella* or Diana Kristarium (Figure 3) [16], will serve as a model for the real-time avatar interaction study. *Crystagella* performed a real-time live interaction in a holographic box at the pop culture exhibition Indonesia Comic Con in 2022 [17]. By using this established avatar, the researchers can focus on analyzing the communication components and building a communi-

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cation model in real-time avatar interactions. In addition, the qualitative approach of the Design Thinking method will allow the researchers to gain a deeper understanding of the object.

Design thinking is a problem-solving approach that involves identifying user needs and developing solutions that meet those needs. This methodology is commonly used in the business industry, where companies aim to create innovative products and services that meet the needs of their customers. By using design thinking, businesses can create a user-centered design that is both creative and effective. [18]

One of the key elements of design thinking is user orientation. This means that the development process focuses on the needs and preferences of the end-users. By understanding the user's perspective, developers can design products that are more intuitive and user-friendly. The objective is to create an experience that is engaging and interactive, enabling the user to achieve their goals in a seamless manner. [18]

Figure 3. Using Crystagella as a model to study real-time avatar interaction.

In the context of real-time avatar interaction, design thinking plays a crucial role in ensuring that the interaction between the communicators and recipients is effective. The communicators and recipients play different roles, and the avatar serves as the medium of communication between the two parties. The communicators use the avatar to change their appearance, while the recipients use it to interact directly. Design thinking can be used to define the problems that occur when an actor simulates an avatar in order to develop an effective communication process.

By using design thinking in their study, the researchers can define real-time avatar interaction in a more comprehensive manner. This methodology allows for a more in-depth analysis of the user's needs and preferences [18], enabling the researchers to create a schematic that is both innovative and effective. The resulting innovation can then be used to develop new and improved products and services that meet the needs of the end-users. Overall, design thinking is a valuable tool that can be used to create innovative solutions that meet the needs of users in a variety of contexts.

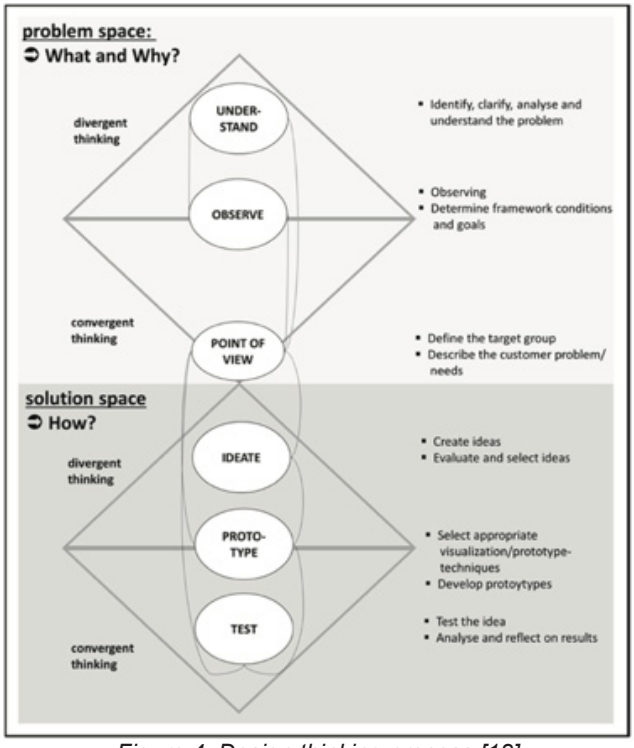

Figure 4. Design thinking process [18]

In the context of communication, the message sender is commonly referred to as the communicator. However, I prefer to refer to them as "*The Actor*," and the recipient as "The Viewer" To gain a better understanding of the real-time avatar interaction process using the Design Thinking method, the process can be divided into six distinct phases, as shown in Figure 4:

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Understanding the problem

The initial stage focuses on gaining comprehension of the challenge, problem, need, or requirement (problem understanding). The communication process is divided into three parts: *The Actor* simulating *Crystagella*, *Crystagella* interacting with *The Viewers*, and *The Viewers* providing feedback to *The Actor*.

Observation

This is conducted to gather data related to the needs or problems in a communication process. The observation process involves recording when *The Actor* is simulating *Crystagella*, with a focus on the hardware needed to build interpersonal communication. Meanwhile, interactions between *Crystagella* and *The Viewers* are captured by taking screenshots. Interviews are also conducted with *The Actor* simulating *Crystagella* to analyze the necessary hardware when receiving feedback from *The Viewers*.

Define the Problem

Following the process of observation, the collected data should be synthesized to identify a typical user whose communication problem or need can be summarized in a clear and well-defined question. This approach of condensing the data is essential to develop a deep understanding of the user's perspective and to formulate an effective solution to their problem. By focusing on a single prototypical user, the design team can ensure that the solution is tailored to address the specific needs and preferences of the user, rather than being a generic solution that does not fully address the underlying problem.

Ideate

During this phase, the actual brainstorming process occurs, where ideas for the communication hardware are generated. It is important to keep this process separate from the previous phase. Once the ideas have been generated, they are analyzed in terms of *The Actor*, The Avatar (*Crystagella*), and *The Viewers* to identify any weaknesses. Finally, the ideas are evaluated, and a selection decision is made based on their strengths and weaknesses. This is a crucial phase in the design thinking process, as it involves generating and evaluating ideas to address the user's needs identified in the previous phase.

Prototyping the simulation

During this crucial phase, the ideas generated in the previous phase will be rapidly visualized, tangible prototypes will be created, sketches will be designed, and models/simulations will be developed. This is done to prepare the necessary hardware for the communication process and to constantly iterate the process until a satisfactory outcome is achieved. The visualization and prototyping allow for a better understanding of how the communication hardware will work and enable the team to identify any potential issues early on. If new needs or problems are identified, the process will cycle back to the define phase to address them (Figure 4).

In the context of prototyping for *Crystagella*, the prototyping process takes place in a studio. Ideas from previous phases are refined and supplemented with the purchase, creation, and modification of hardware components. This is done in the form of online streaming through various platforms, such as Twitch and Instagram Live.

The content of the live streams is varied and tailored to *Crystagella*'s brand positioning. This includes interviews about the release of singles and albums, talk shows about music and fashion, and other relevant topics. The goal of the live streams is to provide an interactive and immersive experience for users to engage with *Crystagella* and create a community around the avatar.

The use of Design Thinking in the prototyping process allows for a user-centered approach, which ensures that the needs and desires of the users are prioritized. By prototyping in a studio, the team can iterate and refine the hardware and software components of *Crystagella* to ensure a seamless and engaging experience for users.

Overall, the use of online streaming platforms and diverse content for *Crystagella* demonstrates the versatility and potential of avatars in entertainment and communication. The ongoing prototyping process ensures that the avatar remains relevant and engaging for users, reflecting the evolving landscape of technology and user preferences.

Testing

In the final phase, the ideas that have been generated need to be refined and tested through further experiments and user feedback. This process may circle back to the Define phase or move

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on to the Prototyping phase if it is related to improving a particular hardware component (Figure 4). Once satisfaction is achieved with all components of communication, the end result will be a schematic interaction for real-time interactive avatars. This process of refinement and testing will continue until the desired level of functionality and usability is achieved.

To further test the real-time interaction process of *Crystagella*, a testing phase was conducted at the Indonesia Comic Con 2022 event on October 1-2, 2022. The interaction was carried out using a holographic box that allowed *Crystagella* to interact directly with *The Viewers* (Figure 5). The testing phase consisted of two main content segments: live chatting sessions and a DJ show performed on stage.

Figure 5. Crystagella live in holographic box.

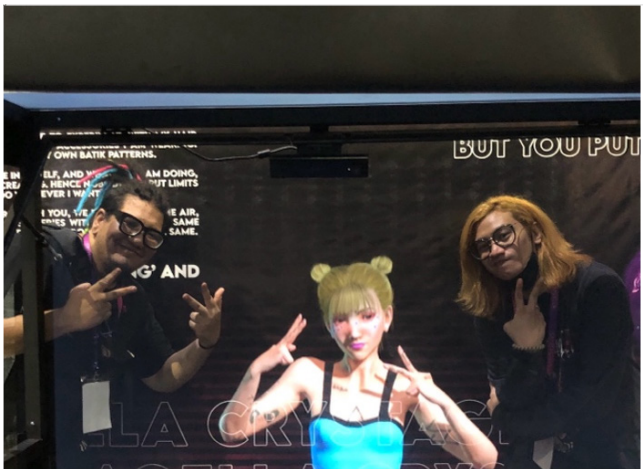

Figure 6. Crystagella interaction booth at Indonesia Comic Con 2022.

The live chatting sessions were held for two days at an exclusive booth for *Crystagella* at Indonesia Comic Con, during which *The Viewers* were able to engage in direct conversation with *Crystagella* (Figure 6). Through these interactions, we were able to observe and gather data on how *The Viewers* interacted with the avatar, allowing us to gain insights for future improvements. By circling back to the prototype and define phases with the data gathered from this testing phase, we will be able to make more comprehensive improvements to the interaction process of *Crystagella*.

III. Discusion

A. The Actor and Crystagella as an Interpersonal Communication

When *The Actor* simulates an avatar, it's like a concept of reflection or in the communication theory can be define as an interpersonal development. In this case, the movement of *The Actor* constructed the animation and the voice character design of *Crystagella*.

The Actor uses motion capture technology that includes body movement and facial expressions, which are then applied to a *Crystagella*. *The Actor* can see on the computer screen how the character is animated to match the movements simulated by themselves. When *The Actor* raising the hand, *Crystagella* will raising the hand, when *The Actor* shaking the head, *Crystagella* will shake her head. The same thing with regards to sound, the mouth movements must match the sound produced by *The Actor*.

Therefore, before the real-time avatar interaction is witnessed by *The Viewers*, who is the recipient, it is necessary to have a monitor uses to *The Actor* encoding The Avatar that includes both audio and visual elements. To understand the process of forming the interpersonal model between *The Actor* and The Avatar, it can be seen from the diagram on figure 7.

Looking at the diagram on figure 7, the things that need to be considered in forming an avatar's interpersonal include:

- Fullbody movement; *The Actor* utilizes motion capture technology that is connected to the avatar (Figure 7).
- Facial movement; It produces two outputs, facial capture, which utilizes motion capture technology, and voice capture, which is recorded using a microphone.
- Monitor or Virtual Mirror; Both components are displayed on a monitor in the form of audio and video for monitoring and evaluating the Avatar by *The Actor*.

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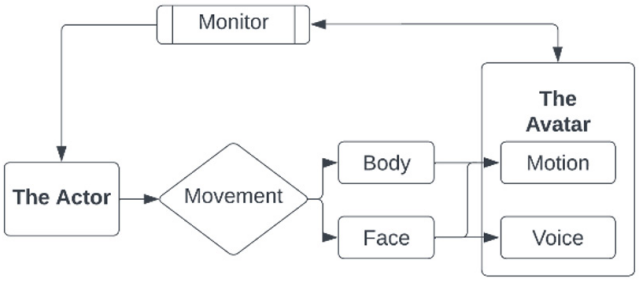

Figure 7. illustrates the encoding process used to simulate The Avatar.

The success of the encoding process in forming the interpersonal relies on the quality of the three aforementioned medium aspects. For the animation, the following aspects should be taken into consideration:

- The lower the latency of the motion capture, the more closely the avatar's movements will match those of *The Actor*.
- The level of detail in motion capture depends on the number of markers that can be placed on each joint of the body. The more markers used in the motion capture process, the more detailed the resulting movements will be, such as the use of markers on each fingertip joint.

Figure 8. showcases the facial motion capture system, complete with the helmet. [19]

To generate facial movement, two outputs are produced. The first is related to facial capture to create facial movements, while the second is voice development, where the quality of the microphone should be carefully considered. Therefore, to synchronize these two aspects in building facial movement, the following aspects should be considered:

- Types of microphones divided into 3 types, namely condenser, dynamic, and ribbon. These three types are differentiated by their frequency response and polar pattern aspects. The microphone type selection should be adjusted to the needs.
- Proper microphone placement is sticking to the head. However, the microphone placement should be considered to not disturb the facial capture process.
- Similar to the previous point, must be installed to follow the head's movement. One way is to use a device called a facial capture helmet. In addition, the size and weight are the main concerns, the smaller and lighter the device, the more *The Actor* can move their head freely.

Figure 9. depicts the motion capture of real-time avatar movement.

The Monitor component is what makes the simulation of the Avatar by *The Actor* a form of interpersonal communication. There are also aspects that need to be considered in monitoring, as follows:

- Separate audio and visual monitors are better, where the voice can use earphones while the animation can be viewed on a television screen.
- The placement of the monitors is important, which is parallel to the direction of motion capture so that the Avatar will appear to be speaking with its conversational partner. However, the placement must not interfere with the facial and motion capture processes.

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B. They Are Not Talking with You (The Actor), They Are Talking with the Other You, it's Crystagella!

In the context of the sub-topic above, it is true that " They Are Not Talking with You (*The Actor*), They Are Talking with the Other You, it's *Crystagella*!". Despite the fact that the sender of the message remains *The Actor*, *The Viewers* interprets it as the movements, expressions, and voice of the avatar. This refers to the sub-topic *The Actor* and the Avatar as an Interpersonal Communication. The simulation of *The Actor* into an avatar creates a new interpersonal communication.

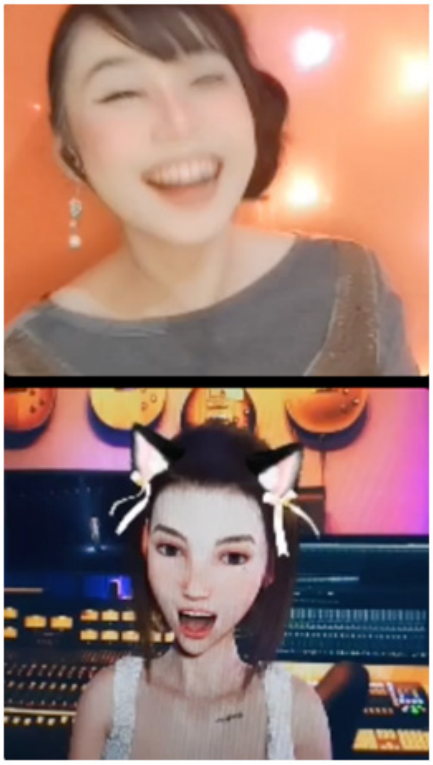

Figure 10. illustrates Crystagella's real-time interaction with people (@bolehmusic) on Instagram Live.

In this context, *The Actor* is no longer known as themselves. *The Viewers* sees them as *Crystagella* (Figure 10). Referring to the components of a message in communication theory, there are two, which are language and sign [8]. What *The Actor* does is positioned as a language, while the movements, expressions, and voice of *Crystagella* (avatar) are a sign. For a clearer understanding, Table 1 provides an example.

Table 1. provides an example of what The Actor encoded and what The Viewers decoded of Crystagella.

Character Design (Sign)	Language	
	The Actor do (encoded)	*The Viewers* see (decoded)
The Animation	Movement of *The Actor* *The Actor* waving hand *The Actor* jumping *The Actor* kicking *The Actor* shaking head	Movement of *Crystagella* *Crystagella* waving hand *Crystagella* jumping *Crystagella* kicking *Crystagella* shaking head
The Expression	*The Actor* smiling *The Actor* sad	*Crystagella* smiling *Crystagella* sad
The Voice	Voice of *The Actor* *The Actor* singing *The Actor* talking	Voice of *Crystagella* *Crystagella* singing *Crystagella* talking

C. Crystagella Cannot See and Hear The Viewers, The Actor Can!

Animated *Crystagella* looks real, but it is still just an avatar. As previously mentioned in the sub-section "*The Actor* and *Crystagella* as an Interpersonal Communication", the simulation of *The Actor* into *Crystagella* creates a new form of intrapersonal communication. From a communication perspective, *Crystagella* remains a medium of communication, with *The Actor* as the source of the message and communicator.

According to Schramm, communication is a transactional process that involves feedback [8], [9]. After the communicator delivers a message to the recipient, the recipient sends feedback to the communicator [8]. However, in the context of

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feedback in avatar interactions, the process does not revolve around the avatar but uses another medium directrly interact with *The Actor* (Figure 11).

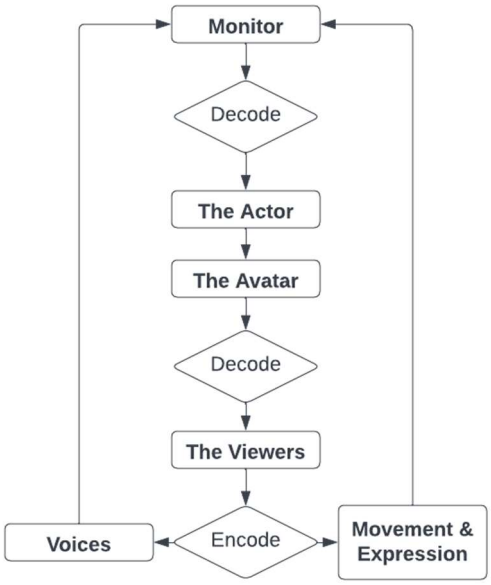

Figure 11. shows the feedback process from The Viewers through The Actor.

In this context of modeling, the form of interaction is almost similar to what has been discussed in the subchapter "*The Actor* and *Crystagella* as an Interpersonal Communication". This indicates the importance of proper monitoring to achieve effective communication. As previously mentioned, the components of the monitor should be split between audio and visual to allow for greater focus on each aspect of communication. This can be achieved by using earphones for the voice component and a television for the visual component.

Additionally, the placement of the monitor should be carefully considered to ensure that it is aligned with the motion capture direction. This will help create the illusion that the avatar is talking to its counterpart. However, the placement should not interfere with the facial and motion capture processes. By properly implementing these aspects, the communication between *The Actor* and *The Viewers* can be enhanced, resulting in a more realistic and effective interaction.

D. So How They Communicate Each Other Through the Avatar?

Continuing from the previous subchapter, the process of building the real-time interactive avatar is divided into three main discussions: the formation of intrapersonal communication between *The Actor* simulating The Avatar, the encoding and decoding process of a message where The Avatar communicates with *The Viewers*, and finally the feedback process captured by *The Actor* and sent by *The Viewers*. The complete modeling of the real-time interactive avatar interaction can be seen in figure 12.

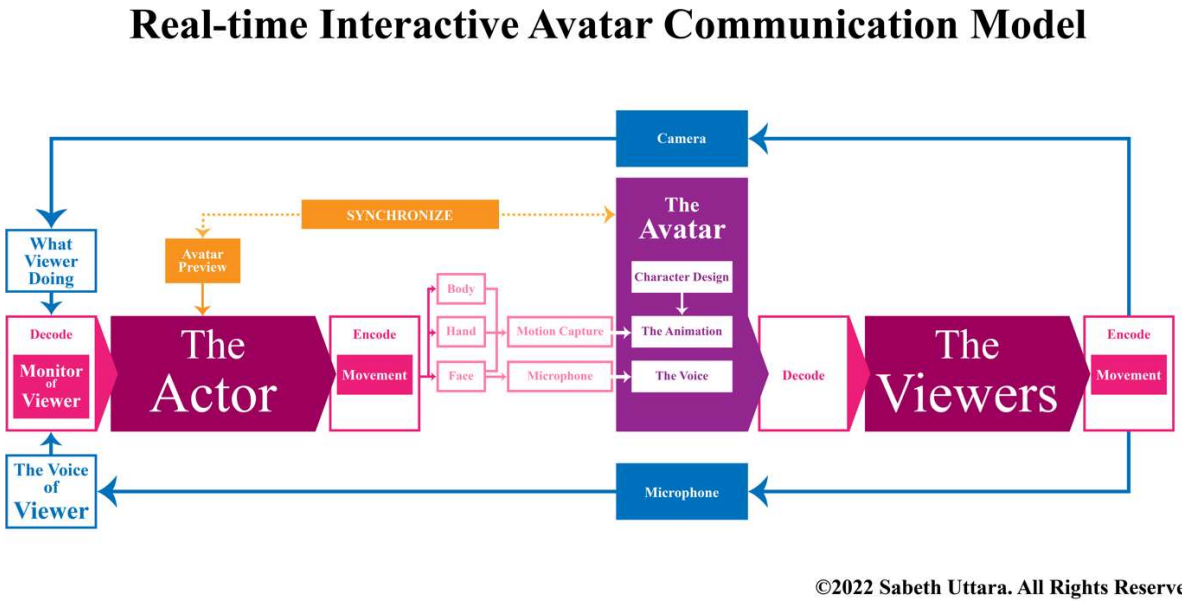

Figure 12. illustrates the interaction model of a real-time interactive avatar, which demonstrates the dynamics of user-avatar engagement in real-time settings.

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This model represents the complex process of communication between *The Actor*, The Avatar, and *The Viewers*, which involves not only language but also nonverbal cues such as gestures, facial expressions, and tone of voice. It is important to note that in this model, *The Actor* and The Avatar are not considered as separate entities but rather as a single unit forming a new interpersonal communication. The encoding and decoding process is also crucial in ensuring effective communication, as The Avatar's movements, expressions, and voice must be properly interpreted by *The Viewers*. Finally, the feedback process plays an important role in improving the communication process by allowing *The Actor* to adjust their communication based on the responses of *The Viewers*.

IV. Conclusion

In addition, the use of real-time interactive avatar in interpersonal communication has significant implications in terms of bridging the gap between physical and virtual communication. This type of avatar allows individuals to communicate and interact in a virtual environment in a more natural and human-like way, creating a more immersive experience for both *The Actor* and *The Viewers*.

Moreover, the development of such an avatar requires a thorough understanding of the communication process and the technical knowledge to implement it. The process involves several phases, including defining the problem or need, observing the communication process, brainstorming and visualization, prototyping, and testing. These phases require a multidisciplinary approach and collaboration between experts in fields such as psychology, communication, design, and technology.

One of the main advantages of real-time interactive avatar is its potential application in various fields, including education, entertainment, and healthcare. For example, in education, it can be used to create immersive and interactive learning experiences, where students can interact with avatars to learn and practice new skills. In healthcare, it can be used for telemedicine and remote patient monitoring, allowing healthcare professionals to interact with patients virtually and monitor their health remotely.

the concept of real-time interactive avatar, which Schramm created, provides a new and innovative approach to interpersonal communication [9], that has significant potential for various applications, such as education, entertainment, and healthcare. In education, avatars can provide an immersive and interactive learning experience that can improve student engagement and understanding of complex concepts. In entertainment, avatars can enhance the user experience by providing a more personalized and interactive entertainment experience. In healthcare, avatars can be used to facilitate remote consultations and telemedicine, allowing patients to receive medical care without leaving their homes.

Moreover, the concept of real-time interactive avatar also has the potential to transform the way we communicate and collaborate in virtual and remote settings. Avatars can provide a more natural and intuitive way of communicating and collaborating, allowing for a more seamless exchange of ideas and information. In virtual meetings and remote work, avatars can help bridge the gap between physical distance and improve team collaboration and productivity.

However, the development of real-time interactive avatar also presents various challenges and ethical concerns. For instance, the use of avatars for communication and collaboration raises questions about privacy, security, and identity. It is crucial to ensure that users' personal information and data are protected and that avatars are not used to misrepresent or manipulate others.

In conclusion, real-time interactive avatar has significant potential for various applications and can transform the way we communicate and collaborate in virtual and remote settings. However, its development also requires careful consideration of ethical concerns and challenges that may arise.

For future research, there are several areas that can be developed from the interaction model mentioned above. One of them is related to the development of server systems for direct avatar interactions. Various modeling can also be developed through the basic scheme, such as live control systems, or even to an Actor who can live together in several places. Additionally, further research can be conducted to investigate the effectiveness of avatars as an immersive media.

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