THE EFFECTS OF 3D CHARACTERS' FACIAL EXPRESSIONS ON STUDENT MOTIVATION TO LEARN JAPANESE IN A GAME-BASED ENVIRONMENT

by

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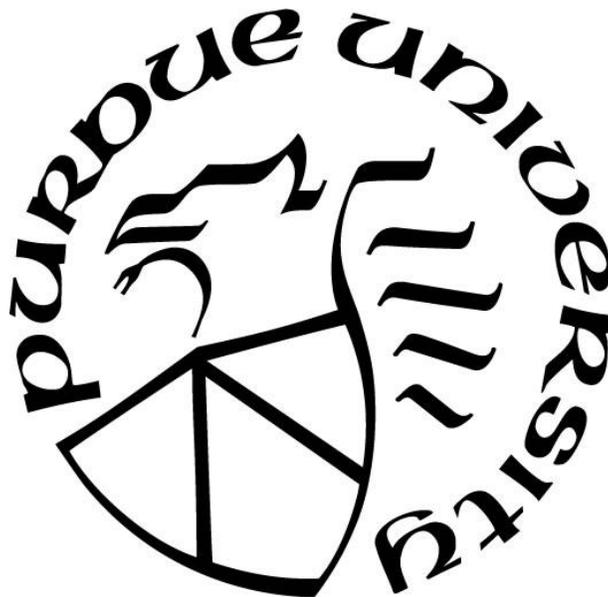
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To my family and friends.

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ABSTRACT

Previous research has shown that student-teacher interaction is very important in motivating students to learn a second language. However, it is unclear whether facial expression, which is one of the most important components of interaction, affects in-game language learning motivation or not. The purpose of this study was to examine whether the game characters' facial expressions would influence the learning motivation of Japanese L2 (second language) students. The researchers of this study developed four versions of a 3D animated Japanese role-playing game. Each version of the game includes characters displaying one of four different facial expression, namely neutral, happy, sad or angry. Two experiments were conducted: a validation study and a motivation study. Before the motivation study, a validation study was conducted to ask participants how realistic each facial expression was. Questionnaires using recognition, intensity, typicality and sincerity as the dependent variables were sent to participants outside of Japanese departments of Purdue and other universities. After validating all the facial expressions of five main characters in the game, 84 college students from 200/300 level Japanese courses joined in the motivation study voluntarily. They played a version of the game assigned randomly to them and then did a post-questionnaire. Conclusions were drawn based on the survey results. The findings of this research suggested that virtual characters' facial expressions in game had no significant effect on participants' learning motivation. However, for the factor years of learning Japanese, the significant effect was found on the variable time spent, realism for character appearance, immersion into games and interaction with characters. Meanwhile, it was found that the two factors, facial expression and years of learning Japanese, had an interactive effect on the variable immersion into games. Furthermore, significance was found in gender on the four variables learning motivation, realism for character appearance, immersion into games and attention on in-game characters. Overall, it was concluded that facial expressions did not affect the learning motivation of Japanese L2 student

CHAPTER 1 INTRODUCTION

This chapter presents a basic overview of this research in order to facilitate a macroscopic understanding of the issue addressed. It provides general information including the problem and purpose statement, research question, scope, significance, assumptions, limitations, delimitations and key terms.

1.1 Problem and Purpose Statement

The problem addressed by this research is that researchers currently have minimum knowledge on whether facial expression, which is one of the most important portions of interaction, affects the learning motivation of Japanese L2 students or not. After the literature review, it is found that although there are a few studies determining the relationship of instructors' facial expressions with learners' learning motivation in general, few studies have been conducted on the effect of each individual facial expression on learning motivation. This research is designed to find out the evidence demonstrating the facial expressions of the other party, in this case, virtual characters in game, will or will not influence the learning motivation of Japanese L2 students.

The main purpose of this research is to answer the following research questions (RQ):

- **RQ1:** Do characters' facial expressions in 3D game affect the learning motivation of Japanese L2 students?
- **H0:** Facial expressions have no effect on language learning motivation.
- **H1:** Facial expressions have an effect on language learning motivation.

Meanwhile, this research is to answer the following research questions in order to seek out whether there are other potential elements that influence learning motivation or not:

- RQ2: Do characters' facial expressions in 3D game affect any other examined variables?
- RQ3: Do participants' years of learning Japanese affect any of the examined variables?
- RQ4: Does gender affect any of the examined variables?
- RQ5: Is there any significant interaction effect in between characters' facial expressions and participants' years of learning Japanese on any of the examined variables?

1.2 Scope

This research centered on the perception of facial expressions of computer-generated characters in 3D games, including realism for characters' facial expressions, appearance and reaction. Although many different uses of computer-animated characters (education, film) can be compared, simply for ease of study computer-animated characters from 3D games were studied in this research. At the same time, it centered on the effect of facial expressions on learning motivation although there may be other elements that influence participants' motivation.

Additionally, it centered on the effect of facial expressions on Japanese learning motivation. It is much easier to define a narrower field to study and the result can be applied to other language learning.

1.3 Significance

Why would it be useful to study the effect of facial expressions in 3D game on Japanese learning motivation? There are many reasons that show that the information would be very valuable to both language educators and CGT researchers. To the best of the author's knowledge, there is no similar research conducted in the past.

Previous research has shown that interaction is a very important factor in motivating students to learn a second language. Instructors' personal role and enthusiasm are also key to motivate the students. Therefore, educators need to understand what facial expressions can better motivate students to learn language. This research intends to tell educators the impact of facial expressions in teaching.

In terms of theoretical significance, there are many academic theories and books on learning motivation, such as Dornyei (Dornyei, Cheng, 2007) and Ebata's theory (Ebata, 2008) on motivation and success. Also, Jeng-Chung Woo (Woo, 2014) and Obrentz's (Obrentz, 2012) conducted research regarding motivation in areas other than language learning. However, studies on the effect of facial expressions on language learning motivation are rare. In order to address this lack, this research explored and built a reasonable theory system by connecting animation, game, language studies to computer interaction and psychology theories, such as learning motivation and immersion into games, and provided CGT field with innovative topics. The

research can provide language learning games developers with theoretical basis for creating suitable games for different groups of language learners.

1.4 Assumptions, Limitations and Delimitations

1.4.1 Assumptions

This research assumes the following to be true:

- Participants will be able to complete the gameplay.
- Participants will be able to view the in-game animations.
- Participants will be able to perceive the facial expressions as expected.
- Participants will be able to read and understand English, specifically the questions and instructions given in the tests.
- The Japanese language ability of participants will be sufficient to understand the in-game text.
- Participants will answer questions accurately and honestly.

1.4.2 Limitations

The limitations of this research are as follows:

- In addition to characters' facial expressions there may be other in-game elements that will affect participants' learning motivation, such as in-game environment, game story, character animation, game interactivity, etc. Because these in-game elements cannot be removed, there is no way to neglect their effects. Since all participant groups will be exposed in the same gaming environment, the effects of game environment, game story, character animation, game interactivity will be across groups, and such effect will have minimum impact on the final results.
- Participants may not pay much attention to in-game characters' facial expressions. In this case, the effect of facial expressions on them cannot be measured correctly, which might result into biased data.

1.4.3 Delimitations

This research is not concerned with determining the following:

- The effect of game usability on participants' learning motivation.
- Cultural differences in the perception of facial expressions.
- Learning effects of participants after the gameplay.

1.4.4 Definitions of Terms/Concepts

Motivation - means a reason or reasons that makes people to act or behave in a certain way.

Facial expression - refers to a "non-verbal" behavior that expresses emotions of a person. It is done by using facial elements (Wolfgang, 31).

Role-Playing Game - is a type of game that allows the players to control one or multiple major characters. It is designed to make the player an in-game character and complete the game scenario along with tasks and challenges.

Interaction - is defined as direct action or involvement in between two people. L2 means second language learning. Japanese.

L2 - means second language learning. Japanese L2 students are those learning Japanese as their second language.

A non-player character - any character in a game which is not controlled by a player.

Japanese polite form - Polite language, teineigo, is characterized by the use of the sentence ending "desu" and the verb ending "masu" and the use of prefixes such as "o" and "go" towards neutral objects. Television presenters invariably use polite language, and it is the form of the language first taught to most non-native learners of Japanese. (Wikipedia contributors, 2020)

Japanese casual form – Casual (plain) Form can be used anytime you are speaking casually with friends or family members. This is why it is the form you will tend to hear in music, anime, film, and TV shows (not that you will never hear polite verbs or -masu form in these media, but casual form is what you will more frequently hear — unless you are watching a

workplace or historical drama, most TV or anime characters speak quite casually, and frequently quite rudely). (Cernak, 2018)

1.5 Chapter Summary

Chapter 1 gives a brief overview of this research by outlining the key research question and significance. Based on the problem addressed by the study, and purpose, scope and significance of the study, the research question is revealed. Moreover, the statements of assumptions, limitations, delimitations and definitions of key terms define the scope of the research question more clearly.

CHAPTER 2 LITERATURE REVIEW

In order to address the research question fully and clearly, four related topics are assessed in this chapter. These topics include previous studies on motivation, interaction, facial expression and game. In addition, sources and concepts of the literature review are stated in the first part.

2.1 Methodology
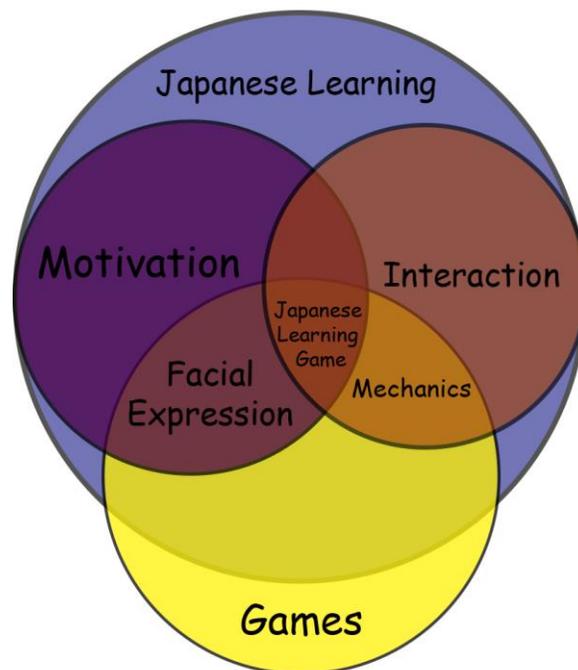
Figure 2.1 Concept Map of the Literature Review

The largest frame of this study is Japanese learning. Within Japanese learning, there are motivation and interaction, both being important factors to language learning success. Also, games are used as tools for Japanese learning. In between games and motivation are facial expressions; and between games and interaction are interactive mechanics. As a result, Japanese learning games appear at the intersection of all the concepts. The methodology of the literature review is shown in figure 2.1.

IEEE was the databases for searching for animation and game related sources because it contained many well-built articles regarding model fidelities, emotions and human interactions. PsycINFO and ERIC were also good sources for psychology related research. For the Japanese

learning, it was a good choice to use Google Scholar that provided foreign sources on research articles.

2.2 Motivation Studies

Motivation in language learning is an important factor for student success. There are many studies that have demonstrated the key factors that affect motivation. According to Ebata from Digital Hollywood University, self-confidence, experience of success and satisfaction, good relationships among teacher and students, and a friendly environment are the key factors to high motivation (Ebata, 2008). Having self-confidence is important when students are trying to solve problems to complete assigned tasks from classrooms. Ebata mentioned a quote from Atsuta saying, "At the heart of all learning is a person's belief in his or her ability to accomplish the task" (Atsuta, 2003). It is true that students feel more satisfied and positive when they can answer a question, write down a correct sentence or even give a simple oral response. All these task achievements grant them the confidence toward the next-level learning.

The instructors' personal role and enthusiasm are also key to motivate the students. A study done by Cheng and Dornyei has come up with a list of important elements that affect students' motivation. On the top of that list, teachers' self interest in the subject matter and effort has a strong impact on the students' motivation of learning L2 language. (Dornyei, Cheng, 2007) Another researcher agreed with Ebata's opinion. Karaoglu, from the University of Northern Virginia, mentioned in his article that creating situations in which students would feel a sense of accomplishment could assure students' positive attitude and encourage self-evaluation (Karaolglu, 2008).

Previous studies have shown there is a task processing procedure when students gain knowledge. In 2009, Dornyei and Tseng developed this equation diagram (shown in figure 2.2) to show the motivational task processing. It consists of three steps that are task execution, appraisal on the content and controlling self-action. These three steps also interact with each other. The number on the model represents the coefficient of effect in between each other, which is really high in this model. According to them, better self-motivation to learn would grant students better troubleshooting strategies (Dornyei & Tseng, 2009). From these studies conclusions can be drawn that it is essential to consider both context and methodology while teaching.
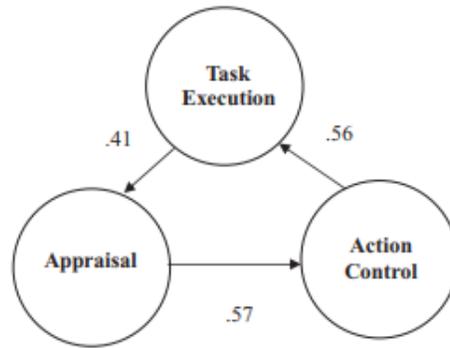
Figure 2.2 Structural Equation Diagram of Motivational Task Processing (Dornyei, 2009)

Furthermore, Motivation has been proven to be great effect on students' success. Jeng-Chung Woo, in 2014 did a study in which he asked participants to play on an online Computer-aided Manufacturing game for 8 weeks. The results have verified that motivation is proportional to cognitive performance and skill performance (Woo, 2014). Moreover, a study done by Obrentz on Chemistry students has shown significant effect of learning motivation on their final grades, self-efficacy and controlling anxiety (Obrentz, 2012). These studies provide sufficient evidence on the importance of studying the elements affecting students' learning motivation.

2.3 Interaction Studies

Previous research has shown that interaction is a very helpful way of motivating students to learn a second language. Aja Dailey, from University of Birmingham, mentioned that students trying to adapt to a society's specific culture, would start talking to the native speakers in that group. This shows positive effects of interaction.

Leo Van Lier has found that teaching and learning go together with interaction (Lier, 1998). In his opinion, communicating and practicing conversations can give students the consciousness they need in language learning. In his study it was found that students went through a process of shifting in different awareness levels, from affordance to critical awareness. In this process, practical application would enhance students' comprehension of learning materials (Lier, 1998). Non-verbal interaction has also shown significant effects on students' academic achievements. Irungu, Nyagah and Mugambi were seeking out learner-teacher nonverbal interaction effect on Chemistry learners (Irungu, Nyagah, Mugambi, 2019). With the support of eye-contacts and gestures, etc., students perceived teachers as being friendly and appreciating.

In Japan, some researchers have been studying on the interaction between students and faculty when they are learning Japanese. Meryl Siegal, a researcher who observed students studying in Hiroshima, proposed that interaction should be weighted based on the need of the student (Siegal, 1996). According to her research, for non-native Japanese learners, pragmatic inappropriateness was usually not considered a critical failure and thus interaction between non-native and natives were largely encouraged (Siegal, 1996).

Appropriate method of feedback is also crucial in language teaching. Katja Lochtman did a study on oral corrective feedback. She had three groups of students in the study and each group received a different type of feedback. The ones getting corrections only had a worse result than those who started with less interaction (Lochtman, 2002). In addition, it is essential to guide students into the state where they can have better self-awareness.

Furthermore, according to Johnson's research about English learning, groups of students were tested to see whether different amount of interaction have any effect on different variables of language learning. As a result, interaction had an effect on students' vocabulary comprehension (Johnson, 1983, p. 55). Therefore the importance of implementing interaction progress in classrooms was emphasized.

2.4 Expression on Learning Motivation Studies

Wolfgang's "Nonverbal Behavior" mentioned that previous studies had pointed out a clear relationship between facial emotions and motivational system (Wolfgang, 1979). And Mowrer, a prominent learning theorist, indicated that emotion affected human behavior in general and helped people learn (Mowrer, 1960).

Also, motivation was tested when people were seeing different sequences of emotions. A group led by Oliver and Joyce did a test on a large sample of students regarding the motivation change when they saw various emotions. It turned out that the highly motivated students preferred the low-dominance emotion and the low-motivated students preferred the high-dominance emotion (Schultheiss, O. C., Pang, J. S., Torges, C. M., Wirth, M. M., & Treynor, W, 2005). This research has proved that it is possible to study incentive-human behavior (motivative actions) in detail while still following ethical limitations.

Furthermore, an attempt of creating a virtual motivational agent was done by Baylor. Virtual avatar's appearance, especially facial emotions can affect students' learning motivation

(Baylor, 2011). Though he had findings on the macro part of the characters (e.g. models, outfits), further research needs to be done on the non-verbal aspects.

Hudlicka and Broekens asserted in their modeling tutorial, that emotions on models affected gamers' cognition through human's neuromodulator transmitters (Hudlicka, Broekens, 2009). Therefore, it is reasonable to see learners' change of motivation when they find different facial expressions happening on the non-player characters.

2.5 Game Studies

There used to be some games for Japanese learning. The Japanese MMORPG Crystalize from Cornell University was designed to help students learn Japanese vocabulary (shown in figure 2.3). By learning new words within conversations, students (players) can create a new vocabulary list and get to study and review those words. After collecting a certain amount of words, students can complete later conversation tasks.

Figure 2.3 Language Learning Game "Crystallize" from Cornell University

Another example is a language learning game called "Influent" (shown in figure 2.4). It is a third person Japanese vocabulary learning game. Its mechanics are simple: by selecting the object in the room, players can learn the word for that item. In the end there are pop-quizzes for testing

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the number of words memorized. It has positive feedback and many Japanese learners use it as a "virtual flashcard" to visualize Japanese words when memorizing.

Figure 2.4 Language Learning Game "Influent" from Steam

Some people also use existing Japanese role-playing games (JRPGs) for language learning purposes, such as Pokémon. The dialogue in the game is at the introductory level, and many beginning Japanese learners use it as a source. The drawback is that there aren't any interactions designed to test out the players' comprehension. According to Brian Tomlinson, teaching materials, such as textbooks, has been shifting from simple cliché dialogues into social culture based contents (Tomlinson, 2012). It is believed that more realistic contents will grant students more interests in learning.

2.6 Chapter Summary

The main function of Chapter 2 is to clarify relevant views from previous studies and provide a theoretical basis for this study. This chapter illustrates the methodology of the literature review and summarizes existing theories pertaining to this research. In a word, it presents reference methodology for the theoretical analysis of this research.

CHAPTER 3 METHODOLOGY

This chapter outlines the research methodology and general framework of this research. It also explains the four parts of the study design: experimental instrument, validation study, motivation study and study schedule. For the validation study and motivation study, the testing flow is briefly described, along with the sample questions that the participants were asked to answer.

3.1 Methodology and Framework

This research was based on quantitative experiments. Based on the literature review, the problem addressed by this study is that there is rare study on the effect of facial expressions on the learning motivation of Japanese L2 students. To solve the problem, the researchers developed four versions of a 3D Japanese role-playing game to test the effect of virtual characters' facial expressions on students' motivation of learning Japanese polite and casual form. Before the motivation study, a validation study was conducted to validate the characters' facial expressions. After that, 84 college students from 200/300 level Japanese courses joined in the motivation study voluntarily. They were randomly assigned to four groups, played one of the four versions of the game and took the post-questionnaire. Then, three sets of one-way ANOVA and a set of factorial ANOVA were run for data analysis. Finally, post hoc comparisons with Bonferroni corrected estimates were used to seek out which variable had the most significant effect. This study was IRB approved and exempted. The motivation study flow is shown in figure 3.1.
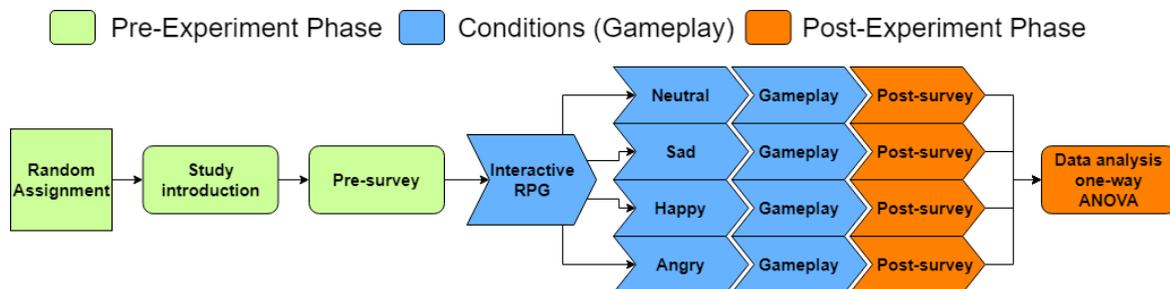
Figure 3.1 The Flow Chart of the Motivation Study

3.2 Experimental Instrument

3.2.1 3D JRPG Daigaku Life

As shown in the review of literature, using games for language learning was successful in past cases and encouraged to be applied into classrooms. Therefore, researchers of the study decided to develop a Japanese role-playing game to achieve the purpose of inquiry. Compared to other games, a JRPG allows players to adapt to the content easier than to the textbook since it provides more immersive experiences of the main character. Furthermore, a JRPG with a real-world-based story is much easier for students to comprehend Japanese language and culture.

Researchers of this study developed a 3D animated Japanese role-playing game. The game story was created based on personal study abroad experience in Nanzan University, Nagoya, Japan. A main character called Takeru wants to make a documentary film of his study abroad life in Japan. Then he tries to find his interviewees. By interviewing his classmates and teachers, he has finally got enough clips for making the video (shown in figure 3.2). The game has four versions. Each version represents one facial expression that is neutral, happy, sad or angry (shown in figure 3.3). All the four versions have the same story and mechanics.

Figure 3.2 A Screenshot of the Gameplay with the Main Character Exploring the Campus
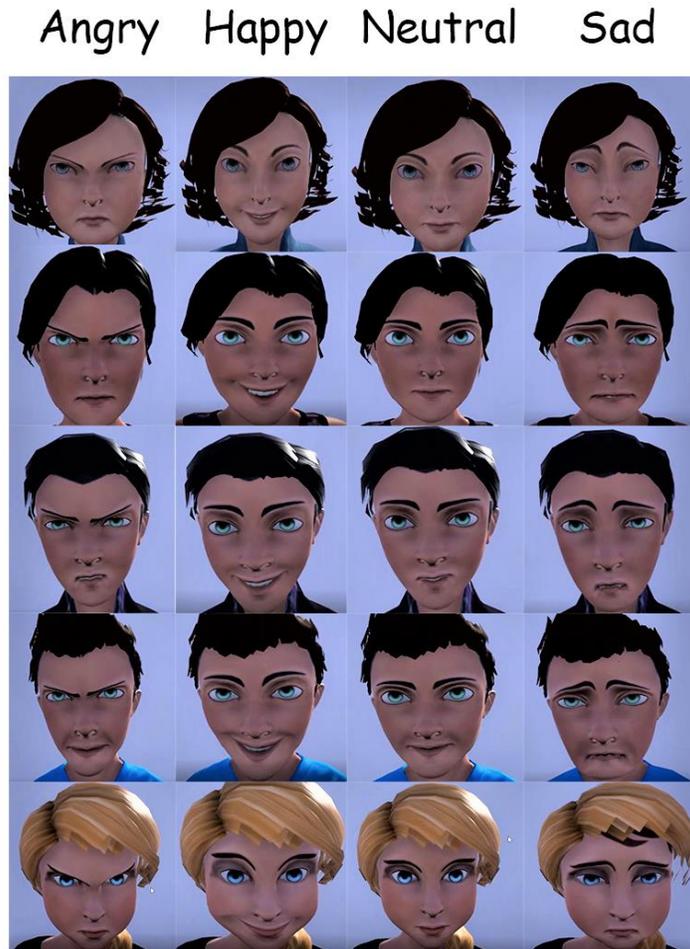
Figure 3.3 Four Facial Expressions of the Five Main Characters in Game

3.2.2 Game Mechanics

The game is played in a third perspective view. Players are required to control the main character to finish tasks, make conversations with other characters and keep moving on to the next levels. Operations in the four versions are the same. Indicators are designed to instruct players how to continue to the next levels. Players need to select correct responses to the other party based on his or her social identity and level to move on to the next levels (shown in figure 3.4). If they make the wrong choice, the facial expression of the virtual character will change from neutral to angry, sad, or happy, or just stay the same, depending on the version they play, and a hint box will pop up and say "use appropriate language" at the same time (shown in figure 3.5).

Figure 3.4 Players Need to Select the Correct Response to the Virtual Character

Figure 3.5 The Virtual Character' Facial Expression Changed and A Hint Box Popped Up As Soon As the Wrong Response Was Selected

3.3 Validation Study

3.3.1 Flow of the Validation Study

Before the motivation study, a validation study was conducted to ask participants how realistic each facial expression was. Twenty video clips from in-game scenes of the emotion transitions of five main characters were gathered for setting up questionnaires that used **recognition**, **intensity**, **typicality** and **sincerity** as the dependent variables. The questionnaires were sent to participants outside of Japanese departments of Purdue and other universities. Based on the data analysis of the results, the facial expressions that hadn't been validated were revised and a re-validation study was run.

3.3.2 Population of the Validation Study and Re-validation Study

The population of the validation study was intended to be any one out of the Japanese department and composed of at least 25 participants. Participants for the survey was found by the researcher requesting CGT main office to send the link to the CGT students and also by the researcher himself to send the link to his relatives, friends and classmates. Finally, 29 completed questionnaire results were received for the validation study.

The population of the re-validation study was any one out of the validation study participants and Japanese departments and composed of at least 25 participants. The sample was found by the researcher to send the link to his relatives, friends and classmates. Finally, 35 completed questionnaire results were received for the re-validation study.

3.3.3 Variables of the Validation Study

At the very beginning of each questionnaire, there was an introduction of the following three variables:

- **Typicality** refers to, "how often different variants of a facial expression are encountered in the real world." In other words, is the facial expression something you would see every day or is it in some way unusual? Typicality is also defined as, "having the distinctive qualities of a particular type of person or thing."
- **Sincere** means "free from pretense or deceit; proceeding from genuine feelings." Is the emotion being displayed genuine or deceitful?
- **Intensity** is defined as "the magnitude of a quantity." In this case it refers to the strength of the emotion.

Each questionnaire included two sections: one asking participants to identify emotion of a facial expression, another about realism of the facial expression. An example of the questionnaires is shown in figure 3.6. In the first section, after watching a video on the transition of a facial expression, participants were asked to recognize to which emotion the character in the video switched. This section was designed to validate the identity of each character's facial expressions in game. The recognition standard was set to 80%. According to Bartone's research in 2007, the test-retest reliability after 3 weeks of testing on 104 military samples was 0.78 (Bartone, 2007, p. 943).

The second section contained three scale-based questions asking about the facial expressions' **typicality**, **sincerity** and **intensity**. According to Nicoletta Adamo's research, the three variables above are essential to explore the reality of a facial expression (Adamo et al., 2019), and the test results from her research showed the three variables' significance on the identification. After watching a video on the transition of a facial expression, participants were required to answer the three questions by a rating scale from 1-7, 1 being the worst and 7 being the best. Then, the data was collected and analyzed. Next, the expressions that had not been proved realistic enough were modified, and a re-validation study was run. Finally, all the facial expressions of five main characters in game were validated.

Figure 3.6 An Example of Validation Questionnaires

3.4 Motivation Study

3.4.1 Population of the Motivation Study

The focus of the motivation study was on L2 Japanese college students. Participants were drawn from 200/300 level Japanese learners whose language skills were enough to complete the testing with the least biased results.

The samples were intended to consist of at least 40 participants (10 participants per group). Participants for the survey were found by the researcher requesting several professors in College of Liberal Arts of Purdue and other universities, who teach Japanese classes, to spread the study information to their students. In the end, 84 participants joined in the motivation study voluntarily.

3.4.2 Flow of the Motivation Study

To begin with, the participants were separated randomly into four groups with 21 in each group. After the study explanation, each group played one of the four versions of the game assigned to them. After the gameplay, they took a post-questionnaire using scales of different variables to indicate their level of motivation.

3.4.3 Variables of the Motivation Study

Toure-Tillery and Fishbach's studies have summarized a set of measures of motivation, which focus on accessibility, evaluation, experience, perception, speed, performance and choices (Toure-Tillery, Fishbach, 335). By assigning each of these variables a scale, researchers can come up with parameters and compare the effect of emotions.

The post-questionnaire of the motivation study was consisting of 11 categories. The first 5 categories were used for analyzing the effect of facial expressions on motivation, which were **language learning motivation**, **time spent**, **performance, Positive and Negative Affect Scale (PANAS) emotion** and **personal subjective feelings**. PANAS is widely used in psychology related studies. In this study the PANAS questionnaire asked about the participants' feelings during and after the gameplay. Six other categories were used to determine whether there were other potential elements affecting motivation or not. They were **realism for character reaction**, **realism for facial expressions**, **realism for character appearance**, **immersion into games**, **attention on in-game characters** and **interaction with characters**. All the 11 categories had a total of 21 questions. The participants answered all the questions by a rating scale from 1-7, 1 being strongly disagree and 7 being strongly agree. An example of the questionnaire is shown in figure 3.7.

Post Questionnaire

After the gameplay, please answer the following questions in the section below. Response by rating how much you agree with the question: 1 being strongly disagree and 7 being strongly agree.

1. I was confident I could learn the basic concepts taught in this game. *

	1	2	3	4	5	6	7	
Strongly Disagree	○	○	○	○	○	○	○	Strongly Agree

2. The characters encouraged me to learn Japanese. *

	1	2	3	4	5	6	7	
Strongly Disagree	○	○	○	○	○	○	○	Strongly Agree

3. I think the reaction from the characters I saw is appropriate. *

	1	2	3	4	5	6	7	
Strongly Disagree	○	○	○	○	○	○	○	Strongly Agree

Figure 3.7 An Example of Motivation Post-questionnaire

3.5 Study Schedule

This research was planned as shown in figure 3.8.

Gantt Chart	Months											
Tasks	1	2	3	4	5	6	7	8	9	10	11	12
Game Development	██	██	██	██	██	██						
Study Design					██	██	██	██	██			
Project Proposal									██	██		
Validation Study										██	██	
Recruiting Samples								▓▓	▓▓	▓▓	▓▓	
Motivation Study											▓▓	▓▓
Data analysis												▓▓
	▓▓ incomplete											
	██ completed											
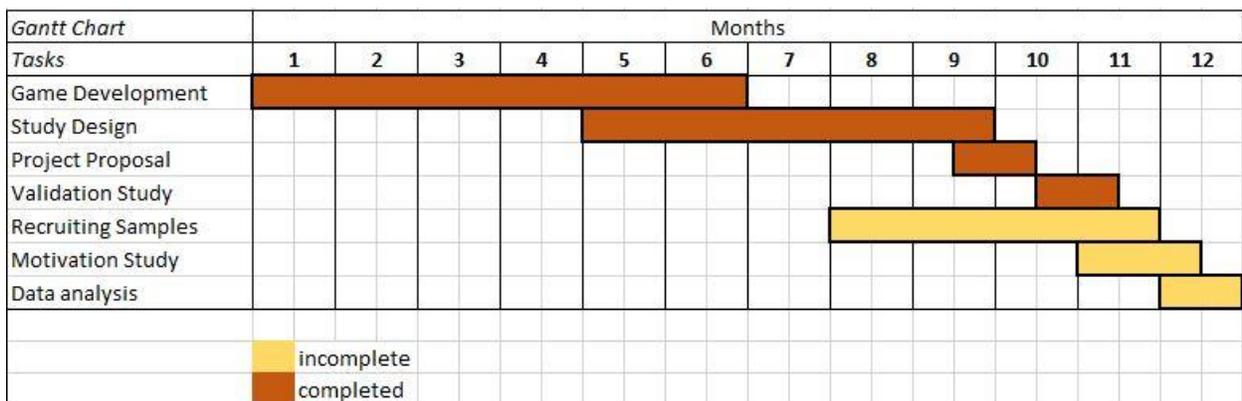
Figure 3.8 Gantt Chart Showing the Planned Procedure of the Research

3.6 Chapter Summary

Chapter 3 summarizes the methodology and framework of the research, clarifies the general procedure, explains the testing flow and provides information on the analysis methods used in this research. This chapter also explicates the population, samples, variables and testing tools of this research.

CHAPTER 4 RESULTS AND ANALYSIS OF VALIDATION STUDY

This chapter presents data and explains how the data were analyzed for the validation and re-validation studies. The ensuing section also provides related results based on the process detailed in the prior chapter. The data were sorted in Excel spreadsheets.

4.1 Results on the Validation Study

A total of 29 complete responses were received in the validation study. The participants answered all the questions by a rating scale from 1-7, 1 being strongly disagree and 7 being strongly agree. The research focused primarily on recognition, but the other ratings were important as well.

4.1.1 Results on the Four Facial Expressions' Recognition

The mean of the ratings for 4 facial emotions of 5 characters was 87.14% (neutral = 90.76%; happy = 90.04%; sad = 86.44%; angry = 81.32%). The overall was beyond the standard line of 80% except 5 individual expressions (angry 1 = 78.6%; angry 2 = 75%; sad 1 = 78.6%; neutral 1 = 78.6%; happy 1 = 78.6%). The result on the 4 facial emotions' recognition is shown in figure 4.1. Based on the results, the five individual expressions with an average score less than 80% were modified and used for the re-validation study.
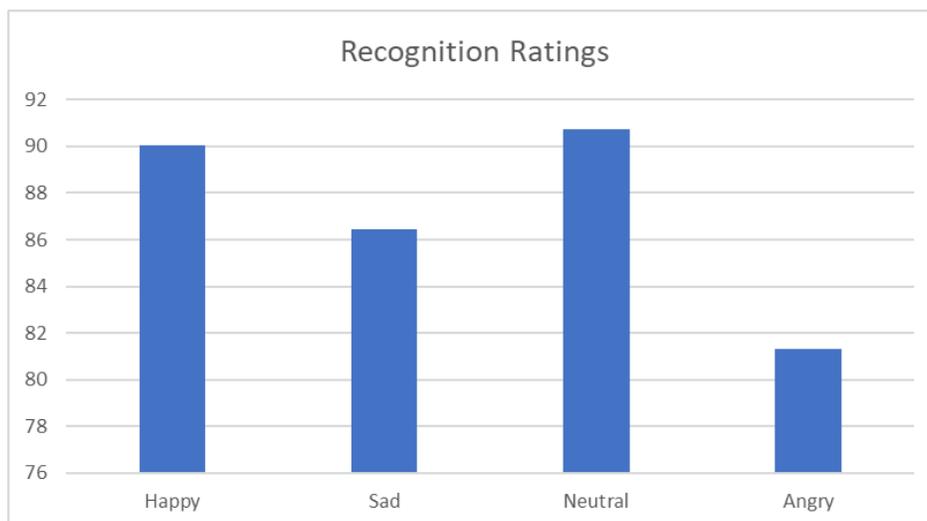
Figure 4.1 Data Analysis of the Four Facial Emotions' Recognition Ratings

4.1.2 Results on the Four Facial Expressions' Realism

Typicality. For all the facial expressions' typicality, the participant rating was: M = 5.37, SD = 0.36. For the happy facial expression, the participant rating was: M = 5.50, SD = 0.39; for the neutral facial expression, the participant rating was: M = 5.41, SD = 0.38; for the angry facial expression, the participant rating was: M = 5.34, SD = 0.43; for the sad facial expression, the participant rating was: M = 5.22, SD = 0.38.

Sincerity. For all the facial expressions' sincerity, the participant rating was: M = 4.99, SD = 0.35. For the happy facial expression, the participant rating was: M = 5.10, SD = 0.47; for the neutral facial expression, the participant rating was: M = 4.88, SD = 0.31; for the angry facial expression, the participant rating was: M = 5.12, SD = 0.28; for the sad facial expression, the participant rating was: M = 4.87, SD = 0.39.

Intensity. For all the facial expressions' intensity, the participant rating was: M = 4.94, SD = 0.55. For the happy facial expression, the participant rating was: M = 4.93, SD = 0.67; for the neutral facial expression, the participant rating was: M = 4.40, SD = 0.18; for the angry facial expression, the participant rating was: M = 5.25, SD = 0.43; for the sad facial expression, the participant rating was: M = 5.17, SD = 0.53.

The results on the 4 facial emotions' realism are shown in figure 4.2 and figure 4.3.
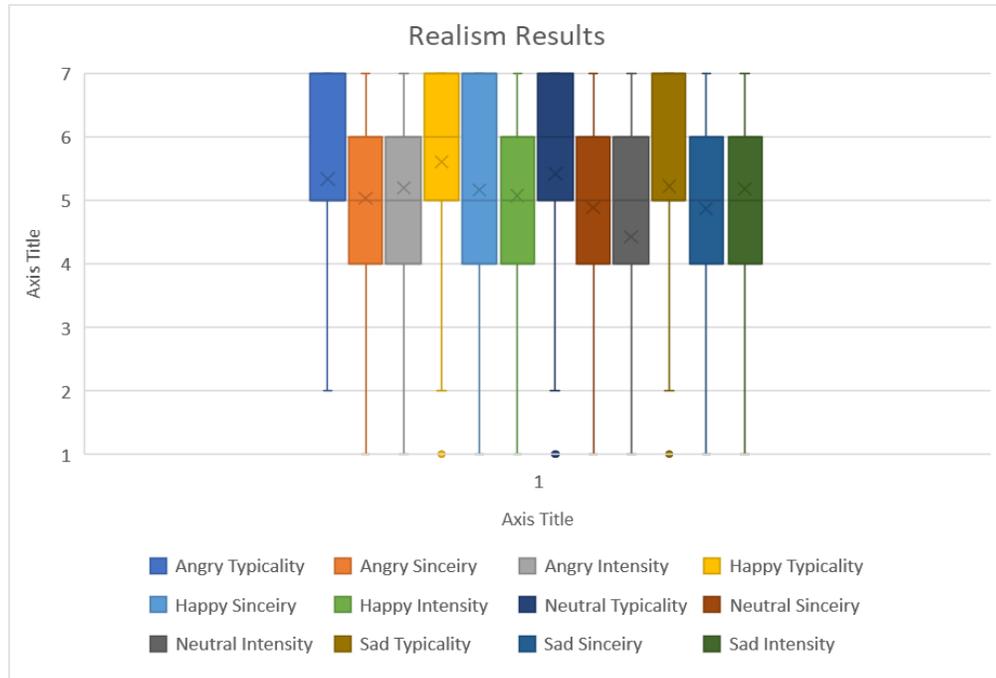
Figure 4.2 Data Analysis of the Four Facial Emotions' Typicality, Sincerity and Intensity
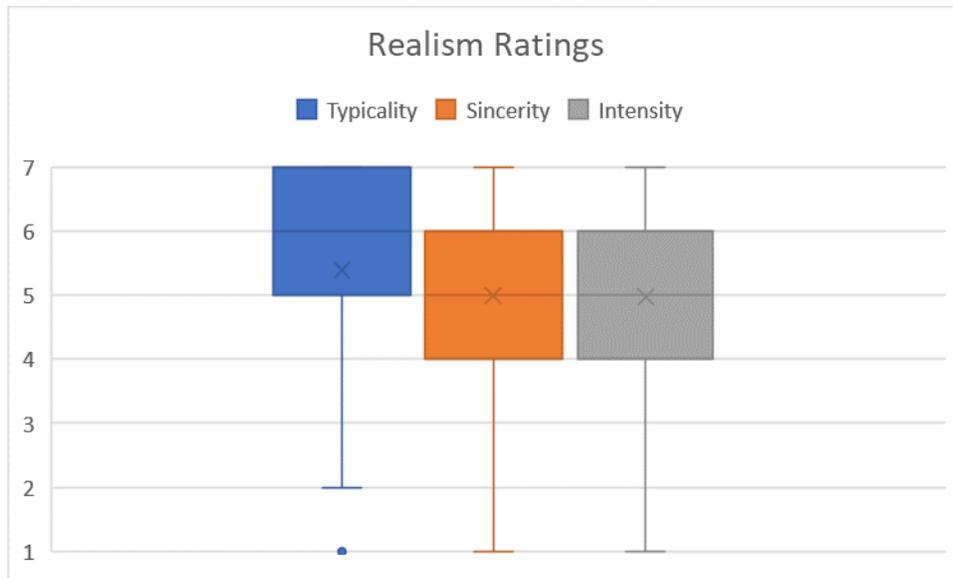
Figure 4.3 General Analysis of the Four Facial Emotions' Realism Ratings

4.2 Results on the Re-validation Study

A total of 35 complete responses were received in the re-validation study. The participants answered all the questions by a rating scale from 1-7, 1 being strongly disagree and 7 being strongly agree.

4.2.1 Results on the Five Individual Facial Expressions' Recognition

According to the validation study results, there were 5 individual expressions with a recognition rating less than 80%. After they were adjusted on minor features a re-validation study was run. The result showed that the mean of the ratings for the 5 facial expressions was 90.86% (angry 1 = 100%; angry 2 = 80%; sad 1 = 94.3%; neutral 1 = 91.4%; happy 1 = 88.6%). All the 5 facial expressions reached 80% or more recognition rate. Thus, all the facial emotions of 5 major characters in game were validated and can be used for the motivation study.

4.2.2 Results on the Five Individual Facial Expressions' Realism

Typicality. For all the five individual facial expressions' typicality, the participant rating was: M = 5.65, SD = 0.30. For angry 1, the participant rating was: M = 5.23, SD = 1.94; for angry 2, the participant rating was: M = 5.20, SD = 1.69; for neutral 1, the participant rating was: M = 5.63,

SD = 1.71; for sad 1, the participant rating was: M = 5.77, SD = 1.76; for happy 1, the participant rating was: M = 5.97, SD = 1.18.

Sincerity. For all the five individual facial expressions' sincerity, the participant rating was: M = 5.18, SD = 0.26. For angry 1, the participant rating was: M = 4.74, SD = 2.02; for angry 2, the participant rating was: M = 4.86, SD = 1.68; for neutral 1, the participant rating was: M = 5.37, SD = 1.69; for sad 1, the participant rating was: M = 5.34, SD = 1.75; for happy 1, the participant rating was: M = 5.20, SD = 2.00.

Intensity. For all the five individual facial expressions' intensity, the participant rating was: M = 5.06, SD = 0.31. For angry 1, the participant rating was: M = 5.09, SD = 1.63; for angry 2, the participant rating was: M = 4.91, SD = 1.63; for neutral 1, the participant rating was: M = 4.54, SD = 1.72; for sad 1, the participant rating was: M = 5.43, SD = 1.76; for happy 1, the participant rating was: M = 5.20, SD = 2.00.

The results on the re-validation realism are shown in figure 4.4.
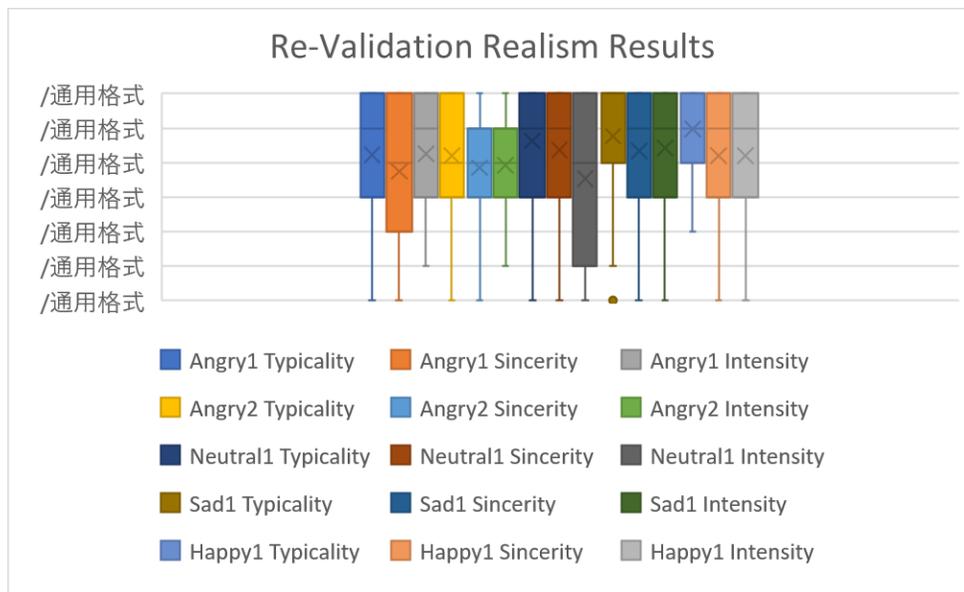
Figure 4.4 Data Analysis of the Re-validation Realism Results

4.3 Chapter Summary

Chapter 4 describes the process used to analyze the data collected for the validation and re-validation studies, presents an explanation of the results from the data and illustrates all the facial emotions of the five major characters in game were validated and can be used for the motivation study.

CHAPTER 5 RESULTS AND ANALYSIS OF MOTIVATION STUDY

This chapter concentrates on the description and explanation of the motivation study results. The ensuing section throws light on the statistical analysis that was essential in providing answers to the hypothesis. The statistical models used to analyze the data sets were three sets of one-way ANOVA and one set of factorial ANOVA. The data was sorted in Excel spreadsheets then analyzed using SPSS Statistical 26. Post ho tests were performed using Bonferroni corrected estimates to find the significant mean differences in between the dependent variables.

5.1 Demographics

There were 84 Japanese L2 college students participated. Among them, 15 people learned Japanese for less than one year, 57 people learned Japanese for 1-2 years, 6 people learned Japanese for 2-3 years and 6 people learned Japanese for more than 3 years. Within all the 84 participants, 19 are male and 65 are female. They were randomly separated into four facial expression groups with 21 at each group.

5.2 Results on the Factor "Facial Expression"

The data were collected from 84 college students learning Japanese as a second language. Although most of the participants were sophomores, their time of learning Japanese was different. Therefore, the data were analyzed using one-way ANOVA. The descriptive statistics is in table 5.1.

Table 5.1 Descriptive Statistics of the factor "Facial Expression"

Facial Expression	Learning motivation		Performance		Time spent		Realism for character reaction		Realism for facial expressions			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Angry	5.21	1.11	4.81	1.30	3.67	1.36	5.60	1.19	5.10	1.22		
Happy	4.88	1.09	4.76	1.23	4.14	1.46	4.98	1.34	4.81	1.21		
Neutral	5.29	1.20	4.24	1.60	4.62	1.33	5.33	1.39	4.76	1.35		
Sad	4.79	1.05	4.86	1.25	4.43	1.22	4.83	1.18	4.26	1.15		

Facial Expression	Realism for character		Immersion into games		Attention on in-game		Interaction with		PANAS emotion		Personal Subjective	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Angry	5.29	1.19	5.27	1.18	5.60	1.34	4.93	1.51	4.79	1.32	4.88	1.35
Happy	4.93	1.06	5.40	1.07	5.64	1.23	4.95	1.09	4.50	1.32	4.95	1.21
Neutral	4.83	1.47	4.79	1.42	5.76	0.88	4.90	1.53	4.57	1.42	4.81	1.71
Sad	4.79	0.96	4.59	1.02	5.02	1.05	4.40	1.34	4.10	1.39	4.55	1.34

Table 5.2 showed that the effect of **facial expression** was not significant on participants' **performance** ($F_{(3,80)} = 0.91$, $p = 0.44$), **time spent** ($F_{(3,80)} = 1.905$, $p = 0.135$) or **learning motivation** ($F_{(3,80)} = 0.97$, $p = 0.411$). Similarly, no significance was found on **realism for character reaction** ($F_{(3,80)} = 1.458$), $p = 0.232$), **realism for facial expression** ($F_{(3,80)} = 1.572$, $p = 0.203$), **realism for character appearance** ($F_{(3,80)} = 0.726$, $p = 0.539$), **immersion into game** ($F_{(3,80)} = 2.118$, $p = 0.104$), **attention on in-game characters** ($F_{(3,80)} = 1.669$, $p = 0.18$), **interaction with characters** ($F_{(3,80)} = 0.723$, $p = 0.541$), **PANAS emotion** ($F_{(3,80)} = 0.896$, $p = 0.447$) and **personal subjective feelings** ($F_{(3,80)} = 0.311$, $p = 0.818$).

Table 5.2 Univariate Test Result on the Factor **Facial Expression**

(significance at 0.05 level)

ANOVA (Factor: Facial Expression)						
Dependent Variable		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Learning motivation	Between Groups	3.795	3	1.265	0.97	0.411
	Within Groups	104.31	80	1.304		
	Total	108.104	83			
Performance	Between Groups	5.238	3	1.746	0.91	0.44
	Within Groups	153.429	80	1.918		
	Total	158.667	83			
Time spent	Between Groups	10.81	3	3.603	1.905	0.135
	Within Groups	151.333	80	1.892		
	Total	162.143	83			
Realism for character reaction	Between Groups	7.509	3	2.503	1.458	0.232
	Within Groups	137.381	80	1.717		
	Total	144.89	83			
Realism for facial expressions	Between Groups	7.557	3	2.519	1.572	0.203
	Within Groups	128.167	80	1.602		
	Total	135.723	83			
Realism for character appearance	Between Groups	3.223	3	1.074	0.726	0.539
	Within Groups	118.381	80	1.48		
	Total	121.604	83			
Immersion into games	Between Groups	9.295	3	3.098	2.118	0.104
	Within Groups	117.026	80	1.463		
	Total	126.321	83			
Attention on in-game characters	Between Groups	6.818	3	2.273	1.669	0.18
	Within Groups	108.929	80	1.362		
	Total	115.747	83			
Interaction with characters	Between Groups	4.345	3	1.448	0.723	0.541
	Within Groups	160.214	80	2.003		
	Total	164.56	83			
PANAS emotion	Between Groups	5.25	3	1.75	0.896	0.447
	Within Groups	156.238	80	1.953		
	Total	161.488	83			
Personal Subjective Feelings	Between Groups	1.964	3	0.655	0.311	0.818
	Within Groups	168.595	80	2.107		
	Total	170.56	83			

5.3 Results on the Factor "Years of Learning Japanese"

Considering participants may have variety in Japanese learning time, which can be a potential factor affecting learning motivation, the data of the factor **years of learning Japanese** were collected during the study. Below is the univariate test result (one-way ANOVA) on the effect of the factor **years of learning Japanese**.

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Table 5.4 Univariate Test Result on the Factor **Years of Learning Japanese**
(significance at 0.05 level)

ANOVA (Factor: Years of learning Japanese)						
Dependent Variable		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Learning motivation	Between Groups	3.387	3	1.129	0.863	0.464
	Within Groups	104.717	80	1.309		
	Total	108.104	83			
Performance	Between Groups	8.491	3	2.83	1.508	0.219
	Within Groups	150.175	80	1.877		
	Total	158.667	83			
Time spent	Between Groups	24.481	3	8.16	4.742	0.004
	Within Groups	137.661	80	1.721		
	Total	162.143	83			
Realism for character reaction	Between Groups	12.939	3	4.313	2.615	0.057
	Within Groups	131.95	80	1.649		
	Total	144.89	83			
Realism for facial expressions	Between Groups	10.728	3	3.576	2.289	0.085
	Within Groups	124.995	80	1.562		
	Total	135.723	83			
Realism for character appearance	Between Groups	13.285	3	4.428	3.271	0.025
	Within Groups	108.319	80	1.354		
	Total	121.604	83			
Immersion into games	Between Groups	13.07	3	4.357	3.077	0.032
	Within Groups	113.252	80	1.416		
	Total	126.321	83			
Attention on in-game characters	Between Groups	10.619	3	3.54	2.694	0.052
	Within Groups	105.128	80	1.314		
	Total	115.747	83			
Interaction with characters	Between Groups	16.251	3	5.417	2.922	0.039
	Within Groups	148.308	80	1.854		
	Total	164.56	83			
PANAS emotion	Between Groups	5.969	3	1.99	1.024	0.387
	Within Groups	155.519	80	1.944		
	Total	161.488	83			
Personal Subjective Feelings	Between Groups	11.769	3	3.923	1.976	0.124
	Within Groups	158.791	80	1.985		
	Total	170.56	83			

In Table 5.3, ANOVA showed that the effect of **years of learning Japanese** was significant on **time spent** ($F_{(3,80)}$ = 4.472, p = 0.004), **realism for character appearance** ($F_{(3,80)}$ = 3.271, p = 0.025), **immersion into games** ($F_{(3,80)}$ = 3.077, p = 0.032) and **interaction with characters** ($F_{(3,80)}$ = 2.922, p = 0.039). No significant effect of **years of learning Japanese** was found on **learning motivation** ($F_{(3,80)}$ = 0.863, p = 0.464), **performance** ($F_{(3,80)}$ = 1.508, p = 0.219), **realism for character reaction** ($F_{(3,80)}$ = 2.615, p = 0.057), **realism for facial expressions** ($F_{(3,80)}$ = 2.289, p = 0.085), **attention on in-game characters** ($F_{(3,80)}$ = 2.694, p =

0.052), **PANAS emotion** (F(3,80) = 1.024, p = 0.387) and **personal subjective feelings** (F(3,80) = 1.926, p = 0.124).

In Table 5.4, multiple comparisons were made. Significances were found in several groups. For the variable **time spent**, the 1-2-year group (M = 3.91, SD = 1.35) spent significantly less time than the 1-year group (M = 5.07, SD = 1.34) and more than 3-year group (M = 5.33, SD = 0.82). For the variable **realism for character appearance**, significant difference was found between the less than 1-year group (M = 5.734, SD = 0.377) and the 1-2-year group (M = 4.703, SD = 0.149). As for the variable **immersion into games**, the less than 1-year group (M = 5.583, SD = 0.378) was significantly more immersive into the game than the more than 3-year group (M = 3.981, SD = 0.499). And lastly for the variable **interaction with characters**, the more than 3-year group (M = 3.583, SD = 0.608) felt significantly less interactive than the less than 1-year (M = 5.031, SD = 0.461) and the 1-2-year group (M = 4.796, SD = 0.182).

Table 5.6 Bonferroni Test Result on the Significant Variables
(significance at 0.05 level)

Multiple Comparisons							
Bonferroni	1=less than 1 year, 2= 1-2 years, 3= 2-3 years, 4= more than 3 years						
Dependent Variable	(I) Years of learning Japanese	(J) Years of learning Japanese	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Time spent	1	2	1.15	0.38	0.02	0.12	2.18
		3	1.23	0.63	0.33	-0.48	2.95
		4	-0.27	0.63	1.00	-1.98	1.45
	2	1	-1.15	0.38	0.02	-2.18	-0.12
		3	0.08	0.56	1.00	-1.44	1.60
		4	-1.42	0.56	0.08	-2.94	0.10
	3	1	-1.23	0.63	0.33	-2.95	0.48
		2	-0.08	0.56	1.00	-1.60	1.44
		4	-1.50	0.76	0.31	-3.55	0.55
	4	1	0.27	0.63	1.00	-1.45	1.98
		2	1.42	0.56	0.08	-0.10	2.94
		3	1.50	0.76	0.31	-0.55	3.55
Realism for character appearance	1	2	0.97	0.34	0.03	0.06	1.88
		3	1.23	0.56	0.19	-0.29	2.75
		4	0.40	0.56	1.00	-1.12	1.92
	2	1	-0.97	0.34	0.03	-1.88	-0.06
		3	0.26	0.50	1.00	-1.09	1.61
		4	-0.57	0.50	1.00	-1.92	0.78
	3	1	-1.23	0.56	0.19	-2.75	0.29
		2	-0.26	0.50	1.00	-1.61	1.09
		4	-0.83	0.67	1.00	-2.65	0.98
	4	1	-0.40	0.56	1.00	-1.92	1.12
		2	0.57	0.50	1.00	-0.78	1.92
		3	0.83	0.67	1.00	-0.98	2.65
Immersion into games	1	2	0.64	0.35	0.39	-0.29	1.58
		3	1.14	0.57	0.30	-0.41	2.70
		4	1.59	0.57	0.04	0.03	3.14
	2	1	-0.64	0.35	0.39	-1.58	0.29
		3	0.50	0.51	1.00	-0.88	1.88
		4	0.94	0.51	0.41	-0.44	2.33
	3	1	-1.14	0.57	0.30	-2.70	0.41
		2	-0.50	0.51	1.00	-1.88	0.88
		4	0.44	0.69	1.00	-1.41	2.30
	4	1	-1.59	0.57	0.04	-3.14	-0.03
		2	-0.94	0.51	0.41	-2.33	0.44
		3	-0.44	0.69	1.00	-2.30	1.41
Interaction with characters	1	2	0.43	0.40	1.00	-0.64	1.50
		3	0.52	0.66	1.00	-1.26	2.30
		4	1.93	0.66	0.03	0.15	3.71
	2	1	-0.43	0.40	1.00	-1.50	0.64
		3	0.08	0.58	1.00	-1.50	1.66
		4	1.50	0.58	0.07	-0.08	3.08
	3	1	-0.52	0.66	1.00	-2.30	1.26
		2	-0.08	0.58	1.00	-1.66	1.50
		4	1.42	0.79	0.45	-0.71	3.54
	4	1	-1.93	0.66	0.03	-3.71	-0.15
		2	-1.50	0.58	0.07	-3.08	0.08
		3	-1.42	0.79	0.45	-3.54	0.71
* The mean difference is significant at the 0.05 level.							

5.4 The Interaction Effect between "Facial Expression" & "Years of Learning Japanese"

After the two one-way ANOVA tests above, a factorial ANOVA test was conducted to see the interaction effect of **facial expression** and **years of learning Japanese**. As a result, one significance was found on the variable **immersion into games** ($F_{(13,70)} = 2.202$, $p = 0.0440$). Below is the table for the two factors' interaction effect.

Table 5.8 Univariate Test for Interaction Effect of **Years of Learning Japanese** and **Facial Expression** on **Immersion into Games**
(significance at 0.05 level)

Tests of Between-Subjects Effects

Dependent Variable: Immersion into games

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	40.914a	13	3.147	2.579	0.006
Intercept	724.528	1	724.528	593.824	0
YearsoflearningJapanese	7.692	3	2.564	2.101	0.108
FacialExpression	13.078	3	4.359	3.573	0.018
YearsoflearningJapanese * FacialExpression	18.802	7	2.686	2.202	0.044
Error	85.407	70	1.22		
Total	2236.333	84			
Corrected Total	126.321	83			
a R Squared = .324 (Adjusted R Squared = .198)					

Table 5.9 Estimated Marginal Means of **Years of Learning Japanese** and

Facial Expression on Immersion into Games

Years of learning Japanese * Facial Expression					
Dependent Variable: Immersion into games					
Years of learning Japanese	Facial Expression	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
1	1	6.5	0.781	4.942	8.058
	2	5	0.552	3.898	6.102
	3	5.833	0.391	5.054	6.612
	4	5	1.105	2.797	7.203
2	1	5.167	0.276	4.616	5.717
	2	5.4	0.285	4.831	5.969
	3	4.267	0.349	3.57	4.963
	4	4.917	0.276	4.366	5.467
3	1	5	0.638	3.728	6.272
	2	.a	.	.	.
	3	4.333	0.781	2.776	5.891
	4	3.333	1.105	1.13	5.536
4	1	.a	.	.	.
	2	6.167	0.781	4.609	7.724
	3	2.667	1.105	0.464	4.87
	4	3.111	0.638	1.839	4.383
a This level combination of factors is not observed, thus the corresponding population marginal mean is not estimable.					

As shown in Table 5.6, the participants in *the Angry Group* who studied Japanese for less than a year felt the most immersive into the game, while the participants in *the Neutral Group* who studied Japanese for more than 3 years felt the least immersive.

5.5 Results on the Factor "Gender"

In Table 5.7, a set of one-way ANOVAs showed that the effect of **gender** was significant on the variable **learning motivation** ($F(1,82) = 7.152$, $p = 0. 009$), **realism for character appearance**

(F(1,82) = 4.083, p = 0.047), **immersion into games** (F(1,82)= 9.01, p = 0.004) and **attention on in-game characters** (F(1,82)= 7.058, p = 0.009). Nevertheless, no significance was found in **performance** (F(1,82) = 0.773, p = 0.382), **time spent** (F(1,82) = 2.837, p = 0.096), **realism for character reaction** (F(1,82) = 2.883, p = 0.093), **realism for facial expressions** (F(1,82) = 3.808, p = 0.054), **interaction with characters** (F(1,82) = 2.318, p = 0.132), **PANAS emotion** (F(1,82) = 0.795, p = 0.375) and **personal subjective feelings** (F(1,82) = 2.234, p = 0.139).

In table 5.8, comparisons were made for two gender groups. For the variable **learning motivation**, female group (M = 5.215, SD = 0.137) was more motivated than the male group (M = 4.447, SD = 0.253); for the variable **realism for character appearance**, female group (M = 5.1, SD = 1.21) felt more realistic than the male group (M = 4.474, SD = 1.0471); for the variable **immersion into games**, female group (M = 5.22, SD = 1.17) was more immersive than the male group (M = 4.35, SD = 1.19); for the variable **attention on in-game characters**, female group (M = 5.685, SD = 1.0664) paid more attention than the male group (M = 4.895, SD = 1.3701).

Table 5.10 Univariate Test Result on the Factor **Gender**
(significance at 0.05 level)

ANOVA (Factor: Gender)						
Dependent Variable		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
learning motivation	Between Groups	8.672	1	8.672	7.152	0.009
	Within Groups	99.432	82	1.213		
	Total	108.104	83			
Performance	Between Groups	1.481	1	1.481	0.773	0.382
	Within Groups	157.185	82	1.917		
	Total	158.667	83			
Time spent	Between Groups	5.422	1	5.422	2.837	0.096
	Within Groups	156.721	82	1.911		
	Total	162.143	83			
Realism for character reaction	Between Groups	4.921	1	4.921	2.883	0.093
	Within Groups	139.969	82	1.707		
	Total	144.89	83			
Realism for facial expressions	Between Groups	6.024	1	6.024	3.808	0.054
	Within Groups	129.7	82	1.582		
	Total	135.723	83			
Realism for character appearance	Between Groups	5.767	1	5.767	4.083	0.047
	Within Groups	115.837	82	1.413		
	Total	121.604	83			
Immersion into games	Between Groups	12.506	1	12.506	9.01	0.004
	Within Groups	113.816	82	1.388		
	Total	126.321	83			
Attention on in-game characters	Between Groups	9.173	1	9.173	7.058	0.009
	Within Groups	106.574	82	1.3		
	Total	115.747	83			
Interaction with characters	Between Groups	4.523	1	4.523	2.318	0.132
	Within Groups	160.036	82	1.952		
	Total	164.56	83			
PANAS emotion	Between Groups	1.55	1	1.55	0.795	0.375
	Within Groups	159.938	82	1.95		
	Total	161.488	83			
Personal Subjective Feelings	Between Groups	4.523	1	4.523	2.234	0.139
	Within Groups	166.036	82	2.025		
	Total	170.56	83			

Table 5.11 Comparison between Gender Groups on Multiple Variables
(significance at 0.05 level)

	(I) Gender	(J) Gender	Mean Difference (I-J)	Std. Error	Sig.b	95% Confidence Interval	
Pairwise Comparisons (Gender 1= male, 2 = female)							
						Lower Bound	Upper Bound
learning motivation	1	2	-.768*	0.287	0.009	-1.339	-0.197
	2	1	.768*	0.287	0.009	0.197	1.339
Realism for character appearance	1	2	-.626*	0.31	0.047	-1.243	-0.01
	2	1	.626*	0.31	0.047	0.01	1.243
Immersion into games	1	2	-.922*	0.307	0.004	-1.533	-0.311
	2	1	.922*	0.307	0.004	0.311	1.533
Attention on in-game characters	1	2	-.790*	0.297	0.009	-1.381	-0.198
	2	1	.790*	0.297	0.009	0.198	1.381
Based on estimated marginal means							
* The mean difference is significant at the .05 level.							
b Adjustment for multiple comparisons: Bonferroni.							

5.6 Chapter Summary

Chapter 5 implements the research realization process using the guidelines suggested in previous chapters. The results from the motivation study are discoursed in this chapter. Three one-way ANOVAs were run for each individual measurement and a factorial ANOVA test was run for the interaction effect between **facial expression** and **years of learning Japanese** for each measurement.

CHAPTER 6 DISCUSSIONS AND CONCLUSIONS

The final chapter of this thesis provides an explanation for the entire research based on the analysis conducted in the previous steps. This chapter chiefly states the final conclusions of this research. The ensuing section in this chapter details the findings and explains the relevance of the findings from the data analysis and discussion of the same. Finally, recommendations for future research are presented in the area of language learning, game development and social psychology.

6.1 Discussions of the Findings

6.1.1 Findings of the Research

The findings showed that there were 2 measurements, **facial expression** and **years of learning Japanese**, which gave one-way and two-way interaction effects. Significance was also found in **gender**.

6.1.2 Findings of the Factor "Facial Expression"

For **facial expression**, no significant effect was found on participants' **learning motivation**. The overall goal of this research was to assess the effect of characters' facial expressions in 3D game on the learning motivation of Japanese L2 students. Below is a recall of the hypothesis of this research:

- **H0:** Facial expressions have no effect on language learning motivation.
- **H1:** Facial expressions have an effect on language learning motivation.

  Based on the data analysis mentioned in Chapter 5, the findings of this research failed to reject the null hypothesis. The results of the data analysis provided the evidence demonstrating the facial expressions of virtual characters in game will not influence the learning motivation of Japanese L2 students. Moreover, for **facial expression**, no significant effect was found on any other examined variables, which answered RQ2—whether characters' facial expressions in 3D game affect any other examined variables or not. One interesting finding was that *the Angry Group* and *the Sad Group* paid less attention to the virtual characters than *the Happy Group* and *the*

Neutral Group. For the variable **attention on in-game characters**, the highest mean among all the four groups was *the Happy Group*.

The present research investigated the relationship between facial expression and learning motivation. The results suggest no facial emotion-related differences in learning motivation. In line with Jana Nikitin and Alexandra Freund's research, the motivation to approach positive and avoid negative stimuli seems to change with age. The two researchers studied age-related differences between younger and older adults in avoidance motivation and the influence of avoidance motivation on gaze preferences for happy, neutral, and angry faces. As a result, the younger participants showed less difference in avoidance motivation when looking at negative emotions (Nikitin & Freund, 2011, p. 696). Their study demonstrated the importance of interindividual differences beyond young adulthood. They mentioned that further studies including other factors, such as interaction, are needed to prove their findings. The present research with interaction extended Nikitin and Freund's research.

6.1.3 Findings of the Factor "Years of Learning Japanese"

For **years of learning Japanese**, the significant effect was found on the variable **time spent**, **realism for character appearance**, **immersion into games** and **interaction with characters**, which answered RQ3—whether participants' years of learning Japanese affect any of the examined variables or not.

(1) For **time spent**, the participants studying Japanese for 1-2 years completed the gameplay significantly faster than those studying Japanese for less than a year and more than 3 years. The possible reason was that the Japanese focus of the game fitted exactly into 200/300 level course content. According to the Japanese professors of 200/300 level course, the Japanese contents within the game, such as the use of "suggestion", "advising" and "expressing opinions", matched exactly the learning chapters of the 1-2-year group.

A similar result was found by a research group at University of Alabama led by Rebecca Oxford. In accordance with their research, previous language learning experience affected instrumental and general motivation at a near significance level (Oxford, Park-Oh, It, & Sumrall, 1993). Moreover, Tillery's research suggested that motivation can manifest itself in terms of the amount of time it takes an individual to act in the pursuit of a goal and **time spent** can be applied to various aspects of behavior to measure the strength of motivation (Touré-Tillery & Fishbach,

2014). According to Tillery's research, in a goal-focused task, the less time participants spend, the more motivated they are. Therefore, it can be concluded that the participants who completed the gameplay significantly faster had more strength of motivation than the others.

(2) For **immersion into games**, the participants studying Japanese for less than a year were significantly more immersive into the game than those studying Japanese for more than 3 years. According to the previous research, it was determined that there was a relationship in between optimal challenge and positive engagement (Shernoff, 2013). The results of Shernoff' research indicated that the more challenging the game is, the more flow state the players get into. Shernoff's theory gave a reasonable explanation on the reason why the participants studying Japanese for less than a year were significantly more immersive into the game than those studying Japanese for more than 3 years. The answer was that the game was more challenging for the less than 1-year group than the more than 3-year group. Indeed, according to the Japanese professors, the Japanese contents within the game were more difficult to the former than to the latter. Thereupon, the less than 1-year group who faced more challenges were more engaged in the gameplay than the more than 3-year group.

(3) For **realism for character appearance**, the participants studying Japanese for less than a year felt the virtual characters significantly more realistic than those studying Japanese for 1-2 years. Not surprising, the less than 1-year group had less experience with real Japanese society than the 1-2-year group, and found the game more challenging, thus was more easily attracted to the game. As a result, it was easier for them to accept the in-game characters' appearance. A research done by Kevin Cheng and Paul Cairns showed that an immersive experience, once achieved, could in fact help to overcome other usability issues. As long as there is no inconsistency in the environment, players are more likely to get immersive and notice less of the surrounding environment. Therefore, immersion and realism can be affecting each other in a certain way (Cheng & Cairns, 2005, pp. 1–3).

Kokkinara and McDonnell studied the relationship between realism of virtual characters and task engagement. Their research has shown that animation realism affects perceived character appeal of a self-virtual face. In a virtual museum, the more realistic the assets are, the more positive feedback is retrieved from the users (Kokkinara & McDonnell, 2015, pp. 1–3). As Kokkinara and McDonnell mentioned, appearance and animation realism of virtual characters in games, movies

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or other VR applications has been shown to affect audience's levels of acceptance and engagement with these characters.

(4) For **interaction with characters**, the participants studying Japanese for more than 3 years felt significantly less interactive with the virtual characters than those studying Japanese for less than 2 years. Similarly, it was likely that the more than 3-year group experienced more with Japanese culture and people and had higher requirements for interaction than the less than 1-year and the 1-2-year group. It can be inferred that the more than 3-year group expected to see something more attractive beyond the content. However, failing to meet their expectation caused a decrease in tension and thus leading into less interaction with the in-game characters. Due to no previous studies were found regarding the relationship between learning experience and character interaction, further studies are needed before any conclusions can be drawn.

6.1.4 Findings of the Factor "Gender"

Significance was found in **gender** on the four variables **learning motivation**, **realism for character appearance**, **immersion into games** and **attention on in-game characters**, which answered RQ4—whether participants' gender affects any of the examined variables or not. For all the four variables mentioned above, more significant effects were found on the female group than the male group.

(1) For **learning motivation**, the female group were more motivated by the games than the male group. That meant the female group had more motivation on the Japanese learning. Similar outcome was found by the research group at University of Alabama led by Rebecca Oxford. Their research indicated that females showed significantly more motivation on the integrative and personal aspect in language learning than males (Oxford, Park-Oh, It, & Sumrall, 1993). Oxford's research also mentioned that males needed more encouragement to recognize the value of learning a foreign language (Oxford, Park-Oh, It, & Sumrall, 1993).

(2) For **immersion into games**, the female group felt significantly more immersive into the game than the male group. During the motivation study, the participants spent most of their time watching the 3D JRPG called "Daigaku Life", only occasionally clicking the mouse to keep the game going. In Nicovich's research regarding computer-mediated communications, it was found that women tend to engage themselves more in watching instead of doing

(Nicovich, Boller, & Cornwell, 2006). Nicovich's theory gave a reasonable explanation for the result on the variable **immersion into games**.

(3) For **attention on in-game characters,** the female group paid significantly more attention to the virtual characters in game than the male group. Likewise, according to Nicovich's theory, it was likely that the female group became more engaged in playing the game and thus more intensely intrigued by watching the in-game characters.

(4) For **realism for character appearance**, the female group felt significantly more realistic than the male group. A similar result was found in research about media stories conducted by a group led by Michael Shapiro (Shapiro & Barriga, 2007). Their research has found a significant difference between females and males regarding the realism of media story that females perceived the story more realistic than males (Shapiro & Barriga, 2007). The findings of Shapiro & Barriga' research presented a good reason for the result on the variable **realism for character appearance**.

The game story in the 3D JRPG "Daigaku Life" was just a media story, so the female group perceived the virtual characters' appearance in game more realistic than the male group.

6.1.5 Findings of the Interaction Effect between "Facial Expression" and "Years of Learning Japanese"

It was found that the two factors, **facial expression** and **years of learning Japanese**, had an interactive effect on the variable **immersion into games**, which answered RQ5—whether there is any significant interaction effect in between characters' facial expressions and participants' years of learning Japanese on any of the examined variables or not.

The data analysis conducted in Chapter 5 showed that the participants who studied Japanese less than a year in *the Angry Group* felt the most immersion into the game, while the participants who studied Japanese for more than 3 years in *the Neutral Group* felt the least. Based on the theories of Oxford and Shernoff mentioned above, it can be deduced that the participants who studied Japanese for less than a year in *the Angry Group* felt the most immersive experience during the gameplay due to the challenging Japanese content and strong facial expression' response. On the contrary, the participants who studied Japanese for more than 3 years in *the Neutral Group* felt the least immersion in the game because of the least of challenge and the neutral response.

6.2 Conclusions

Conclusions of this research were drawn based on the data analysis results. The main finding of this research demonstrated that virtual characters' facial expressions in game had no significant effect on participants' **learning motivation**. Meanwhile, no evidence indicated it influenced any other examined variables. The second finding was that, for the factor **years of learning Japanese**, had the significant effect on the variable **time spent**, **realism for character appearance**, **immersion into games** and **interaction with characters**. That meant the participants' experience of language learning affected the amount of time they spent in completing the game, their awareness of the realism of the virtual characters, their immersion into the game and their interaction with the virtual characters. The third finding was that **gender** had significant influence on the four variables **learning motivation**, **realism for character appearance**, **immersion into games** and **attention on in-game characters**. The data analysis results suggested that females were more motivated than males in language learning. Females also felt the game more immersive and the virtual characters more realistic and thus paid more attention to them. Eventually, evidence showed that the two factors **facial expression** and **years of learning Japanese** had an interactive effect on the variable **immersion into games**.

6.3 Limitations

As was mentioned in Chapter 1, two limitations were exposed during the research process. One was that there existed other in-game elements that influenced the results of the study, such as in-game environment, game story, character animation, game interactivity and so on besides the virtual characters' facial expressions, which might result into biased data. Another was that the research was not capable of using an eye-tracking device to capture the attention of all the 84 participants due to the limited number of eye-tracking devices. That meant the effect of facial expressions on them may not be measured precisely because the participants may not pay much attention to in-game characters' facial expressions.

6.4 Recommendations for Future Work

It is recommended to apply this type of research into other language areas to validate the findings and applicability. This research has shown some values in language learning and psychology fields.

In order to build stronger evidence, additional studies in different subject domains and settings need to be conducted. As an extension, based on the significant findings of this study, more research should be done by the learning game developers, like the ones who made "Crystalize" and "Influent", on different aspects of a learning game in order to maximize the language learning effect. Further suggestion is about experiment prototypes. Elements potentially influencing the experiment outcome should be considered in advance and eliminated during the development process so that the most accurate data can be obtained in the experiment. Lastly, it is suggested that an eye-tracking device should be used when asking people to rate their motivation to ensure the most precise data on participants' attention captured in experimental language learning and social psychology research.

APPENDIX POST QUESTIONNAIRE

Post-test (Always rated from 1-7, 1 being strongly disagree (negative experience) and 7 being strongly agree (positive experience))

• Language Learning Motivation
1. I was confident I could learn the basic concepts taught in this game.
2. The characters encouraged me to learn Japanese.

• Realism for character reaction
3. I think the reaction from the characters I see is appropriate.
4. I think the responses from the characters are realistic.

• Realism for facial expressions
5. I think the facial expressions of the characters are realistic.
6. I think the facial expressions of the characters are reasonable.

• Realism for character appearance
7. I think the appearance of the character is realistic.
8. I think the appearance of the character is appropriate.

• Immersion into games
9. To what extent did you feel you were focused on the game?
10. To what extent did you feel that the game was something you were experiencing, rather than something you were just doing?
11. At any point did you find yourself become so involved that you wanted to speak to the game directly.

• Attention on in-game characters
12. I paid close attention to characters' animation.
13. I paid close attention to characters' appearance.

• Interaction with characters
14. I had fun interacting with the in-game character.
15. I felt connected to the virtual characters.

• PANAS emotion
16. How enthusiastic did you feel during your time in the game?
17. How inspired did you feel during your time in the game?

• Personal Subjective Feelings
18. I was influenced by characters' facial expressions.
19. I felt stimulated by the characters' facial expressions.

• Motivation Parameters
20. I spent less time in the game.
21. I performed well in this game

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