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Education Gamification and Student Motivation: A Case Study of Chinese Language Education

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Abstract:

A new generation of pupils has grown up with a strong familiarity with technology in the context of Industry 4.0. This technological revolution has made learning a foreign language more critical. However, learning a foreign language can only be accessible with that crucial component- motivation. The purpose of this study was to find out how students' motivation to learn Mandarin was affected by gamification. A gamification application was designed with the Game Development Document (GDD) as a foundational guide, utilizing the Mechanics, Dynamics, and Aesthetics (MDA) architecture. Two schools participated in the experimental research project, with 56 and 58 students divided into control and experimental groups. A questionnaire gathered data, and SPSS was used to compute Cronbach's Alpha. The results showed that gamification increased students' enthusiasm to study Mandarin well. When employing gamification as a teaching strategy, students with different levels of Mandarin proficiency saw varied results. Therefore, gamification can tailor Mandarin language instruction to each student's needs and skill level.

Keywords: *Experiment, Gamification, MDA, Motivation*

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Introduction

Industry 4.0 has given rise to a generation of well-versed students in technologies such as smartphones, computers, and laptops (Rafiola et al., 2020). Generation Z students represent the first cohort to grow alongside the ongoing technological advancements. This has resulted in behavioural differences between students from this era and previous generations. Consequently, the approach to education needs to evolve to align with these contemporary developments (Saxena & Mishra, 2021).

In addition to keeping pace with science and technology, mastering language skills is paramount. Acquiring proficiency in a new language is not a straightforward task, and as a result, only some possess an inherent in learning a foreign language. As noted in previous research from Pinto et al. (2021), several challenges are associated with learning a foreign language. These challenges include teacher training, inadequate facilities, non-specialized learning materials, and insufficient feedback for students' errors. Despite ongoing efforts to create a more conducive learning environment, students' motivation towards language learning has not been given due consideration. While the quality of learning content has improved, students' commitment is not guaranteed (Arce & Valdivia, 2020).

Motivation plays a crucial role in increasing students' learning of a new foreign language. Motivation can be intrinsic and extrinsic (Wardani et al., 2020). Intrinsic motivation is driven by the inherent desire to achieve a goal, while extrinsic motivation relies on external factors such as rewards and punishments to encourage action. Both types of motivation can be derived from various sources, but intrinsic motivation tends to have a more significant influence (Vu et al., 2021)

A gamification is an approach that can influence both intrinsic and extrinsic motivation (Razali et al., 2020). Gamification involves integrating game elements into non-gaming contexts, such as educational applications. Where gamification is not a typical game, it is essential to distinguish gamification from traditional games (Sailer & Homner, 2020). Elements of a game, such as leaderboard and competition, have impacted the users, giving them an engaged and fun experience in gamification (Schöbel et al., 2020). An example of gamification in practice is the Quizizz application, which enhances students' extrinsic motivation through gamification elements (Razali et al., 2020). Implementing gamification in online learning has been shown to boost students' motivation, even though it comes with certain limitations compared to traditional offline learning (Dirgantoro et al., 2022).

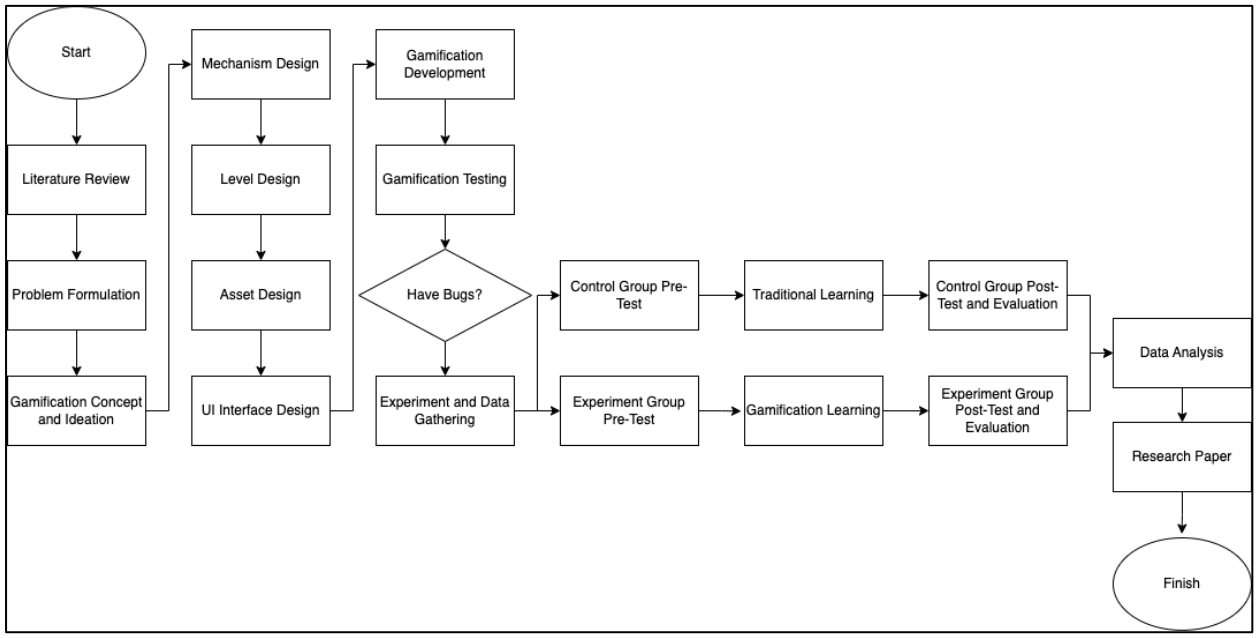
Gamification can be applied in most learning environments to enhance the overall learning experience (Cespón & Lage, 2022). The gamification design should consider a method to ensure the intended targets and objectives are appropriately aligned. This research uses the MDA (Mechanics, Dynamics, Aesthetics) framework to design gamification. Mechanics pertain to the rules of the game, dynamics govern the interaction between users and the game, and aesthetics relate to users' emotional responses to the dynamics (Angelia & Isa, 2020).

Research from Ng et al. (2022) and Ofosu-Ampong (2020) shows that gamification has increased engagement and academic achievements in Mandarin learning. In contrast, research from Chee et al. (2020) shows that gamification is not an effective learning method for all students. Thus, this research aims to assess the impact of gamification on the motivation of Batam City students to learn Mandarin. The gamification application will be designed using the MDA method and developed using Unity. The study employs an experimental method that includes both a control and an experimental group. The effectiveness of the gamification application in enhancing motivation for learning Mandarin will be rigorously tested in this study.

Research Method

This research employs an applied and experimental methodology to develop a learning media with gamification and to comprehend the effect of gamification on students' learning motivation towards Mandarin. The gamification will be implemented using the MDA (Mechanics, Dynamics, Aesthetics) framework and tested through an experimental approach with control and experimental groups (Arce & Valdivia, 2020; Cespón & Lage, 2022; Liu & Lipowski, 2021). The research flow is illustrated in Figure 1.

Figure 1. Research Flow



MDA framework is a widely used framework for designing gamification and comprises three key components: mechanics, dynamics, and aesthetics (Putra & Yasin, 2021). The output of the MDA framework is a Game Development Document (GDD) used to create the gamification application. The details of the MDA application are described as follows.

Mechanics

In this phase, the product specifications, game overview, and gameplay of the gamification are determined and documented in the GDD. Product specifications include the name and description of the gamification. The game overview encompasses the platform, genre, target audience, objectives, and the flow of the gamification. Game play and mechanics define how the gamification operates and the win-lose conditions.

Dynamics

The dynamics phase involves the creation of storyboards and the formulation of game rules. Storyboards illustrate how the gamification will operate through sketches created using MediBang Paint and Huion Kamvas 13. Game rules provide a detailed version of game play and mechanics, including the game duration, point system, and leaderboard system.

Aesthetics

Aesthetics pertain to the design of assets and the user interface for the gamification app. Assets are created using MediBang Paint and Huion Kamvas 13, while the gamification's interface is designed using Figma.

The GDD from the MDA framework is subsequently developed using Unity 2022 and Visual Studio 2019, with programming carried out in the C# language (Figure 2). Unity is a cross-platform game engine developed by Unity Technologies, released in 2004, and supports various game platform developments, including virtual reality, augmented reality, 3D, 2D, and mobile (Hussain et al., 2020). Visual Studio is an Integrated Development Environment (IDE) created by Microsoft, suitable for C# development and 35 other programming languages (Popescu & Costache, 2019).

Following the completion of gamification development, the research proceeds to the experimental phase. Participants in the experiment are students from ABC High School and XYZ High School. Participants are divided into two groups: the control group, which will learn Mandarin using traditional methods, and the experimental group, which will learn Mandarin using the pre-developed gamification. Both groups will undergo pre-tests and post-tests to assess the differences in their comprehension after learning. The pre-test and post-test are shown in Table 1. After the experiment concludes, an evaluation will be conducted to understand how both learning methods affect motivation to learn

Mandarin. Following with Chee et al. (2020), the evaluation for this experimental study should be focused on learning motivation. The questionnaire for evaluation is presented in Table 2.

Figure 2. Gamification Development

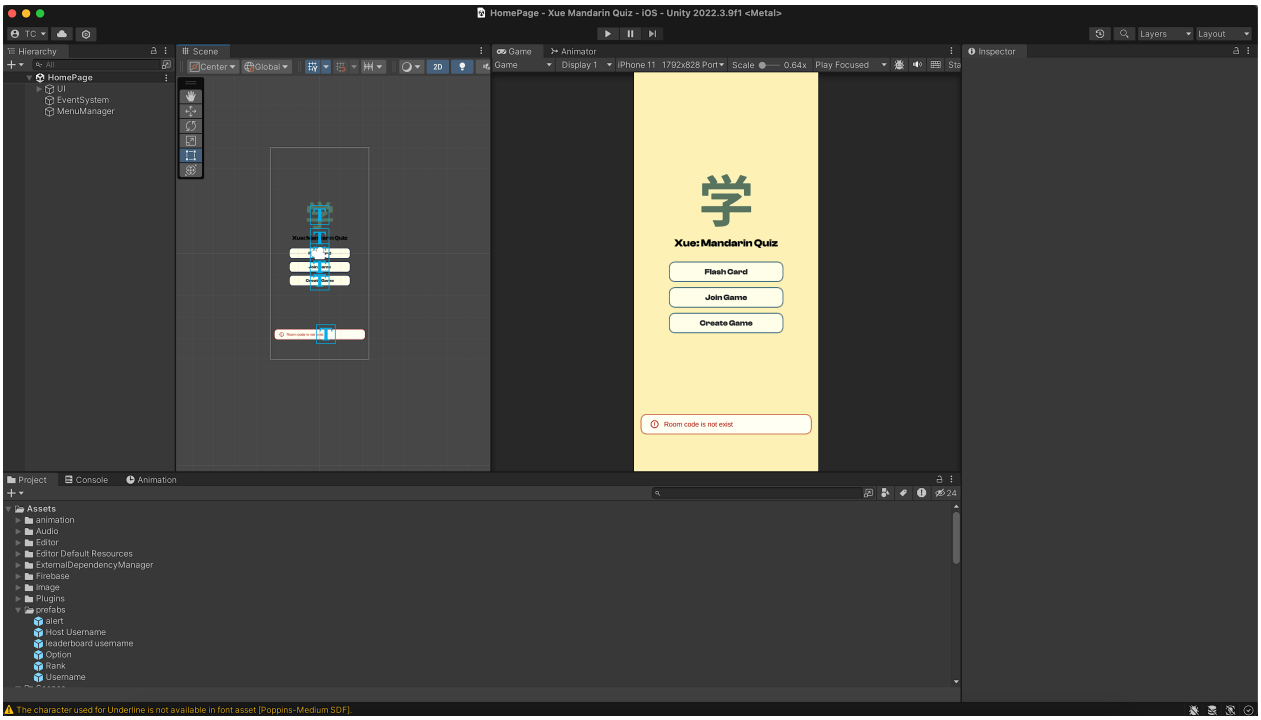


Table 1. Pre-Test and Post-Test

No	Question
1	What is the Hanyu Pinyin of “问”?
2	What is the Hanyu Pinyin of “长”?
3	What is the Hanyu Pinyin of “两”?
4	What is the meaning of "问"?
5	What is the meaning of "长"?
6	What is the meaning of "两"?
7	What is the Hanyu Pinyin of “给”?
8	What is the Hanyu Pinyin of “非常”?
9	What is the Hanyu Pinyin of “已经”?
10	What is the meaning of "给"?
11	What is the meaning of "非常"?
12	What is the meaning of "已经"?
13	What is the Hanyu Pinyin of “快乐”?
14	What is the Hanyu Pinyin of “介绍”?
15	What is the Hanyu Pinyin of “晚上”?
16	What is the meaning of "快乐"?
17	What is the meaning of "介绍"?
18	What is the meaning of "晚上"?
19	What is the Hanyu Pinyin of “生日”?
20	What is the Hanyu Pinyin of “开始”?
21	What is the meaning of "生日"?
22	What is the meaning of "开始"?

The quality of responses from the evaluation will be assessed using Cronbach's Alpha with the assistance of SPSS. The pre-test and post-test results will be averaged across all participants in both groups to compare the understanding of each group following the experiment with either traditional learning methods or gamification.

Table 2. Evaluation Questionnaire

No	Question
1	I feel like understanding the topic with gamification/traditional learning method
2	I feel like having an active interaction in the classroom with gamification/traditional learning method
3	I feel competitive to win against my peer
4	I feel like my interest toward Mandarin increase
5	I feel motivated to learn Mandarin with gamification/traditional learning method
6	I feel happy to do gamification/traditional learning method with Mandarin
7	I feel satisfied by what I have learned with gamification/traditional learning method
8	I like to play the developed gamification
9	I want to do gamification/traditional learning method with Mandarin again

Result and Discussion

Applied Method

The applied methodology in this project results in three main outcomes: the Game Development Document (GDD), the User Interface (UI) design, and the gamification application. The GDD is a comprehensive document with eight key sections, covering product specifications, an overview of the game, game mechanics, levels, game rules, storyboards, assets, and the user interface.

In terms of the gamification concept, a quiz game was designed with flashcards and a leaderboard feature to complement the learning experience. The flashcards are used as the primary tool for learning, and the leaderboard enhances the competitive aspect of the gamification. The intended users for this gamification are high school students in Batam, and the gamification designed to work on both iOS and Android platforms. The core idea is that users have 10 seconds to answer quiz questions, and their scores are determined by how quickly they respond.

The UI design is based on the specifications outlined in the GDD (Figure 3). On the home screen, users will find three buttons for flashcards, joining a game, and creating a game. When a flashcard is selected, it will reveal the answer to the question. The quiz functionality is divided into three parts: joining a game, creating a game, and participating in the quiz. To join a quiz game, users use the 'join game' function and enter a room code. To create a game, users need to use the 'create game' function, which will automatically generate a room code. The owner of the room can start the quiz once all participants are ready. Users who join the quiz will see the questions and three answer choices, and they need to select the correct answer within the given time limit. After completing the questions, the leaderboard will display the results to the users. This UI design is then incorporated into the gamification development process, which is implemented using Unity 2022.3.9f1. The scripting for the gamification is done in Visual Studio 2019, utilizing the C# programming language.

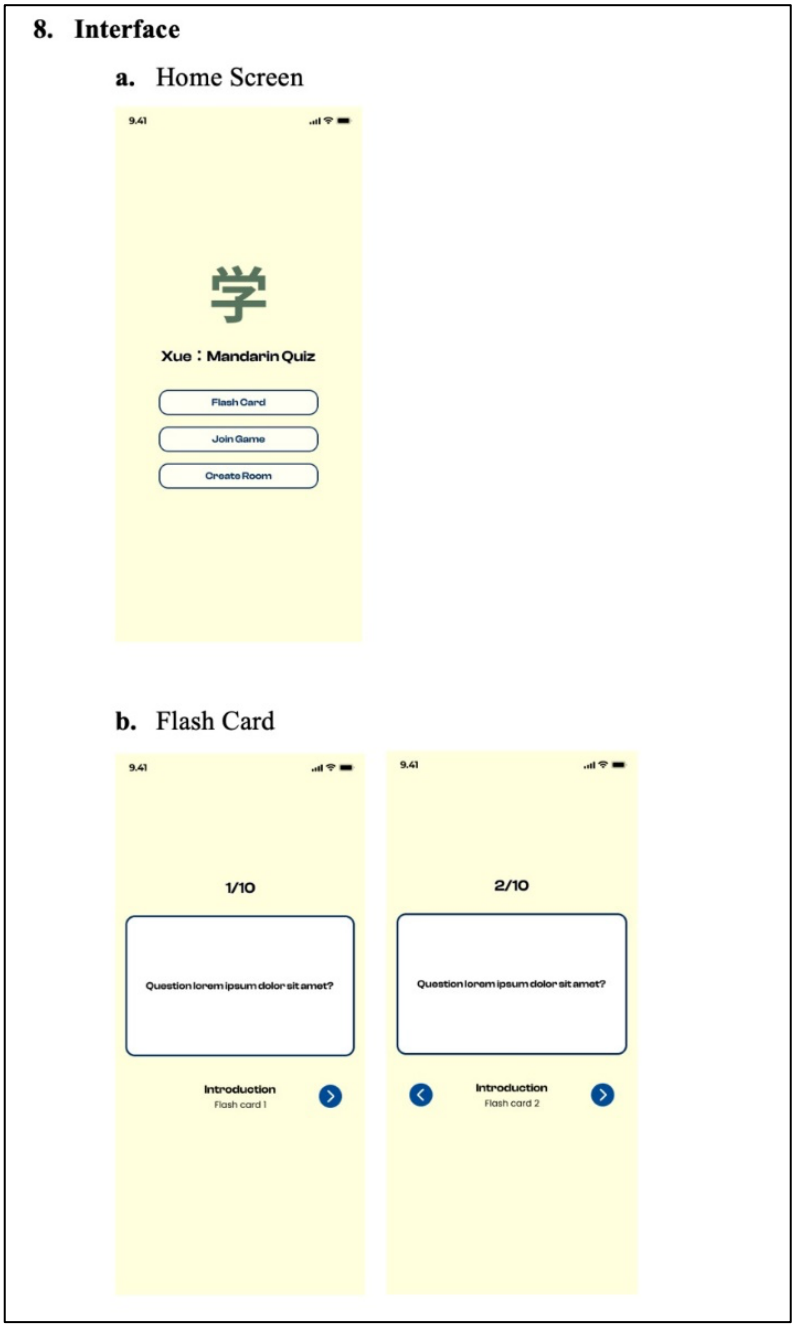


Figure 3. UI Implementation in GDD

Experimental Method

The participant of the research are students from ABC High School and XYZ High School. Total participant from ABC High School are 19 participants from control group and 22 participants from experiment group. The participant from XYZ High School are 36 participants from control group and 36 participants from experiment group.

Both groups from both schools were exposed to the same experimental environment. After collecting and analysing the responses from the evaluation questionnaire, the Cronbach's Alpha value was calculated using SPSS. To ensure the reliability of the test results, the Cronbach's Alpha value should ideally around 0,70-0,90 (Olaniyi, 2019). The results indicate a Cronbach's Alpha value of 0.840 for the control group and 0.898 for the experiment group (Table 3). The calculated Cronbach's Alpha values for both the control group and the experiment group demonstrate the reliability of the evaluation results.

Table 3. Cronbach's Alpha Result

Group	ABC High School	XYZ High School
Control Group	0,840	0,898
Experiment Group	0,909	0,908

Pre-test and post-test result of both schools shows improvement after learning. Both test result that conducted on ABC High School and XYZ High School are shown in Table 4 and Table 5.

Table 4. Pre-Test and Post-Test Result from ABC High School

Group	Test	Range	Mean
Control Group	Pre-Test	25-55	37,5
Control Group	Post-Test	35-110	86,14
Experiment Group	Pre-Test	25-100	52,65
Experiment Group	Post-Test	90-100	104,74

Table 5. Pre-Test and Post-Test Result from XYZ High School

Group	Test	Range	Mean
Control Group	Pre-Test	30-110	88,11
Control Group	Post-Test	55-110	99,14
Experiment Group	Pre-Test	35-110	99,44
Experiment Group	Post-Test	65-110	107,08

Students from ABC High School from both groups have a significant improvement on the test score. The score of control group have increased for 43% and experiment group have increased for 50% with a mean difference of 51,64 and 52,09. Both learning method have brought an improvement in terms of understanding for both control and experiment group.

While students from XYZ High School also have a slight improvement on the test score. The score of control group have increased for 10% and experiment group have increased for 6% with a mean difference of 11,03 and 7,64. Both learning method have brought an improvement in terms of understanding for both control and experiment group.

The research on ABC High School control group have shown that students have understood Mandarin using traditional learning method (89%). The traditional learning method also bring an active interaction in the class when learning Mandarin (92%). Students have the tendency to compete with their peer in the learning process (74%). The traditional methods also increase the students' intention and motivation to learn Mandarin (82%). Learning Mandarin using traditional method made the students' feel satisfied and happy (83% and 85%). Students who follow the traditional learning method have the will to learn Mandarin using the similar method (80%). The conclusion of the evaluation is shown in Table 6. The evaluation consists of 5 indicators: very disagree (VD), disagree (D), neutral (N), agree (A), very agree (VA).

Table 6. Control Group Evaluation ABC High School

Question	VD	D	N	A	VA
I feel like understanding the topic with traditional learning method	0%	0%	10,5%	31,6%	57,9%
I feel like having an active interaction in the classroom with traditional learning method	0%	0%	0%	36,8%	63,2%
I feel competitive to win against my peer	5,3%	0%	36,8%	31,6%	26,3%
I feel like my interest toward Mandarin increase	0%	0%	15,8%	57,9%	26,3%
I feel motivated to learn Mandarin with traditional learning method	0%	0%	26,3%	36,8%	36,8%
I feel happy to do traditional learning method with Mandarin	0%	0%	21,1%	42,1%	36,8%
I feel satisfied by what I have learned with traditional learning method	0%	0%	21,1%	36,1%	47,4%
I like to play the developed gamification	0%	5,3%	26,3%	36,8%	31,6%
I want to do traditional learning method with Mandarin again	5,3%	0%	15,8%	47,4%	31,6%

While the research on experiment group from ABC High School have shown that students have quite understood Mandarin using gamification learning method (68%). The gamification method also brings an active interaction in the class when learning Mandarin (75%). Students slightly have the tendency to compete with their peer in the learning process (61%). The gamification learning methos also slightly increase the students' intention and motivation to learn

Mandarin (59% and 66%). Learning Mandarin using gamification learning method made the students' feel satisfied and happy (79% and 71%). Students who follow the gamification learning method have the will to learn Mandarin using the similar method but not significant (65%). The conclusion of the evaluation is shown in Table 7. The evaluation consists of 5 indicators: very disagree (VD), disagree (D), neutral (N), agree (A), very agree (VA)

Table 7. Experiment Group Evaluation ABC High School

Question	VD	D	N	A	VA
I feel like understanding the topic with gamification	4,5%	9,1%	40,9%	31,8%	13,6%
I feel like having an active interaction in the classroom with gamification	9,1%	4,5%	9,1%	54,5%	22,7%
I feel competitive to win against my peer	18,2%	13,6%	22,7%	31,8%	13,6%
I feel like my interest toward Mandarin increase	13,6%	18,2%	36,4%	22,7%	9,1%
I feel motivated to learn Mandarin with gamification	9,1%	18,2%	22,7%	31,8%	18,2%
I feel happy to do gamification with Mandarin	0%	22,7%	18,2%	36,4%	22,7%
I feel satisfied by what I have learned with gamification	4,5%	4,5%	13,6%	45,5%	31,8%
I like to play the developed gamification	4,5%	13,6%	22,7%	36,4%	22,7%
I want to do gamification with Mandarin again	9,1%	13,6%	31,8%	31,8%	13,6%

The research on ABC High School shows that by using gamification will have a positive impact but not as significant as the traditional method. This shows that learning using traditional method will be a better choice in ABC High School.

The research on XYZ High School control group have shown that students have quite understood Mandarin using traditional learning method (75%). The traditional learning method also bring an active interaction in the class when learning Mandarin (78%). Students slightly have the tendency to compete with their peer in the learning process (70%). The traditional methos also slightly increase the students' intention and motivation to learn Mandarin (68% and 69%). Learning Mandarin using traditional method made the students' feel quite satisfied and happy (76% and 68%). Students who follow the traditional learning method slightly have the will to learn Mandarin using the similar method (70%). The conclusion of the evaluation is shown in Table 8. The evaluation consists of 5 indicators: very disagree (VD), disagree (D), neutral (N), agree (A), very agree (VA).

Table 8. Control Group Evaluation XYZ High School

Question	VD	D	N	A	VA
I feel like understanding the topic with traditional learning method	2,9%	2,9%	32,4%	41,2%	20,6%
I feel like having an active interaction in the classroom with traditional learning method	0%	11,8%	20,6%	32,4%	35,3%
I feel competitive to win against my peer	2,9%	8,8%	47,1%	31,6%	26,3%
I feel like my interest toward Mandarin increase	11,8%	8,8%	29,4%	29,4%	20,6%
I feel motivated to learn Mandarin with traditional learning method	2,9%	14,7%	38,2%	20,6%	23,5%
I feel happy to do traditional learning method with Mandarin	0%	14,7%	41,2%	29,4%	14,7%
I feel satisfied by what I have learned with traditional learning method	0%	5,9%	29,4%	41,2%	23,5%
I like to play the developed gamification	2,9%	8,8%	29,4%	20,6%	38,2%
I want to do traditional learning method with Mandarin again	2,9%	11,8%	35,3%	29,4%	20,6%

While the research on experiment group from XYZ High School have shown that students have understood Mandarin using gamification learning method (88%). The gamification learning method also bring an active interaction in the class when learning Mandarin (82%). Students have the tendency to compete with their peer in the learning process (81%). The gamification methos also increase the students' intention and motivation to learn Mandarin (79% and 81%). Learning Mandarin using gamification method made the students' feel satisfied and happy (82%). Students who follow the gamification learning method have the will to learn Mandarin using the similar method (81%). The conclusion of the evaluation is shown in Table 9. The evaluation consists of 5 indicators: very disagree (VD), disagree (D), neutral (N), agree (A), very agree (VA)

Table 9. Experiment Group Evaluation XYZ High School

Question	VD	D	N	A	VA
I feel like understanding the topic with gamification	4,5%	9,1%	40,9%	31,8%	13,6%
I feel like having an active interaction in the classroom with gamification	9,1%	4,5%	9,1%	54,5%	22,7%
I feel competitive to win against my peer	18,2%	13,6%	22,7%	31,8%	13,6%
I feel like my interest toward Mandarin increase	13,6%	18,2%	36,4%	22,7%	9,1%
I feel motivated to learn Mandarin with gamification	9,1%	18,2%	22,7%	31,8%	18,2%
I feel happy to do gamification with Mandarin	0%	22,7%	18,2%	36,4%	22,7%
I feel satisfied by what I have learned with gamification	4,5%	4,5%	13,6%	45,5%	31,8%
I like to play the developed gamification	4,5%	13,6%	22,7%	36,4%	22,7%
I want to do gamification with Mandarin again	9,1%	13,6%	31,8%	31,8%	13,6%

The research on XYZ High School shows that by using gamification will have a positive impact towards motivation in learning Mandarin. While traditional learning method have a positive impact but not as significant as gamification. This shows that learning using gamification will be a better choice in XYZ High School.

The Mandarin proficiency rate at ABC High School is lower than at XYZ High School. Consequently, the results of using gamification in both schools have displayed different levels of impact. A study conducted by Loewen et al. (2019) indicates that lower proficiency in a specific language requires more time for learning through gamification. Additionally, motivation to learn using gamification is influenced by teachers and classmates who are learning the language together. Therefore, it is advisable to employ gamification for students who have previously learned Mandarin to enhance their motivation for continued learning.

Conclusion

The gamification application has been successfully developed and is ready for use by students. The research revealed that both learning methods have had a positive impact on students' motivation in learning Mandarin. Gamification is a more suitable option for students with higher proficiency in Mandarin. However, students who lack proficiency in Mandarin may benefit from utilizing both traditional and gamification learning methods to ensure a better understanding of the language. Further research is needed to clarify how proficiency affect gamification as a learning media.

The gamification platform's choice of iOS and Android led to a decrease in classroom interaction. As a result, students tended to study individually using their own devices, rather than actively engaging in discussions with teachers or fellow students. Also, it's time consuming to make sure all students have installed the app in both iOS and Android due to technical difficulties. It is recommended that future research with similar objectives should focus on developing a more interactive and efficient gamification platform. An interactive platform can encourage students to engage in discussions, which, in turn, can lead to a better understanding of the learning material.

Furthermore, the scope of research should not be limited solely to high school students. Future researchers are encouraged to explore the impact of gamification on primary and secondary school students as well. Given that Mandarin is not widely taught in Indonesia, it would be beneficial to investigate the effects of gamification on other subjects to gain a more comprehensive understanding of its potential benefits. This approach could offer valuable insights into how gamification can be applied in diverse educational settings and subjects beyond Mandarin.

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