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VIRTUAL LEARNING USING METAVERSE-BASED PLATFORM

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Abstract

Metaverse is the next iteration of the internet with a network of decentralized virtual spaces where users can socialize, learn and play. In addition, people leverage other new technologies (5G, blockchain, artificial intelligence), moving from 2D graphics on flat screens to 3D graphics on HMD. Metaverse will enable the creation of interactive and virtual equivalents of the physical world that we will be able to explore via the extended reality platform. In educational institutions, the development of teaching materials is considered as one of the main aspects that will encourage student learning and help achieve academic goals and objectives. In addition, educators need to innovate education under student characteristics and technological developments. This paper aims a guide for those who want to improve themselves in developing metaverse-based teaching materials for various fields of study. Learning in multiple subjects using metaverse-based learning materials is not dull for students. By mastering this material, it is hoped that you will be able to complete work related to the development of metaverse-based teaching materials.

Keywords: learning resources, metaverse, virtual

I. INTRODUCTION

In the School of Game Development, part of the mission is to prepare students to work effectively in a collaborative environment. Because we aspire to provide students with opportunities to work with one another, many of our business courses build metaverse-based learning into their course.

Students are expected to work in a small team to complete a semester-long project. This project lends itself to a student-driven collaborative environment because of the assignment is taken from metaverse learning resources. [1] This project is broken down into three small tasks with each task taking 1-2 weeks to complete. Because the project builds on each task and knowledge gained from any task funnels into the knowledge needed to complete the next task, students tend to make communication using metaverse learning entitled Game Programming. To help our students to work effectively in this project and to prepare them to work in a contemporary

programming environment where teams use technology to facilitate communication and the completion of tasks, we extended the current Metaverse-based Learning system to support the efforts of student teams [2]. This article will focus on these efforts and discuss our strategy for enhancing team effectiveness in virtual space including the development of a self and peer assessment tool used to determine the effectiveness of student teams. We will also provide advice for implementing this environment with metaverse-based space platform currently available on the web.

In the past, students relied on email to communicate with their teammates and to send each other individual work. If they needed to meet, they came to campus. There are limits and challenges to working in this manner. For instance, email is an asynchronous communication tool. Our students often send messages that are incomplete at best and confusing at worse. Because of this, email may not facilitate a common understanding

of the theory or requirements needed to properly complete a project. In addition, there are times that team members cannot be reached and may not show up for a meeting. A student's absence may be legitimate or illegitimate but, either way, the rest of the team could find themselves empty handed, with incomplete files, or rushing to complete a team member's assigned task. We found that reliance on email and on campus meetings increased the risk of turmoil for our groups and often left students with undesirable grades.

We also found that each class would have a handful of students who did not fully participate with completing team projects [3]. Because the grades were assigned to the projects, some unscrupulous students would take advantage of the system and earn a grade that was based on their peers' efforts. If the team members were willing to speak to the teacher about such problems, faculty intervention could help. But, oftentimes, such interventions were too late; students tended to wait until the end of the semester when stress and emotions were high

II. Utilization of Technology in Education

Living up to this reputation, school systems in the 1990s and 2000s fervently adopted and integrated the latest technologies. They were from television and interactive whiteboards to the iPad and beyond. The expected measurable improvements in academic performance have not been as immediate as many had hoped. What's more, technology has repeatedly proven to be an unreliable strategy for fixing problems in education. Even more often causes new problems, especially around the issue of equity.

Undoubtedly, technology has changed how we learn, both inside and outside of school. But unfortunately, the history of technology failing to meet unreasonable expectations has been repeated so many times that researchers coined the term „rhetoric-reality gap“ [4]. To illustrate this phenomenon, researchers have warned against the blind support of technology in education [5].

Sometimes unrealistic promises are made by biased stakeholders with vested interests in the success of the technology. These promises are made to increase interest in technology, then influence decision-makers about the relationship between technology and education. Once im-

plemented at great expense in schools, teachers face an uphill battle. Many are not provided with training, or educational institutions do not acquire the technological, pedagogical, and content knowledge needed to apply technology in learning practice. [6]

For teachers, time is also not in favor of implementing new learning tools. Teachers need the necessary tools for learning. Even computers that should be indispensable in schools are not available to adapt lesson plans to accommodate new technologies. After the first implementation, the teacher needs to reflect on how things are going and start the iterative process. This process requires time that most teachers do not have, who are already burdened with a heavy teaching burden. Therefore, it is imperative that XR project managers and developers design and build their product roadmap.

III. DEVELOPING VIRTUAL REALITY ENVIRONMENT

To support students working in virtual space, we provided students with a custom-designed virtual space on SPATIAL network [7]. This space is public; all visitors can accessed the document, communicate or activities. As an additional benefit, secluding the virtual workspace in this way allows students the ability to work without interruptions, advertisements, and virtual noise. To accomplish this goal, we were able to enhance our learning resources to support our ideas on how to support effective teamwork in a virtual space. The following diagram depicts the virtual team environment we developed.

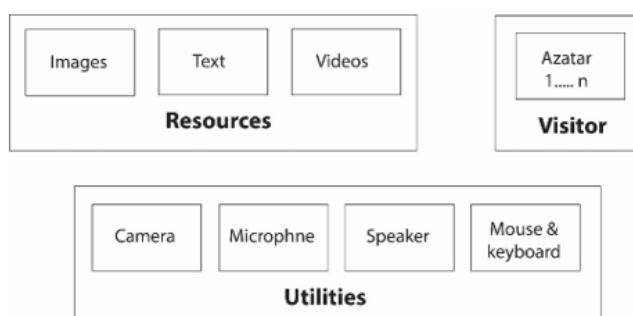


Figure 1. The Virtual Learning Platform

Our virtual leaning system provides a modular environment that allows faculty members to select

a variety of tools based upon the specific goals of a team. We decided to utilize a combination of tools that we identified as being critical elements in an online virtual team experience. The virtual environment has a peer and self-assessment tool that is used to evaluate student performance periodically during the semester.

Within the team space, we provide students with the ability to upload documents that the team needs to work on using the metaverse space, and of course add the label. It can be the PDF documents.

Students need to be instructed on the proper administration of virtual learning environment. If not, they tend to post all documents to one area causing clutter and losing the richness of the system. We've seen students struggling with identifying the document that they either need to submit or obtain advice on. On the positive side, we've also witnessed students begin to understand the need for documentation, versioning, file organization, and uploading the correct one.

IV. DISCUSSION

Through the course administrator module, we can also discover the level of participation of all team members by reviewing team statistics, such as the number of visit per student, activity within each module, as well as the amount of time spent on a particular task. This analysis tools allows us to spot problems in teams and address them before they become problematic.

The discussion module allows students to post messages and files to a shared group space. The board is organized by thread and date, and can be moderated by the instructor of a class. This module works well in situations where a quick and simple common space is needed to share ideas.

After some discussion, we decided to provide students with the discussion board tools in order to allow them to leave messages, instructions, links, and resources for their fellow team members. They tend to focus on earning high grades and are not as intellectual stimulated as compared to students observed in other programs across campus.

We have seen how the metaverse can benefit a business. There is no doubt that the metaverse can also help the eLearning industry.

1. Better eLearning by Leveraging the Virtual World

A student enjoys learning more with a smartphone than with a book in modern times. Metaverse apps can create virtual spaces for students where they can walk, take notes, and communicate with other students, changing the eLearning industry. They can also play games in a virtual world similar to reality. In addition, with the developed application, students can change clothes, hairstyles, and expressions, with various options available.

2. Better Illustration by Leveraging the Virtual World

Instructors often use videos but cannot present proper illustrations of real-life objects through the videos. With technology like AR, instructors can show these illustrations effectively to their students. For example, if a teacher wants to demonstrate car parts, they can use a holographic app to mirror 3D images. Students will better understand scientific experiments, physics, and mathematics.

3. Better Parent-Teacher Interaction

Metaverse can help parents with their child's performance in school. Parents can attend students' classes and see clearly the quality of education offered at the institution. With virtual reality applications, parents can also interact with teachers from remote places and see the quality of the games their children are playing. Similarly, parents can also arrange regular meetings with teachers and plan better eLearning for their children.

XR has several limitations in achieving particular learning objectives, namely:

1. Cognitive Load: XR experiences provide students with a wealth of visual and auditory stimuli that can increase their cognitive load as they process what they see, hear, and read. It may explain the varying learning outcomes with immersive technology regarding what content knowledge is retained. More is needed to understand the optimal learning methods in XR to maximize student understanding and how best to integrate them into learning designs in other materials such as books, slides, and modules.

2. **Time Limitation:** The HMD used for VR and MR can make people uncomfortable or nauseous in just 10-15 minutes, with worsening effects during long exposures. It suggests that VR and MR are best used in small doses rather than as instructional modes for whole lessons. Other technologies such as mobile-based AR and computer applications may be more suitable for long-term interventions.

3. **Accessibility:** The current XR technology is not easy to use for many people. For example, someone with limited mobility in their hands may have difficulty using the controller. Even something as mundane as wearing glasses can make using an HMD difficult. In addition, some technologies are not equally accessible to people from different backgrounds and identities.

4. **Affordability:** XR technology remains more expensive than other learning resources such as computers and books and often requires a high-speed internet connection. In addition, content is also more expensive to create due to the need for specialized equipment and skills to develop the interactive virtual environment necessary for effective learning.

5. **Lack of Educational Content:** There are not many learning programs, nor is there a platform that makes it easy to find content based on learning objectives, the field of study, or age group. In addition, few educators have the ability or capacity to create their own XR learning materials, let alone provide students with information on how to make them.

6. **Privacy and Security:** XR technology was developed by a company whose business model relies on the collection of increasingly detailed and extensive data on each user. XR technology has the potential to track people's movements and emotions, which could reveal sensitive and private information about them.

7. **Difficult to Assess Learning:** XR can provide a more individualized and unstructured learning experience and is well suited to teaching skills, competencies, beliefs, and attitudes that may not be captured by multiple choice learning assessments. And while XR offers the possibility of collecting various forms of user data (e.g., movement, eye tracking), this data has not yet been translated into meaningful learning assessments.

IV. CONCLUSION

We have seen how the metaverse can benefit a business. There is no doubt that the metaverse can also help the eLearning industry: 1) Better eLearning by Leveraging the Virtual World. A student enjoys learning more with a smartphone than with a book in modern times. Metaverse apps can create virtual spaces for students where they can walk, take notes, and communicate with other students, changing the eLearning industry; 2) Better Illustration by Leveraging the Virtual World. Instructors often use videos but cannot present proper illustrations of real-life objects through the videos. With technology like AR, instructors can show these illustrations effectively to their students; and 3) Better Parent-Teacher Interaction, that metaverse can help parents with their child's performance in school. Parents can attend students' classes and see clearly the quality of education offered at the institution.

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WRITING SKILLS NEEDED FOR THE COMMUNICATION INDUSTRY

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Abstract

This descriptive study aims to determine what competencies are most needed by employers of undergraduate fields of study in Communication Science to meet the profession's needs. The method used in this research is a descriptive method, with a collection of data that originates from the ads required by employers, then analysis to present the data in various categories. The results obtained are maps of professions and competencies most needed by employers. By knowing the required professional competence and employers, students can prepare themselves to develop competence and professionalism that is being developed in realizing the ideals and hopes. Likewise, for educational institutions, Communication Science can significantly adapt the curriculum to meet employers' needs.

Keywords: competence, professional, communication science, employers

I. INTRODUCTION

1.1 Background

The quality of higher education here at home is still low, to various studies and international level conducted by the independent institution [1]. The Capacity Building in Higher Education (CBHE) action supports international cooperation projects based on multilateral partnerships between organizations active in higher education. It supports the relevance, quality, modernization, and responsiveness of higher education in third countries for socio-economic recovery, growth, and prosperity and reacting to recent trends, in particular, economic globalization but also the recent decline in human development, fragility, and rising social, economic and environmental inequalities exacerbated by the COVID-19 pandemic. [2] Fresh graduates should be ready and able to enter the world of work. The field of study chosen to develop a profession that has long been prepared, because before graduating student must know the jobs that will be entered, as well as the university should be in collaboration with the business to determine the competence of its graduates [3]. Many attempts

in Higher Education are seen from a vision to be a World-Class University, Accreditation, and the implementation of ISO Quality standards. Still, the results and the reality are the opposite. The primary measure of quality institutions of higher learning is the quality of the marks or graduates who are ready to work according to professional and competence. [4]

Conclusion of the discussions conducted with the students, who choose courses Strategic Communication, they do not know the professions and jobs available in the future for the program of study and some even entered the Communication Science follow parental choice

Rooted in reality as well as the issues above, in this study, then we focus on the following:

- There are many students in Communication Science who do not know the intended profession, competence and skills required by the institutions of the employer, so it does not prepare competency and skills as required while still learning.
- Communication science education curriculum design tends to be static and does not grow to follow the needs of the competence and skills required in workplaces or industries that provide employment.

- Graduates who are not ready to work for low quality.
- Gap views on quality indicators in the competence and skills between educational institutions and industry employers.
- The tendency of parents to guide their children into prestigious Higher Education, not choose a field of study that prepare the profession to be in the field.

1.2 Objectives

The general objective of this study is to collect data needs of employers for graduates of undergraduate communication science field of study and map it in some perspective to reveal the phenomenon or the fact of competence and skill requirements from the employer's perspective. In detail, the purpose of this study, which is associated with the primary objective, namely to find out the following:

- There is a significant difference in the need for competencies and skills of the two periods in a row
- There is a significant difference between the needs of the competence and skills of communication and the non-communication industry.
- Profession and competence of graduates in Communication Science, the most widely required by industry or employer.
- What skills were most needed by employees?

1.3 Benefit of research

Mapping professions and competencies desired or needed industry as an employer can help the parties related to Communication Science education, including students, prospective students, parents, and education providers, be aware of and make adjustments to competencies being developed.

Firstly, the students preparing to compete for the job armed with a diploma Bachelor of Communication understand the profession to be developed and the competencies and skills that must be possessed before entering the workforce. Second, for prospective students and parents who wish to enter higher education in the field of computer science, knowing professions and competencies to be prepared, so do not let the wrong subject or field of study. Third, one for the provider of higher education in Communica-

tion Science, to develop curriculum and learning methods and techniques to prepare students so that after graduating ready to enter the world of work and develop certain professions aspired.

II. METHOD

The feasibility study was conducted to present the realities or facts needs of industry employers for labor to fill the shortage of staff or professional background in Communication Science undergraduate of the new graduate or a fresh graduate or less than two years of experience. Implementation of data collection study with descriptive methods is grouped in the design stage of research variables and determination of sample, data collection, and data analysis and presentation phases. Data were collected in two periods, the end of 2019 and the end of 2020.

2.1 Teoritical Review

Philip Kotler argued that one of the mission and functions is to perform the tasks of information that is to convey the message to the audience or the public about job advertisements, which can be said to deliver the news about the job opening at an institution [5]. Media used to provide the message assortment, ranging from print to sophisticated communication media. Job advertisements, usually in addition to a profession or occupation required, are generally accompanied by required requirements, such as competence, education, age, experience, and others.

The profession is a field of work that requires training or education and specialized competence. A career usually has certifications and licenses specific to the area of the job. Mentions profession in the field of Information Technology is very varied and is usually determined by the scope of duties and responsibilities. Works that generally required for the organization of Tier One Communication Science graduates are: Strategic Communication, Media Designer, Script Writing, Public Speaking, and other designations. [6]

Competence is the ability/capability that comes from the knowledge and skills to perform a particular job consistently and provide adequate performance levels or higher. Competence is a needed source of education, training, and experience that have been undertaken. [7]

2.2 Object of Research

Job advertisements can be seen in various general trend, then that becomes the object of research or study in public as a categorical variable [8], are:

- Types of institutions or businesses that need workers to distinguish Communication Division and vice versa Non-Communication
- The period of data collection, namely one month between late 2019 and early 2020
- Major or Field of study Communication Science, which required contain Strategic Communication, Media Designer, Script Writing, and Public Speaking, and did not specify the majors
- The type of job or profession that requires the employer may contain: Strategic Communication, Media Designer, Script Writing, and Public Speaking.
- GPA required

Competencies required in advertising, including competence in the field:

- Strategic communication is required
- Marketing communication
- Public speaking
- Scriptwriting

2.3 Data collection

The data collected is sourced from job advertisements taken from job advertisements, of attributes are there, then the samples taken are:

- Online daily newspaper that has been circulated, may represent all Daily
- From an existing ad taken at random, within a period of two-time lapse of 2 years.
- Only ads that require work experience of fewer than two years.

III. DISCUSSION

Discussion the result of research falls into describing the plan, input, classify, code, and query.

3.1 Plan

Activities of this stage are:

Planning the codes for the literature review: Reviewers decided to create parent and child codes, as shown in Table I.

Table 1. Planning codes

Num	Code		
	Code Name	Type	Description
1	Skills	Parent	Skills needed in communication industry
2	Communication	Child	Communication is the one you will use every day when working in this field
3	Writing Ability	Child	The ability to write captivating content.
4	Social media	Child	Social media has redefined communication between public relations specialists and their audiences.
5	Multimedia	Child	Having at least a basic knowledge of how to manipulate various types of media.
6	Creativity	Child	Creativity is for specialists whether by writing, coming up with a new approach to an old idea, or finding a way to attract new customers, public relations
7	Attention to detail	Child	Attention to detail is among the most important public relations skills need to develop.
8	Honesty	Child	Individuals working in communication need to have stellar reputations.
9	Definition	Parent	Definitions of some topics
10	What is known	Parent	The well-known information about skills
11	What is not known	Parent	The unwell-known information about skills

We have collected sources: The source of references from online advertisements and media

3.2 Input

The first stage of the qualitative data processing method is input the online data from the website into NVivo. The pdf documents, reports, and websites.

3.3 Coding

After entering the data into NVivo, the next thing to do was coding. Code in qualitative research is a word or phrase that summarizes or captures the essence of a piece of data. Coding is an analytical process for categorizing data. In NVivo, coding is gathering related material into containers called nodes. If a node is open, all the references in the project are coded to that node. With coding, the researchers collected all sources related to the topic. For example, researchers created code on the node when the respondent explained the material he wrote.

Nodes

<

Fig.1 Creating nodes

Then, NVivo gathered all attributes related to the code. The focus of the research was based on "Writing Skills Needed for the Communication Industry." Therefore, the nodes planned are based on topics, namely Skills, Communication, Writing ability, Social media, Multimedia, Creativity, Attention to detail, Honesty, Definition, What is known, and What is not known, as shown in Fig. 1.

3.4 Query

A query is retrieving data from database and providing it for use. Another understanding is a particular set of instructions to retrieve specific data repeatedly [9]. NVivo can complete various queries that can be used to answer questions about data, find patterns, and find ideas. For example, researchers used Word Frequency Query and Text Search Query.

Word Frequency Query

Word Frequency Query allowed researchers to determine the number of times the selected item appears. Seeing how many words appear could help identify themes and concepts, as shown in Fig. 2.



Fig.2 Word Frequency Query

Text search query

Text search query allowed researchers to determine the number of times the selected item appears. Seeing how many words appear can help you identify themes and concepts, as shown in Fig. 3.

Reading the relation of the words shows that listening is half of the communication process - just like it takes two to tango, it takes a clear speaker and an active listener for effective communication. However, listening takes way more patience than talking, while listening instead of pretending to hear is something very few people do. This puts a strain on communication, as shown in Fig. 4.



Fig. 3. Word tree of Search Text Query

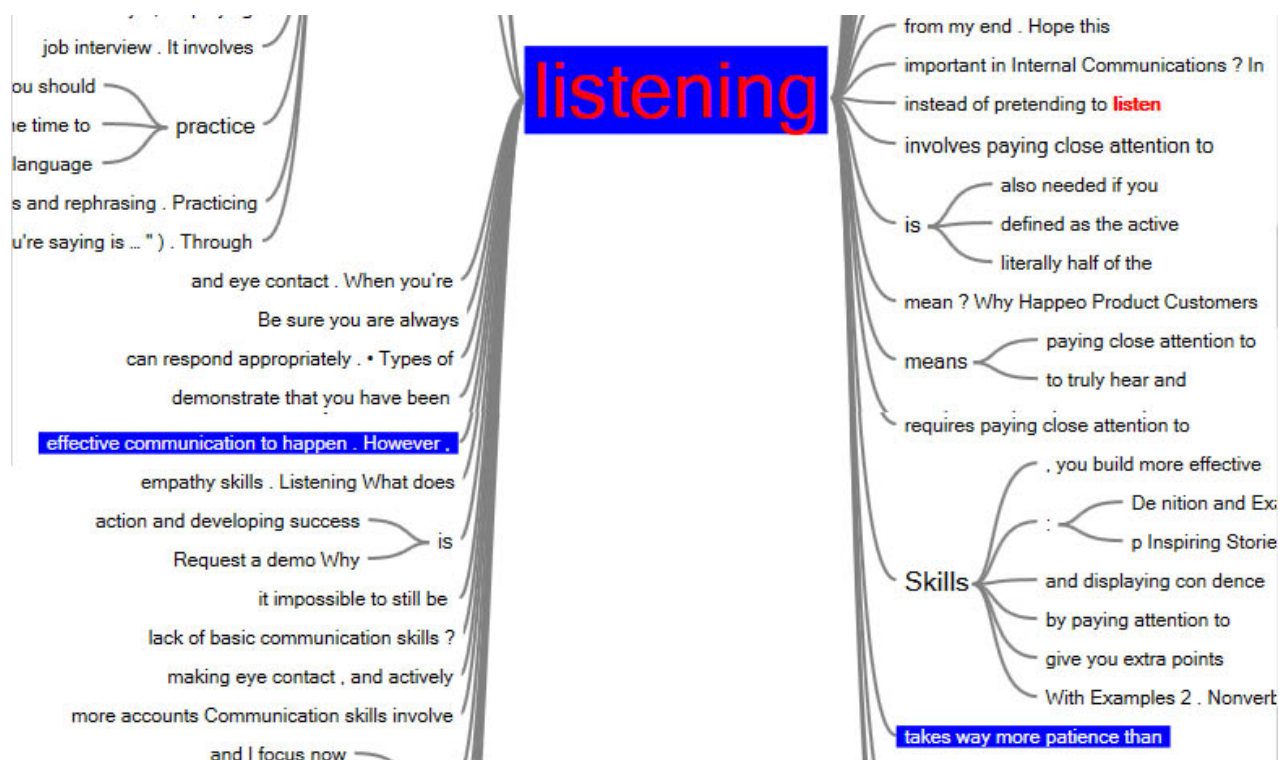
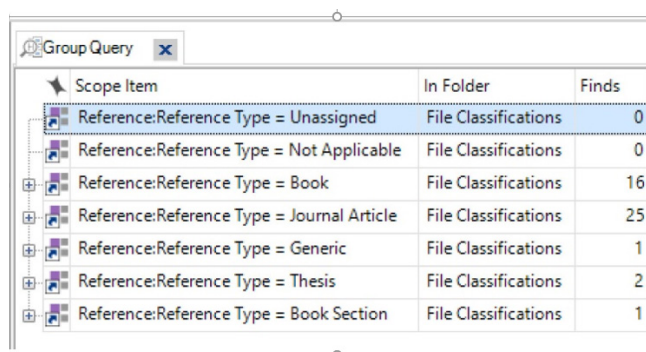


Fig. 4. Relation of the word "listen".

Group query

Group query allowed researchers to determine the number of proper resources in the research since they had academic, psychological, and social benefits, as shown in Fig. 5. They were two thesis, 25 journal articles, one generic, one book section, and 16 books.



Scope Item	In Folder	Finds
Reference:Reference Type = Unassigned	File Classifications	0
Reference:Reference Type = Not Applicable	File Classifications	0
Reference:Reference Type = Book	File Classifications	16
Reference:Reference Type = Journal Article	File Classifications	25
Reference:Reference Type = Generic	File Classifications	1
Reference:Reference Type = Thesis	File Classifications	2
Reference:Reference Type = Book Section	File Classifications	1

Fig. 5. Group query.

IV. CONCLUSION

The literature review using NVivo was considerably shorter than a traditional manual method. The manual process requires more time to locate and prepare documents and produce and edit references [10].

According to the literature review findings from books, journals, and other online sources published between 2004 and 2020, researchers found the relations of words or themes. After the Word Frequency Query, the most appeared word was game. And also, there was a relation between the word innovation and profitable. There are gaps in previous research, but the skills needed in the communication industry are writing and listening to clients.

Professional writing competence is still a profession and the competency of graduates in Communication Science, the most widely required by industry or employer. It needs to be realized by the students and faculty who want to develop professionalism in the learning process in the classroom. In the absence of specific writing that gives a signal that the writing competence is not limited to a particular field, is following the dynamics of science, culture, and environment so quickly requires the strengthening of the basic concepts and theories in addition to the technical skills of writing.

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MOBILE GAME-BASED LEARNING WITH GAMEMAKER STUDIO

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Abstract

In tapping the thriving mobile business, a study on mobile content development, specifically API is urgently required. Highly wanted API is indeed for education, entertainment and games that can be downloaded on Play Store. Thus, we develop a mobile game-based learning about multicultural learning. It was technically tested for its functionality, compliance, compatibility and soaking. Furthermore, to assess the insights of potential players, informal interviews and observations were conducted. In addition to that, the multicultural game characters and the game plan developed for the game were tested for their appealing merit. Overall, responses were remarkably consistent. Participants overwhelmingly considered the game as interesting and really attractive, successful in delivering the intended learning content, easy to play and simple to use. Findings also stressed two important points (1) multicultural, appealing and well-developed characters are important elements to ensure better learning experience and (2) multicultural uniqueness must always be incorporated to ensure better learning motivation and increase mobile acceptance.

Keywords: mobile game, GameMaker Studio, API, game-based learning

I. INTRODUCTION

In the world of games, there are various types of games that can be played. Various types of games according to platforms based on industry trends in 2019 [1], namely PC games, console games, mobile games, and online games. Educational games can be used to assist the learning process. Training in various subjects, using the game is not boring for students. This game is equipped with tutorial, practice and exam functions. Every game developer wants to upload the games to Play Store and sell it.

Even though the developers can now make cross-platform apps and games, they need to know how to release them on platform-specific stores. The Google Play Store is the largest marketplace for apps targeted at Android users and it has a couple of rules that you'll need to follow in order to successfully publish your app or game. If they want to find out how to publish an app to the Play Store, follow this guide and complete the checklist [2].

This paper is a description how to develop a

mobile application with the APK format to suit the requirement Google Play Store, especially about API.

1.1 Game MakerStudio

GameMaker Studio entered beta in March 2012 and full release in May 2012. Supported platforms include Windows, Mac, HTML5, Android, and iOS. In February 2015, GameMaker was acquired by Playtech along with YoYo Games. It accommodated the creation of cross-platform and multi-genre video games using a drag-and-drop visual programming language to develop games using only the drag and drop feature. Besides, game development can use the GameMaker Language scripting language. The scripting language was designed for novice programmers to create computer games using actions without much programming.

The developer intended GameMaker for creating games with 2D graphics, which use the standard library for graphic drawing and 2D primitives. [3]

II. REVIEW OF MOBILE GAMES

2.1 The History

Mark Overmars developed GameMaker, and released this program was first released on November 15, 1999, under the name Animo, as a graphical tool with limited visual scripting capabilities (Ford, 2009). In the next release, Animo's name changed to Game Maker as software that led to the development of 2D games. Versions 5.0 and below are freeware, while version 5.1 was released with an optional registration fee, and version 5.3 was introduced with several new features for registered users. Version 6.0 has limited functionality for use in 3D graphics and runtime migration from VCL to DirectX.

Growing public interest prompted Overmars to seek help to expand the program, which led to a partnership with YoYo Games in 2007 [4]. Further development was handled by YoYo Games, while Overmars retained his position as one of the company's directors. Version 7.0 was the first to appear under this partnership, was compatible with macOS released in 2009, and was published in two operating systems.

GameMaker Studio entered beta in March 2012 and full release in May 2012. Supported platforms include Windows, Mac, HTML5, Android, and iOS. In February 2015, GameMaker was acquired by Playtech along with YoYo Games.

2.2 Game Basic Criteria

In order to judge whether or not a game is included, the basic criteria of a game can be used to differentiate it. This criterion applies not only to "rule game", but to all games. Here are the criteria shared by all games.

- general experience. Games bring people together regardless of gender, generation, and race. Most of the games are multiplayer games which lead to a group experience and take a long time to end the game. However, there are groups of games that are played alone, such as solitaire games and most computer games.
- equality. In a game, all players have an equal chance of winning, which is absolute equality. One of the reasons why children like to play games because in the game they are equivalent to adults.

- freedom. Whoever plays the game does so based on his freedom of choice. He was not forced by anyone to play. Playing games is not a job, not a commitment, and there is no obligation to do it.
- activity. Anyone who reads a book, watches a movie, or listens to music gets something but does not act. While most games get people to take action.
- dive into the game world. Whoever plays the game can enter the game world environment.

2.3 Kinds of Games

In the world of games, there are various types of games that can be played. Various types of games according to platforms based on industry trends in 2019 (WePC. 2019), namely PC games, console games, mobile games, and online games.

- PC Game. A personal computer game (PC game) is a video game that is run on a computer. This game is controlled using input equipment such as a keyboard, mouse, joystick, and others. PC games can be played with or without being connected to the Internet. This type of game is usually played using a personal computer or laptop. A large number of games are available for the PC platform, as Figure 1.1.
- Console Game. Console games are an inactive form of multimedia for entertainment, consisting of manipulated images (and usually sound) that are formed by a console and displayed on a television or audio-video system. The game is controlled and manipulated by players using tools that can be held and connected to a console called a controller.
- Mobile Games. A mobile game is a video game that runs on a mobile device, smartphone, PDA, tablet computer, portable media player, or calculator. This does not include games that run on dedicated handheld video game systems.
- Online Game. An online game is a video game that is partly or wholly executed via the Internet or other available computer network. Many online games are developed by online communities, while social games are integrated between players and communities that exist in the world.

III. USER EXPERIENCE OF ANDROID

Google Play and Apple App Store are by far the two largest platforms for distributing and promoting apps. It doesn't matter whether you develop your app yourself, order it from a professional developer, or build it using a codeless tool, the process of publishing an app to the store is the same for everyone and it's important to comply with some requirements for you. application to successfully pass moderation and be published.

To avoid problems and possible refusal to publish your app, we have compiled a list of requirements that must be met for the app to be published successfully to the respective stores.

3.1 Application Programming Interface

API is the acronym for Application Programming Interface, which is a software intermediary that allows two applications to talk to each other. Each time you use an app like Facebook, send an instant message, or check the weather on your phone, you're using an API [5]

Every new Android version introduces changes that bring security and performance improvements as well as enhance the user experience of Android overall. Each app has a target SDK Version in the manifest file (also known as the target API level) which informs how your app is run on different Android versions. Configuring your app to target a recent API level ensures that users benefit from security, privacy, and performance improvements, while still allowing your app to run on older Android versions (down to the min SDK Version). [6]

3.2 File format

Upload your app files in APK (.apk) or ABB (.abb) format. This is required to run your app on Android devices. Starting August 2021, Google is starting to switch to ABB, as the format is 15% smaller and can be downloaded faster. ABB will soon become the main format and completely replace APK. [7]

3.3 Reason for rejection by Google Play

- Restricted content. Your app will not be approved if it contains inappropriate content related to violence, bullying, harassment, illegal activity and explicit hate that has the

potential to harm children or threaten general users.

- Stolen Intellectual Property. Your application will be deleted if you refer to or copy any brand that is not yours.
- Security and privacy issues. Google is committed to protecting user privacy. If deceptive, malicious or intentional misuse of user personal data is detected - your application will be strictly prohibited.
- The Children's Online Privacy Protection Act (COPPA) is not complied.
- Billing Guidelines are not followed. Once you've included monetization in your app, be sure to state all charges in the description.
- Ads do not comply with all Google policies.
- Functionality is broken. Low quality apps with lots of crashes and freezes are banned from Play Store.

IV. DESIGNING GAMES FOR PUBLICATION

4.1 Publish on Android Platform

This manual section covers the different platform-specific Preferences that need to be set up before compiling your games to certain targets. These generally only need set up once to start with certain things. After that, these will be used to point to any SDKs required and set Compiling basic options for how you want GameMaker Studio 2 to compile your game projects for any given platform. Note that the platforms available will depend on your license, and not all of them may be available.

Setup GameMaker Studio for Android Platform The first part of the general section informs about the product: information and the Build Settings. First, you should fill in the Product information, which includes the project's Display Name. Its Package information, which consists of a Domain, Company, and Product. The package information can only be made up of letters from A-Z and numbers 0-9, with no symbols or other special characters, nor should it have uppercase characters. These details are used to generate a Package ID with the format "com.company.myappname".

The Build Tools (and Support Library if required) are used when GameMaker Studio 2 builds the game for Android target and should be set to appropriate values based on the tools

you have installed using Android Studio [8], s shown in Figure 1:

- **Target SDK.** The Target SDK indicates that you have tested your app on (up to and including) the version you specify here. This gives the Android OS an idea of how it should handle your app in terms of OS features. Most apps will want to set Target SDK to the latest released version of the API (as used by the Compile SDK setting). This will ensure your app looks as good as possible on the most recent Android devices. Starting November 2021, mandatory app updates target API level 30 or higher and make adjustments to behavior changes in Android 11. Current apps that don't receive updates will not be affected and can be downloaded from the Play Store. Wear OS apps must continue to target API level 28 or higher. (Lam, 2021)
- **Minimum SDK.** The Minimum SDK version is the minimum API level that will run your project. For example, the minimum SDK version is 16 for API 28+ and anything built for Android YYC. (Be aware Google Play requires you to use API 30 or above when submitting!)
- **Compile SDK.** The Compile SDK version is the version of the API that the project is compiled against. This means you can use Android API features included in that version of the API. For example, if you try and

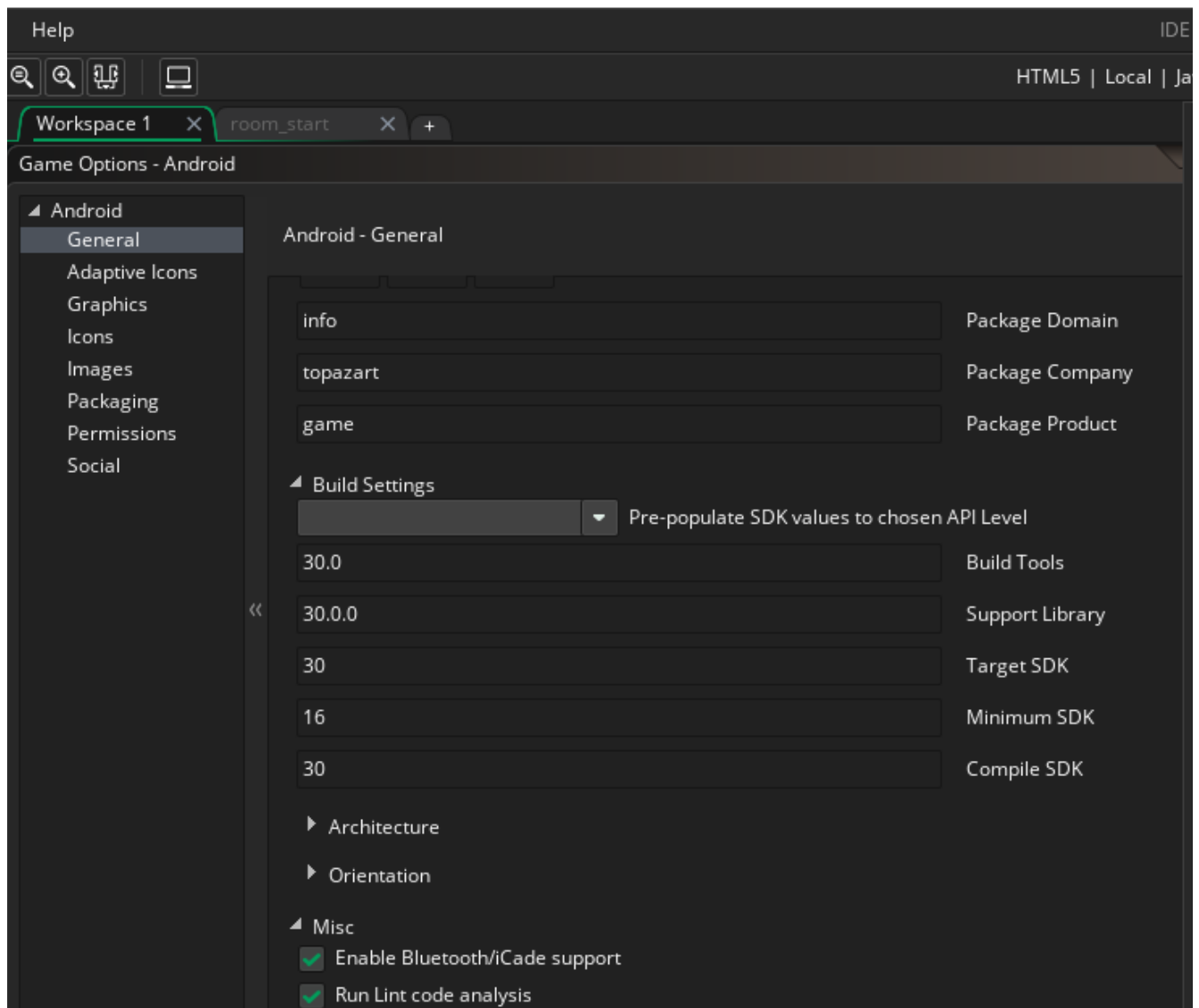


Figure 1. Target SDK and minimum SDK in GameMaker Studio

use API 16 features - for example - but set Compile SDK 15, you will get a compilation error. However, if you set the Compile SDK to 28, you can still run the app on an API 26 device (as well as all other previous versions).

4.2 Game design and development

Mobile game development is more difficult than desktop application development. Its challenges are smaller screen size, low colour depth, limited memory, limited processor, limited file size, short battery life, few input style options and different fragmentation. Due to these, literatures suggest for casual game, game plan should be simple and addictive over graphics game, and also uses simple user controls [5][9]. Furthermore, researchers compared two most popular platforms used for mobile game development, Adobe Animate and GameMaker Studio as shown in Figure 2.

GameMaker Studio	Adobe Animate
Complex	Less complex
Powerful	Powerful
2D games	2D games
Multiplatform	Multiplatform
- Android	- Android
- iOS	- iOS
- Window	- Window
- HTML5	

Figure2. A comparison between Adobe Animate and GameMaker Studio

V. CONCLUSION

Mobile game was technically tested for these dimensions: functionality, compliance, compatibility and soaking. Furthermore, in order to assess the insights of potential players, informal interviews and observations were conducted. In addition to that, the local game characters and the game play developed for the mobile game were tested for their appealing merit. Overall, responses were remarkably consistent. Participants overwhelmingly considered mobile game as interesting and really attractive, successful in delivering the intended learning content, easy to play and simple to use. The majority also said that

they would play and buy similar game content in the future. Furthermore, two important points to stress here are that multi-culture, appealing and well-developed characters are important elements to ensure better learning experience for children, youth as well as adults, and multicultural uniqueness must always be incorporated to ensure better learning gains and increase the game acceptance.

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CREATIVE THINKING IN DIGITAL MEDIA ART DESIGN EDUCATION

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Abstract

The study on the brain mechanism of creativity mainly has two aspects: the creative thinking process and the brain structure and functional connection characteristics of highly creative people. Human's rational thinking mode has a high degree of freedom and transcendence, and such problems cannot be expected to be studied by elaborating on the realization of the nervous system. The rational thinking of the brain is mainly based on the structured thinking mode, and the structured thinking mode shows great scientific power. This paper studies the theoretical model of innovative thinking based on category theory, analyzes the creation process of two scientific theories, landmarks in the history of science, and provides an intuitive, transparent interpretation model and rigorous mathematical argument for creative thinking. The structured thinking method has a great revelation and helps create new scientific theories.

Keywords: category theory, creative thinking mode, structured thinking

I. INTRODUCTION

The discussion of human rational thinking is also at the core of modern philosophy. Philosophers have established various theories of mind in the name of "anthropology" or "human knowledge research", forming two camps "rationalism" and "empiricism. Kant proposed the cognitive model of rationalism and empiricism --- transcendental idealism and rational intuition [1]. Modern philosophy and cognitive research scientists believe or assume that human beings have a specific innate cognitive structure of the brain.

The development of modern technical means has made significant progress in studying the brain's thinking mode [2], allowing people to explore the brain structure and connection with function. Brain imaging technology is used to study unique phenomena such as epiphany and the internal connection of the brain. There are two main aspects of brain mechanism research on creativity: the creative thinking process and the brain structure and functional connection characteristics in highly creative people.

Creativity is the advanced manifestation of human rational thinking, the glory of the human mind, and the source of the progress of human civilization. However, creative thinking itself is complex. As is seen in the above literature, with different experimental conditions and technical means, the research results of the brain mechanism of creative thinking are very different. Therefore, challenging to have a clear and deterministic conclusion about the brain mechanisms of creative thinking (one-to-one explanatory model). No studies have shown that innovative brain functional connectivity can be altered by training and then have practical meaning. [3]

The rational thinking of the brain is mainly based on the structured thinking mode. The structured thinking mode of the brain shows great scientific power, and this thinking mode is the primary mode that had significant scientific discoveries in the whole of humankind's history. This paper studies the structural characteristics of the brain's thinking mode based on the category theory, and the brain's structural thinking mode is clearly explained and understood.

II. LITERATURE

2.1. Creativity

Creativity is the act of turning new and imaginative ideas into reality. Creativity is characterized by the ability to perceive the world in new ways, discover hidden patterns, make connections between seemingly unrelated phenomena, and come up with solutions. Creativity involves two processes, namely thinking, then producing. [4]

Creativity happens when someone produces something new and appropriate, generative, or influential. These criteria are at different levels in the creativity hierarchy with novelty being the lowest qualification for creativity and being influential being the highest level of creativity. According to this definition, new, appropriate, generative, and practical ideas are more creative than new and proper ideas.

Creativity has three levels [5], namely novelty, generative, and influential.

- **novelty** - For something to be creative, it must be new that we have never seen or heard of before
- **generative** - Generative means that this new and precise thing leads to the production of goods, products, ideas and more
- **influential** - Influential means that it will shape the way people think or do such things in the future.

2.2 Principle Design Theory

The visual design of the user-computer interface affects the user in using the computer. The visual design includes the graphic elements used in the interface, including the overall layout, menus, form design, use of color, coding, and the placement of each unit of information. Good visual design strongly influences clarity, consistency, and aesthetics. [6]

Visual clarity

The meaning of the visual display must be clear. To get clarity on the meaning of a visual form, it is necessary to follow the existing guidelines. Some basic rules in organizing visuals to meet needs have been applied by graphic designers since several centuries ago, with the Gestalt rules defined by psychologist Wertheimer in

1930. He argues that personal views determine views in broad terms. Therefore, guidelines for organizing visuals focus on commonality, good approach, closure, and continuity.

Similarity means that two visual forms have properties that they seem to have in common. Likewise, approximation means that two visual forms have properties that are shared. Closure implies that two visual forms can cover the same area. Continuity says that one visual form will connect with the following form as a straight line.

Visual consistency

The principle of consistency is part of the overall user interface discussed previously. The consistency of the visual form makes it easier for users to use commands. For example, the radio button is used to specify only one option, while the checkbox can be used for more than one option. Consistency must be set for a particular image or overall design. The user easily understands information if it has a good flow with few distractions that hinder it. An information flow can be said to be continuous and harmonious if its appearance reflects the continuity from one part to another. Continuity can be created by creating styles, shapes or colors that give the user a sense of continuity.

Aesthetic

User interface design relates to general graphic design principles. Design elements must not only be well designed, but they must also work together. Therefore, it is necessary to pay attention to the guidelines for making a display layout by arranging layout elements such as text, images, animations, and videos. The four basic principles of user interface layout are:

- **Unity.** Design elements should be placed in such a way that they constitute a unity of information.
- **Balance.** Design elements must be placed in such a way that there is an overall balance.
- **Rhythm.** You can create more than one vertical and horizontal cadence line(grid). These lines are used to place design elements.
- **Continuity.** Information is easy for users to understand if it has a good flow and few distractions hinder it. An information flow can be said to be continuous and harmonious if its appearance reflects the continuity from

one part to another. Continuity can be created by having pages have a style, shape or color that gives the user a sense of continuity with other pages.

2.3. Category Theory

As early as in ancient Greece, Aristotle wrote his famous „Categories“, which explored the classification of objects that can be recognized by humans. In the context of modern mathematics, categories have other meanings and precise mathematical definitions. Category theory has expanded into most fields of modern mathematics in a very short period of time, and category theory is the language and thinking way of describing abstract mathematical structures. [7]

With functors as morphisms, all categories form a larger Cat. So naturally, we have the notion of isomorphism between categories: as isomorphisms within other categories, two categories X , Y are isomorphic if and only if there are two functors $F: C \rightarrow D$, $G: D \rightarrow C$, so that both sides are identity functors after they are combined, as shown in Figure 2 below:

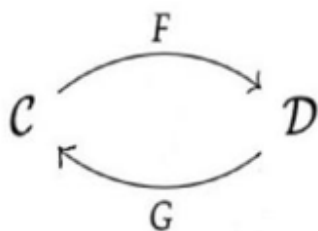


Figure 1. Category isomorphism

The concept of „isomorphism“ is defined by a compositional functor, a thinking way that is consistent with the philosophy of category theory, which defines mathematical structures in terms of morphisms. In other words, the basic ideas of category theory reflect the way we organize the structure of information. The idea that morphism represent category has been widely used in the foundations of mathematics. For example, a subgroup can be equivalently regarded as a single group homomorphism, and the quotient group (or normal subgroup) of a group can be equivalently regarded as a full group homomorphism; thus, a subset can be equivalently defined in terms of injective, a quotient can be equivalently

expressed in terms of surjective. Developing this idea, the concept of homology which measuring the difference between the exact sequence and the surjective of the category can be defined.

Category theory is the study of mathematical structures in a concise, general and abstract way. For example, in topology, a doughnut is the same as a coffee cup. According to category theory, they are isomorphic in a category Top, the object is a topological space, and the arrow is a continuous map (i.e., continuous transformation), so a doughnut and a coffee cup are homeomorphic.

The advantages of category theory is A very obvious trend in the development of modern science is the division between disciplines; knowledge in different fields seems to be divided more and more finely, and it is more and more difficult for us to have an overall understanding of it. At the conceptual level, category theory unifies definitions and concepts from different branches of mathematics. Category theory has partially unified the division of mathematics at the conceptual level, and it has found the same conceptual basis among different branches of mathematics

III. MODEL OF STRUCTURED THINKING

3.1 Break down the problem

In job interviews, you may face a brain teaser like one of these. “What’s the point of guessing the answer to a question when you can just take five seconds and Google it?” you might wonder. The purpose isn’t to make you sweat and scream curse words in your head but to test your capacity for structured thinking and your ability to use logic, practice deduction, and build a great answer by asking many small questions.

With structured thinking, you methodically break down problems and solve them piece by piece rather than worrying, relying on past assumptions, or shrugging in absolute cluelessness. A hypothetical story about asking two job candidates the same question: How tall is the spire on the building they’re in? In this scenario, one candidate happens to know the answer. The other steps outside measure the building’s shadow against her own and gives a rough estimate. “Who are you gonna hire?” Tyson said. “I’m hiring the person who figured it out. ‘Cause that person knows how to use the mind in a way not previously engaged.” [8]

Tools for improving critical thinking

There are 4 ingredients [9] required to make a good an awesome business analyst:

1. Passion for Business Analytics
2. Structured thinking
3. Love for statistics and numbers
4. Business domain knowledge

The tactics and practices mentioned to improve number-crunching abilities and help you apply analytical thinking in day-to-day activities. In addition, there are some exercises to improve structured thinking.

3.2 Rational thinking

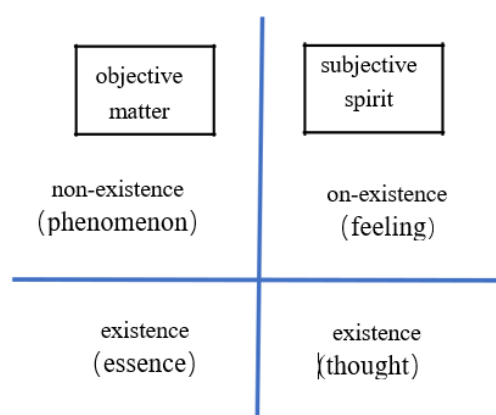


Figure 2. Parmenides' model of rational thinking [10]

After the Renaissance, modern philosophy, physics, mathematics, and neuroscience developed by leaps, the cognition of rational thinking underwent an enormous change, and Descartes put forward the famous slogan "I think, therefore I am" [10], which is logically impossible to refute, that is, all the world of experience, all senses, and all idea are some kinds of illusion. But the existence of this activity itself indicates a being, which is "I", and rational cognition of the world can only proceed from doubt. Only mythical, religious, linguistic, artistic, historical, and scientific symbols can be created and applied in man. Man use symbols to create culture, and the creation and use of symbols is the difference between humans and animals [12].

The various concepts that appear in our thinking and verbal expressions are logically free creations of the mind. They cannot be derived inductively from sensory experience. [13]

3.3 Natural Transformations

To study the structural characteristics of brain thinking, it is necessary to study further the structural aspects of scientific theories, that is, to categorize and axiomatize scientific theories. From the perspective of categorization, the isomorphic characteristics of theoretical models of different disciplines and the categorization characteristics of brain thinking can be shown in Galileo transformation. The transformation is written in matrix T . T connects the two systems and keeps the related physical phenomena consistent in the two systems [14].

Functors and their natural transformations fully demonstrate that the brain has the transcendence of creative thinking, which is manifested everywhere in the process of major scientific discoveries [15]. A scientific theory has its specific mathematical structure, which originates from scientists' free creation. In the process of free products, scientists consciously or unconsciously apply the ideas of category theory. The structured view of category theory simplifies the complex and tentative thinking process, making the thinking process clear and structured. Therefore, category theory is critical in knowledge expression and reasoning. Thinking based on category theory has gradually become a typical paradigm in innovative thinking.

IV. CONCLUSION

Most of the research on innovative thinking is based on neuroscience. This paper analyzes the limitations of existing research methods from the perspective of category theory and proposes a research model on innovative thinking based on category theory. Furthermore, this paper applies the thinking method of categorical equivalence to analyze the creation process of two landmark scientific theories in the history of science, the case is real, and a clear mathematical argument is provide.

Category theory studies structure formed by the relation between objects, so the research focuses on the relationship between objects. Concepts in category theory such as morphism, functor, natural transformation, and isomorphism are the representation of relationships. In a category, the object only needs to satisfy its morphism relation. Category theorists do not need to point out

or care about what constitutes an object; a single object has no significance in a category. The connection between objects is the focus of category theory.

Category theory deals with mathematical concepts abstractly, turning these concepts into sets of morphisms. If we have two theories, each represented as a category whose object is the theoretical model, the morphism preserves the structure of the model in a practical sense. If there is an equivalence relation for these categories, we can say that the two theories are categorically equivalent.

Many scientific theories can be described as a collection of certain mathematical structures. There are two main reasons for applying the equivalence of category theory in studying scientific theories. First, the inherent properties of scientific theories require, for example, the theory has the property of coordinate transformation invariance (isomorphism). Second, the equivalence idea of category theory can simplify theoretical models so that the model can be greatly simplified and the research work can be achieved easily. The structured thinking way has a great revelation and helps to master and create new scientific theories

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DESIGNING DATA AND INFORMATION ARCHITECTURE FOR ELECTRONIC-BASED GOVERNMENT SYSTEMS

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Abstract

The study is part of an issue of women's empowerment and child protection. It handles cases of violence against women and children. The objective is to develop data and information architecture and the domain of a government work unit (SKPD) for women's empowerment and child protection. This paper studies the implementation of a model of object-oriented design and analysis based on the business process. The structured thinking method has a great revelation and helps create the data and information architecture and domain..

Keywords: violence, women's empowerment, children protection, object-oriented design

I. INTRODUCTION

The development of Information Technology (IT) and Information Systems (IS) has overgrown in various fields of life. One of the areas affected by these changes is the application of smart cities in governance management in Indonesia to move towards a government system called the Electronic-Based Government System (SPBE). [1] It means that governments seek to enable the public, employers, and their government programs to better take advantage of the wealth of state data that can be fed into applications and services by ensuring that data is accessible and readable by systems automatically. Governance of the government system is included in one of the aspects of a smart city, namely smart government or E-government. [2] Today, various city administrations around the world are experimenting with emerging technologies, such as the Internet of Things (IoT), cloud computing, sensor networks, and artificial intelligence (AI) [3]. According to the government, the appropriate use of information and communication technology, especially the Internet, can increase citizens' satisfaction with the government. Similarly, better and more convenient services, more accessible and complete information, and

new and better communication channels can reduce information gaps and increase citizens' trust in the government. To implement an electronic-based government, the Indonesian government has challenges integrating planning, budgeting, procurement, and performance management services. SPBE evaluation is an effort the Indonesian government must achieve to improve the implementation of smart governance in Indonesia. [1] The index of evaluation is shown in Table I.

Table I. Evaluation index

NO	SCORE	PREDICATE
1	4,2 – 5,0	Excellent
2	3,5 – < 4,2	Very good
3	2,6 – < 3,5	Good
4	1,8 – < 2,6	Acceptable
5	< 1,8	Poor

Through presidential decree number 5 of 2018 concerning guidelines for evaluating electronic-based government systems, the government aims to increase the achievement index of the

national ranking of each region in Indonesia. This assessment instrument is used to measure the progress of implementing the Electronic-Based Government System in Central Agencies and Local Governments. Therefore, it is necessary to pay attention to Table 1 regarding the SPBE predicate index.

1.1. Electronic-Based Government System Development

In developing SPBE, including thinking about the business processes of each government work unit (SKPD).

Each government work unit must have gone through different processes to achieve business goals. It is the core of the entire business operation. For more details, let us understand what is meant by a business process. [4]

1. Main Process (Primary)

This process becomes the core of the company's operations related to the primary value stream in the business. There are three phases in this process including:

- Production
- Marketing
- Service to customers

By carrying out these three stages, a company has added value to the final offer and successfully delivered it to the customer. This means that business operations have been running according to plans and objectives.

2. Support Process (Secondary)

This process does not add value directly to the final product. However, this process focuses on preparing an environment that can support the primary functions effectively and efficiently. This support process ensures that the company's operations continue to run. It means that this process focuses on serving the internal company.

3. Process Management

In its implementation, the management process requires the involvement of supervision, planning, and monitoring.

This process will regulate all activities, management, and strategic management of the organization or company.

The Guidance for the integration of business processes, data, and public services is prepared for 5 years. Business process based on Permenpan RB no 11 of 2015. [6] Structuring business processes

1. Clean and accountable bureaucracy
2. Effective and efficient bureaucracy
3. Bureaucracy that has quality public services.

The effectiveness of regional apparatus organizations depends on the components of business processes. Vision, mission and objectives, business processes, organizational design, organizational structure, job analysis, job descriptions, job specifications. An OPD must have these business processes to be aligned and consistent. Development of Business Process

1. Development Stage
2. Implementation Stage

Development stage: input, probes, output. The process with BPMN business process model and notation. It is an international standard of open management. How to create a business process

1. Determine the initial and final conditions
2. Define steps and stages to achieve the final condition.
3. Identify needs and requirements
4. The first step starts from the first input condition

1.2. Data and Information Architecture

The database is an architecture that considers the following design principles. It facilitates the emergence of new services developed by Smart Cities governments, organizations, or citizens.

The Presidential Regulation No. 95 of 2018 concerning electronic-based government systems states that the data architecture domain requires data management, which is carried out through a series of processes for managing data architecture, master data, reference data, databases, and data quality. Designing data and information architecture reference and domain uses object-oriented analysis design.

Object-Oriented Analysis and Design.

Object-Oriented Design (OOD): An analysis model created using object-oriented analysis is transformed by object-oriented design into a design model that works as a plan for software creation [5]. OOD results in a design having several

different levels of modularity. The primary system components are partitioned into subsystems (a system-level “modular”), and data manipulation operations are encapsulated into objects (a modular form that is the building block of an OO system.). In addition, OOD must specify some data organization of attributes and a procedural description of each operation. Figure 1 shows a design pyramid for object-oriented systems. It has the following four layers. We focus on the Class and Object Design Layer

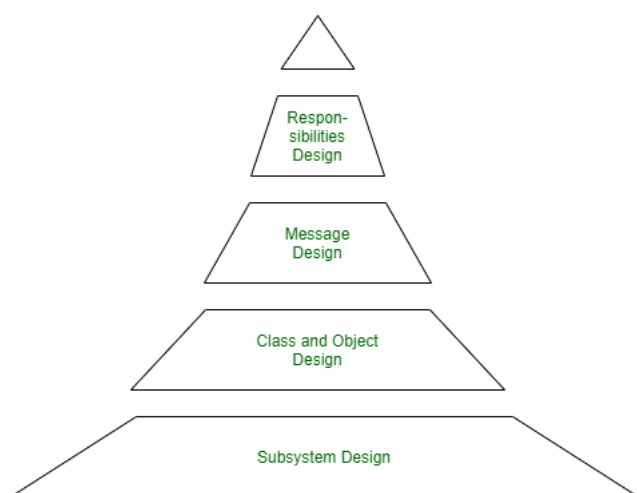


Figure 1. Layers of Object-Oriented systems

II. METHOD

The object of this research is part of an issue of women’s empowerment and child protection. The focus of the study is handling cases

of violence against women and children. First of all, we have to look at the business processes that exist in this case. Next, we determine the class, object, and attributes with OOD. The next step is creating the reference of data architecture based on a standard worksheet form.

III. DISCUSSION

3.1 Business Process

The business processes in this case are:

Perform analysis or assessment
Preparation of follow-up plans
Carry out outreach and case handling
Assist victims of violence
Evaluate the results of handling
Violence cases enter the legal process
Legal process assistance
Reporting the results of case assistance
Report results
Reconciliation of the parties
Problem solved
Report handling results.

3.2 Object-Oriented Design

Based on the business process above, the system can be defined. In the object-oriented diagram, it can be seen that there is one class, namely Case Handling, with its derivative objects, namely Victim, Type of violence, Complaints of violence, Violence Handling, and Counseling.

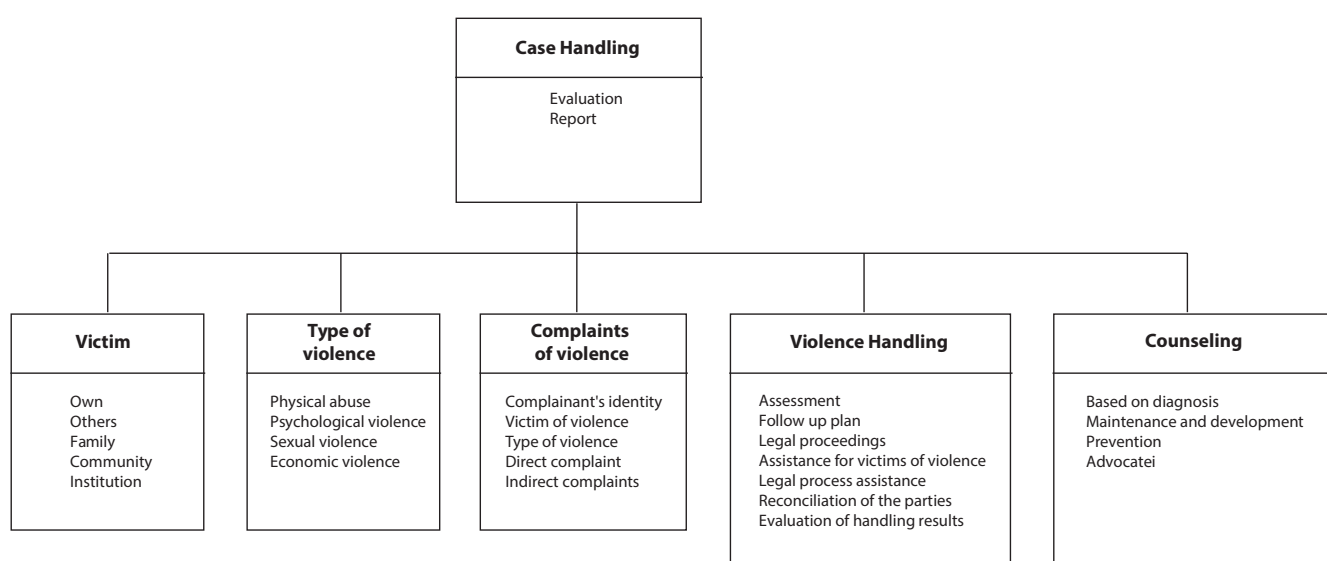


Figure 2 Object -Oriented Diagram

4	ID Data	Name of data	→ RAD Level 1 National (Dependency)	↑ RAD Level 2 (Dependency)	Suggestion RAD Level 3	Suggestion RAD Level 4
5	BJMD-16.06	Case handling	RAD.04 Information on Social Protection and	RAD.04.03 Data on women's empowerment	RAD.04.03.06 Case handling	
6	BJMD-16.06.01	Legal proceedings				RAD.04.03.06.01 Legal proceedings
7	BJMD-16.06.02	Accompaniment				RAD.04.03.06.02 Accompaniment
8	BJMD-16.06.05	Reconciliation of the parties				RAD.04.03.06.03 Reconciliation of the
9	BJMD-16.06.04	Evaluation of treatment results				RAD.04.03.06.04 Evaluation of treatment
10	BJMD-16.07	Counseling			RAD.04.03.07 Counseling	
11	BJMD-16.07.01	Based on diagnosis				RAD.04.03.07.01 Based on diagnosis
12	BJMD-16.07.02	Maintenance and development				RAD.04.03.07.02 Maintenance and
13	BJMD-16.07.03	Prevention				RAD.04.03.07.03 Prevention
14	BJMD-16.07.04	Advocacy				RAD.04.03.07.04 Advocacy

Figure 2 Data reference architecture

The important object is Violence Handling with several attributes of data and information, i.e. Assessment, Follow up plan, Legal proceedings, Assistance for victims of violence, Legal process assistance, Reconciliation of the parties, and Evaluation of handling results. The object-oriented design is used to create architecture and domain, as shown in Figure 3.

IV. CONCLUSION

It made a data reference architecture using a form tool by creating an object-oriented two grams. With this diagram, avoid duplication of data. Making diagrams is done manually because it requires thinking and analyzing the data and its relationship to other data. In OOD theory, a process can be an object with several attributes.

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