


Article

Empirical Study of Virtual Reality to Promote Intergenerational Communication: Taiwan Traditional Glove Puppetry as Example

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Abstract: Based on glove puppetry, a traditional cultural pursuit of Taiwan, this study designed a virtual reality (VR) intergenerational game to bring together the elderly and young participants. In the game, a system of cooperation and sharing was constructed which would lead to an exchange between experience and knowledge of traditional culture and digital technology and result in intergenerational interaction and communication learning. Through interviews with eight subjects after the empirical study, this study explored the operation and experience of this game, the perception of interaction and dialogue, and the cultural heritage and learning. According to the research findings, VR game cultural elements and technology learning positively influence intergenerational relations and communication. Key factors of VR intergenerational games include the following: (1) the game content must be attractive for the elderly; (2) the operating procedure of the game and affordance of the interface for the elderly must be simplified; and (3) the game must establish a sense of achievement for players.

Keywords: intergenerational game; intergenerational communication; VR game; cultural heritage; older adult digital gap



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1. Introduction

Through a digital-technology-based virtual reality (VR) game, this study creates the design elements upon “Glove Puppetry” with the characteristics of the traditional art of Taiwan in order to improve the elderly’s digital gap and enhance the elderly’s interest in digital games. Elderly people play the role of passing on their experience and knowledge and guiding the younger generation to approach the traditional culture of Taiwan. The learning and instruction of the intergenerational interaction enhance the connection between the elderly and digital technology and lead to cultural heritage and intergenerational interaction.

With the progress of medical technology and social care in Taiwan, the average age of the elderly population has continued to increase. According to the Department of Statistics under the Ministry of the Interior, Republic of China (Taiwan), in 2021 the elderly population above 65 years old in Taiwan reached 3,804,000 people and the percentage was 16.2% of the total population. It has passed the threshold of an “aging society” as defined by the United Nations [1]. Thus, the challenge of Taiwan in an aging society refers to the life quality and care of the elderly. Change in family structure, in particular, has lowered the connection between the elderly and other generations, and life after retirement influences one’s social connections and mental health. During the COVID-19 pandemic, digital technology has not only provided more precise and convenient medical support but

also enhanced people's dependence on and demand for digital technology in their lives. Aging is a globally important issue, and the elderly's positive psychological development via digital technology will result in positive returns for the economy and their health [2].

According to research, a person's social environment influences their use of the Internet. Thus, with the encouragement of family and friends, the elderly can effectively increase the use of digital products such as the Internet, and their personal learning motivation will be more significant than learning in other courses [3,4]. In addition, digital games will improve the elderly's psychological and physical health. From the perspective of business, the elderly are an enormous potential market, but up to now most of the present digital games in the market cannot satisfy the increasing demand of this demographic. Thus, there is an enormous potential market for game designers [5]. The elderly are anxious and unfamiliar with new technology, and the operation and use of it are challenging. However, more than 30% of elderly people suggested that they were interested in the upgrading of their use and abilities with new technology [6], and they expected more learning opportunities to obtain new knowledge of technological applications [7,8]; different measures should thus be more actively developed to cope with the intergenerational gap.

The convenience of digital technology serves as a connection between the elderly and families and friends, establishing new relationships and allowing the elderly to search for information related to community activities [9]. Technological training for the elderly reinforces the cohesion of teams and connection among families who have not lived together as well as among friends [10]. For healthy seniors, learning and using social networks enhance their participation in social activities, maintain and improve cognitive functions, and reveal the advantages of online social networks [11]. In the future, the use and progress of the elderly of social technology (such as e-mail and Skype) can strengthen their social connection in old age. Other kinds of technology such as smartphones and virtual assistants change elderly people's management and communication of personal daily activities. VR experience, artificial intelligence, and robots are the directions of technological application to enhance social connection and avoid social isolation [12]. Digital games are recognized as serving to effectively improve and cope with various symptoms of elderly adaptation. Encouraging the elderly to develop physical and mental health and delay illness reinforces their quality of life [13]. According to the overall trend, VR effectively improves the quality of life of the elderly and positively influences their health, social life, and emotion. It is a potential field for further development [14].

According to the "cross-strait elderly life survey" of the Industrial Technology Research Institute (IEK Consulting) in 2010, as to the ideal model of "domestic life" for the elderly above 50 years old in the ranking of the first 40% of monthly income, percentages of "living alone" and "living with spouses" increased significantly; in addition, percentages of "living with other seniors in institutions" and "living with children" successively decreased. This thus shows that if the elderly can live independently, then local aging and living alone will be the future trend. In addition, the domestic life of the elderly has changed, and the percentage of living with children is down. Digital technology such as smartphones has accelerated the elderly's use of technological products, such as laptops, tablets, and others, which have become important tools to contact families and have replaced traditional telephones.

Intergenerational learning is an important measure to preserve culture and historical tradition. It passes on knowledge from the elderly to the younger generations. Continuity of intellectual property rights is extremely important in intergenerational education [15,16]. Interaction between different individuals is mostly based on communication among the same ages. Intergenerational communication can be associated with internal and external interactions of families (such as the interaction between young people and children, and the interaction between middle-aged people and grandparents and grandchildren). At different stages of life, there are different kinds of communication, goals, demands, and behaviors, and so there can be a communication gap [17]. Thus, technological experience not only triggers the topics and interests of different generations but also reinforces interaction

between the generations and sustainability of the intergenerational relationship. In the concept map of the intergenerational game developed by Agate et al. (Figure 1), the priority of the game's process is to promote participants' motivation. By constraints of the content, participants can obtain points and achievements in the process; by different functions of the game content and learning of technological use and rules, the participants acquire benefits through different processes of games [18].

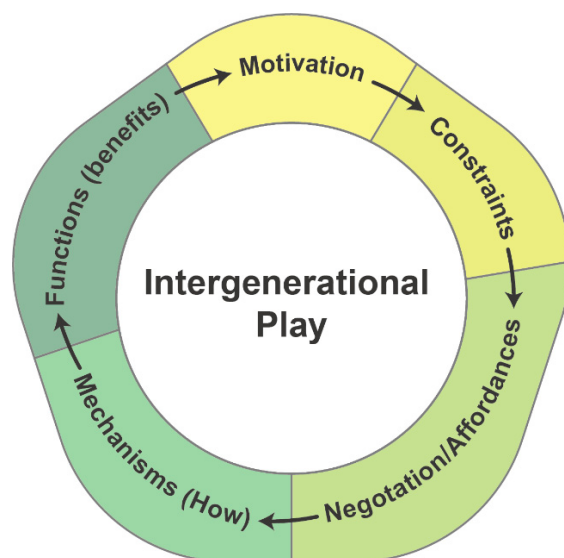


Figure 1. Concept map of the intergenerational game. (Re-drawn for this study.)

Previous related research has established that digital technology has a positive impact on the elderly in many respects, including but not limited to health, medical care, communication, etc., and bringing more convenience [19–22]. Digital technology has not only effectively improved the quality of life for the elderly, but also allowed them to maintain social connections and introduce new learnings and topics into their life. However, in the application of intergenerational communication, there is an issue in the understanding and usage of digital technology by different generations, and it has a certain influence on the digital divide of the elderly. With the advance in digital technology, most elderly maintained the habit to approach and comprehend new technology with the support of family and friends; they learn actively and use new technology in their lives. Therefore, when the elderly, who are not familiar with digital technology, interact and communicate through digital technology with the digital generations, i.e., those born into or raised in the digital era, it may bring about the opposite effect [23–25].

The purpose of this study is to explore whether we can leverage the elderly's deeper understanding of traditional culture to reduce the imbalance and digital gap in the application of digital technology to intergenerational communication. Thus, for this research, we designed a VR game in the theme of Taiwanese puppetry, connecting with local culture, dialect, and history to interest and entertain the elderly, and reduce the sense of rejection to using and learning digital technology. Meanwhile, storytelling and interactivity is also explored in gaming, to determine whether it can create a more relaxed experience, and achieve knowledge sharing and learning regarding cultural inheritance and digital technology between the elderly and younger generations. According to the research purpose, the following research aims are formulated: (1) to discover how an intergenerational program can be properly applied to a game design for the elderly and younger generations; (2) to explore the model of a VR interactive game, which shows Taiwanese culture for the elderly and intergenerational interaction; and (3) to assess the possibility of applying VR in an intergenerational program and providing research development for the interaction and design of future intergenerational programs.

2. Design of VR Intergenerational Game

According to the literature, a proper intergenerational program can successfully enhance intergenerational communication. The game developed by this study focuses on the communication and interaction of different generations. Thus, the game's interaction becomes an extremely important design core. From the scenes of the game, the elderly can recall their childhood, and the younger generation can approach the culture and history of Taiwan through its content. The research design (Figure 2) and game characteristics are shown below.

- (1) The setting is the temple square from 1951 to 1961, and thus the elderly can return to the time of their childhood through the game.
- (2) It selects the waning traditional open-air theatrical performance culture. When the younger generation operates the game, they approach the development and charm of traditional glove puppetry culture at that time and the initial heritage of traditional culture.
- (3) The interaction of VR integrates teamwork, instruction, and communication to learn about different generations and constructs intergenerational interaction and communication.

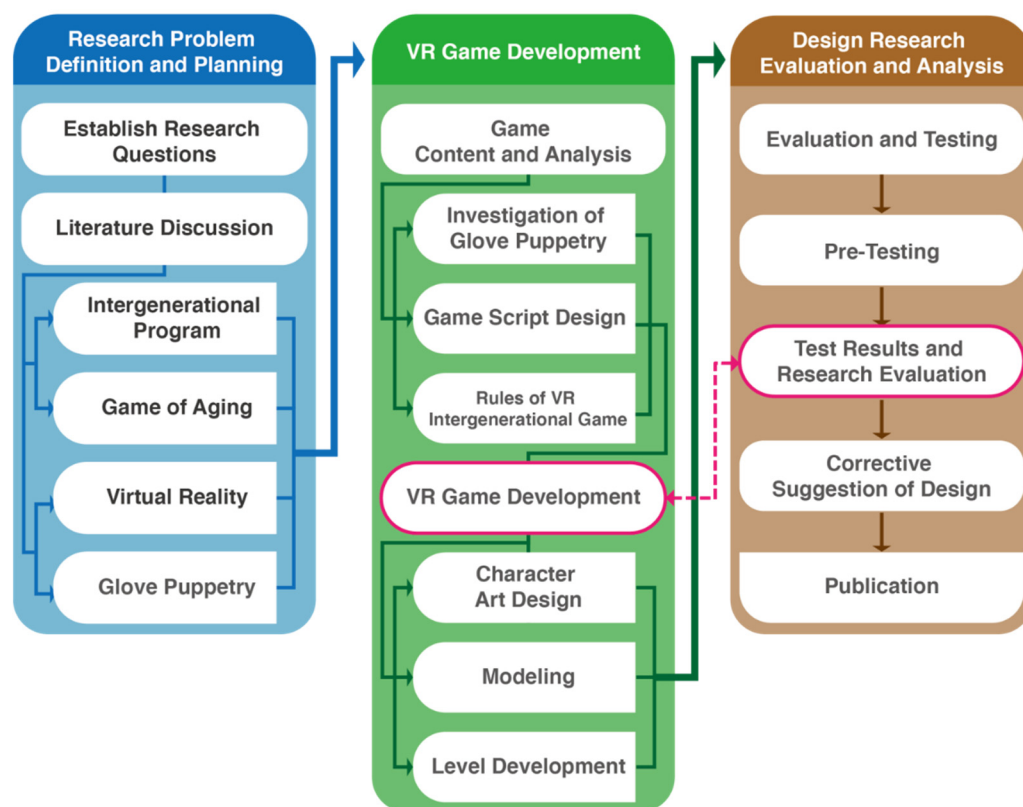


Figure 2. Research design.

The setting of the game is based on an open-air theatrical performance in Taiwan in 1951. According to the traditional stage and environment of an open-air theatrical performance (Figure 3), this study designed the classical plot of the Legend of the White Snake as the theme of the performance. The art design was based on the Song Dynasty. According to the wooden puppet model of traditional glove puppetry, this research designed the appearance and costumes of three important puppets (Figure 4). Virtual puppets are operated by the VR hand gesture function. Thus, the subjects could be immersed in the performance of glove puppetry.

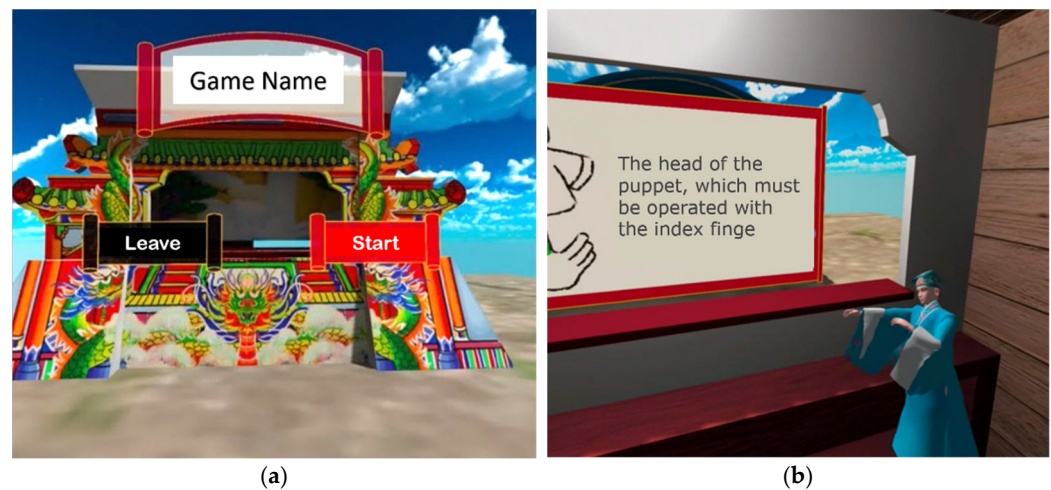


Figure 3. Inside and outside views of open-air theatrical stage (the reality of a VR game). (a) Game login interface, (b) Game teaching screen.



Figure 4. 3D character design of virtual puppets (from left to right, Fa Hai, White Snake, and Hsu Hsien).

3. Empirical Study

In order to recognize the intervention effect of intergenerational game programs, this study recruited four groups of intergenerational subjects, including eight people. In each group, there was one young adult below 35 years old with VR and digital game experience and one senior above 60 years old with experience and interest in the glove puppetry of Taiwan. The subjects' education and gender were random (Figure 5). The subjects were selected by purposeful sampling. In addition to meeting the age requirement, the subjects must live and move independently with good physical and mental health. The logic and validity of sampling aimed to select cases with rich information. According to the goal setting on subjects, this study selected proper cases for the research while considering whether they could provide much important information.



Figure 5. Experience of the game during the empirical study.

The whole empirical study and interview lasted for 80 min, and the game experience was 40 min. Since VR mainly serves as a short-time display experience, each VR game lasted for 15 min. There were eight subjects; A to D refer to different groups, and the coding was anonymous. This study included six female and two male subjects. In each group that participated in this empirical study, there were young adults aged 20~35 and elderly aged 60~75. The subjects were relatively familiar with digital products and could operate them. However, they were not required to possess profound experience or knowledge of VR technology or gaming. Basic information of the subjects is shown in Table 1.

Table 1. Basic information of subjects.

Codename	Gender	Age
A01	Female	66
A02	Female	25
B01	Female	67
B02	Female	30
C01	Male	70
C02	Female	27
D01	Female	60
D02	Male	23

Data collection of this study aims to focus on the interaction of the group in which the elderly and young people experienced the game of VR glove puppetry. The study adopted a semi-structured questionnaire design and collected data from the experience of individual subjects by intensive interviews.

- (1) Depth interview: Through a data collection strategy and method of qualitative research and semi-open-ended questions, the study conducted in-depth interviews with the subjects. During the interaction with the subjects, the researcher maintained sensitivity to explore the topics in order to profoundly recognize the subjects' various kinds of perceptions regarding the use of the device as well as the operation and experience of the game during the empirical study process to further describe the facts. Thus, in the phase of data analysis, this study was able to more properly interpret the perception and significance from the subjects' perspectives. During the process of the interviews, the researcher defined themselves as an observer. By open and flexible data collection, this study fully used the subjects' immediate problems and the characteristics of different cases.
- (2) Semi-structured questionnaire: In the interview with the subjects from different groups, the researcher adopted an open-ended interview and the subjects recalled

and described their various kinds of perceptions, problems, or difficulties from the beginning to the end of the empirical study. When the subjects could not properly describe the problems, the researcher tried to help simplify the description or guide the cases and confirm the origin of the descriptions. The questionnaire of semi-structured interviews aims to result in clearer and smoother questions in the previous interview process, and it validated that subjects' views and perceptions were collected by the questions (Table 2).

Table 2. Questionnaire of semi-structured interview.

Items	Dimensions	Interview Questions
1.	Operation and experience of the game	a. Is there a difference between the operation of VR glove puppetry and realistic puppets?
		b. In the game using the VR device, what were your physical perceptions and experiences?
		c. Which parts of the game should be improved? What are the problems?
2.	Perception of interaction and dialogue	d. What was the interactive content in the game? What impressed you the most?
		e. In the interaction and communication elements of the game, what were the experiences and perceptions that do not exist in real life?
		f. Did you enjoy the interactions in the game? Why?
3.	Cultural heritage and learning	g. Through the game's model and content, did you approach the traditional culture of glove puppetry?
		h. In the VR game, were there new cultural experiences or knowledge learning?
		i. Did you enjoy cultural or related knowledge learning by the VR game? Why?

The design of the interview items focused on the following research purposes: (a) whether the intergenerational program was properly applied to the game design for the elderly and younger generation; (b) exploring the problems and advantages of applying VR games to the elderly; (c) exploring the model of VR interactive games of Taiwanese culture for the elderly and intergenerational interaction; and (d) assessing the possibility of applying VR to intergenerational programs and to serve as a reference for research development for the design of future intergenerational programs. Thus, the topics of the interviews were based on VR devices, the design of the user interface, pair game cooperation, and reflections and experiences after using the game.

4. Analysis

As to the result of coding, this study adopted the Cohen Kappa coefficient. Analysis of two researchers' coding results showed that 0.6 was a stable and reliable standard. According to the selective coding result from the grounded theory, through triangulation, this study cross-checked with other researchers to validate the consistency and objectivity of the analytical results. The analytical process of the three phases is shown below (Table 3).

Table 3. Three phases of categorization in oral analysis.

Phase	Process	Number of Encoding
1	Open Coding	305 Concept Tags
2	Axial Coding	11 Category Items
3	Selective Coding	5 core categories

- (1) Open Coding: At the phase of open coding, the main purpose was to obtain concept tagging and search for concept titles by transcription. The process to categorize data reduced a great number of words and screened the related data content. According to the transcription of the eight subjects, in the first phase of open coding, this study was organized into 305 concept tag groups.
- (2) Axial Coding: The analytical process mainly generalized the correlation among the previous categories. By the structural method, it re-connected and integrated data that facilitated the searching of related clues. In categorification, it searched for keywords and similar questions allocated as axial coding. Axial coding of the second phase in the first categorification included 27 categories. However, after triangulation, this study realized that it could further generalize the keywords and questions. Thus, part of the open coding was reduced and combined into 11 categories. For instance, the same questions with different descriptions were combined. The coding content that was not related to this study and could not be allocated in the 11 categories was deleted (Table 4).

Table 4. 11 Category Items.

Items	Subcategory
1	VR puppetry games can effectively enhance intergenerational communication and improve parent–child interaction
2	The game theme affect the topicality and resonance during intergenerational communication
3	Younger respondents express interest in playing games with the elderly
4	Young respondents take the initiative to help the elderly to solve problems without getting bored
5	Deepening younger generations’ understanding of the value of cultural heritage from puppetry culture and traditional society while playing
6	The elderly need clear instructions and game guidance functions
7	The elderly enjoy playing with younger generations, but are also prone to stress and lack of self-confidence
8	Elderly people enjoy puppetry-themed VR games
9	Insufficient feedback during gaming affects the immersive experience
10	Interruptions during gaming cause frustration and an unpleasant gaming experience
11	Most respondents are more sensitive to the sense of space in VR games and are easily stressed

- (3) Selective Coding: Selective coding is the process of generalizing and refining grounded theory. By the systematic method, different categories are clustered into larger ones as core categories. Thus, in the original 11 categories, the study reviewed the context of the categorification and proposed five core categories: (a) the elderly needed more specific instructions of the operational process; (b) the elderly were not confident in the process of the intergenerational game; (c) related themes of the game effectively enhanced intergenerational communication and parent–children relationships; (d) the spatial visual gap was an important factor in the VR game design and influenced the

sense of equilibrium of space; and (e) the sound and action feedback of the VR game were important factors of game experience.

During the analysis of oral data, an interesting phenomenon was found. Before playing games, most of the elderly had common views: they felt more pressure playing with younger generations, because they may not be patient with them (C01Q3-3, A01Q8-4, D01Q3-2); they lacked of confidence and initiative when new to a game (B01Q8-1); they were resistant and worried about not being able to keep up with other players and causing trouble; and generally, they felt that they were not suitable to play with younger generations (A01Q8-2, D01Q3-3). However, experiencing the game brought unexpected surprises to the elderly: they were very willing to play games with younger generations, especially when given assistance (B01Q8-2, C01Q7-2), and once familiar with the controls they found it to be more enjoyable (A01Q9-2).

Although most younger generations had no experience playing games with the elderly, they enjoyed the experience and felt a great sense of accomplishment (B02Q8-3); they were willing to take the initiative to assist the elderly to quickly familiarize themselves with the game and interact like friends (A02Q7-7, C02Q8-1, D01Q3-5). With guidance, the elderly could become familiar with most of the game functions in a short period and feel that the operation of puppets was very realistic, allowing them to quickly understand how to operate the game (B01Q2-3, A02Q6-1). After becoming familiar with the game, several elderly people not only gradually showed improvement in their self-confidence, but even took the initiative to teach the young people how to walk and perform with the Taiwanese puppet and share stories about puppetry culture (A01Q7-5, C01Q4-5).

In addition, most respondents expressed that in wearing VR glasses for the first time, they felt more sensitive and uneasy in visual space, afraid of colliding or falling, and unable to easily grasp the sense of space (A01Q4-13, A02Q4-9, B01Q5-2, C01Q5-1~7, C02Q2-2, D01Q5-1). However, after an adaptation period, they could focus on the immersive game environment, and felt the operation of the game getting easier and simpler (A01Q9-2, C01Q3-5, B01Q2-3, A02Q6-1). Even elderly respondents suggested in the interview that virtual puppets could have more complex or realistic dynamic effects or a sense of feedback, and rich sound effects would make it more immersive (B01Q1-13, C01Q4-5, A01Q7-4). Another suggestion was to increase the degree of freedom in the game content, allowing for more collaboration and gaming time (D01Q9-3, C01Q6-8). The elderly helped themselves cross the threshold of learning and unconsciously improved their digital ability through establishing self-confidence and interest in the game.

5. Discussion

This study reveals several important findings. According to the interview result, the elderly, in comparison to young people, paid more attention to their performance in the games. They worried that they could not catch up with the young people and that they might cause failure or errors in the game. Therefore, with a lack of game experience, they resisted playing with young people due to the feeling of pressure. This was why the elderly were not confident before participating in the empirical study. Furthermore, the design of the game model and operation for the elderly should not be based on the perspective of the younger generation. It must understand the factors of an age gap. Therefore, the game design of VR glove puppetry not only simplified the complicated interface but also showed a more intuitive operation of puppets instead of relying on joysticks.

The theme of the game was not competitive, and participants should discuss with and help each other regarding the content of the story or the performance of puppets. This could positively influence intergenerational relations and communication. In addition, most of the subjects suggested that the cooperative model to accomplish common tasks in the interactive game and the accumulation of points could effectively enhance the parent–children relationship. Because of game content and themes, they could develop topics besides their own lives. This significantly enhanced the social interaction of players of

different generations and promoted common activities. Based on the previous discussion and the analytical result, this study elaborates on the following.

5.1. In the Closed and Independent Visual Operation Environment of VR Games, the Older Adult Needed More Specific Guidance on the Operational Process and Interface

According to the result of the interviews, most of the elderly people had not experienced VR and needed more time to adapt to and learn the operation of the game. In addition, the speed of the elderly in the game was different from that of young people. The elderly expected a slower process of the game in order to properly receive different kinds of information. Although the young people did not have the same problem, they slowed down to allow the elderly to successfully play the game.

As to the interface design such as the instruction, it was simplified and clearer during the phase of design. However, the elderly still could not intuitively find the menu from the free perspective of VR. With the users' vision of the glasses and since others could not see the operational interface, they were not able to help them. Therefore, it was important to avoid the frustration of the elderly in the process of the game by using a float menu to meet the movement of the users' vision and guidance of different phases of the game.

5.2. Spatial Visual Gap in VR Game Design Influenced the Sense of Security of the Older Adult Players

The VR game developed in this study lasted around 30 min. Since the characters did not move in the game, the players only needed to change their angle of view at the fixed places and to operate glove puppetry and a simple menu by hand. Thus, after playing the game for a while, most players felt fatigued in their hands, or they suggested a function to change the players. According to some female players, the VR glasses were heavy and after a while they were not easy to move. The players who wore glasses were not used to VR glasses, and their glasses tended to become dirty and blurred when they played the game. Furthermore, most of the subjects suggested that when they wore VR glasses at the beginning, they needed some time to adapt to the virtual environment. After taking off the glasses, they needed time to adjust, too. During the process, they did not feel dizzy or uncomfortable.

In the progress of the game, although most of the subjects did not show physical discomfort, in the virtual space most of the subjects noticeably encountered an optical illusion of a cliff at the edge of the scene. It resulted in visual imbalance and the feeling of falling. When they changed the angle of view, they saw themselves floating. In addition, it was not easy for the subjects to control the distance in the virtual environment. When they took the puppets in front of them, it was difficult. The height of the places of puppets indirectly influenced the users' poses. When they had to bend, they were afraid of falling, and so they became nervous.

5.3. The Elderly People Were Not Confident in the Process of the VR Game

Before playing the game, most of the elderly people suggested that they were not good at games and worried that they might affect the other young player in the process. After playing the game, they paid more attention to the instruction and description of steps, and in comparison, they were more careful to avoid errors than their younger counterparts. They even became stressed. After a while, they tended to be less nervous. In the empirical study, the young people would actively help, guide, and wait for the elderly. Thus, they both felt relaxed in the game.

In the interviews, the elderly people suggested their anxiety and concern about the common game and thought that young people would be impatient with them. In comparison to the younger generation, they tended to resist playing the game with those younger than themselves and even preferred playing the game with those of the same age. Nevertheless, in the interview, the young people were open-minded and looked forward to playing the game with the elderly. They understood that the elderly were unfamiliar with the game. They not only actively assisted with their difficulties but also enjoyed playing the

game with them. Thus, the young people enjoyed the game, and by communication and guidance, they helped the elderly and accomplished the tasks. The elderly were delighted when they were helped by the young people, and it resulted in their heightened sense of achievement in the game.

5.4. Sound and Action Feedback of the VR Game Were the Important Factors of Game Experience

The operation design of virtual glove puppetry in this study was based on right-handed gestures to simulate the realistic manipulation of traditional glove puppetry. According to most of the subjects, the operation was intuitive and was similar to the operation and imagination of realistic puppets. However, due to the limitation of programming design, the operation of virtual puppets could not totally simulate realistic puppets. The players could manipulate the legs and steps, but the movement of heads was more sensitive in the program. Therefore, in comparison to the operation of real puppets, it required a concentration of gestures in order to more precisely control the movement of puppets.

In the game, the subjects expected a simulation of a realistic performance of VR glove puppetry. Therefore, they mentioned the issues of sound and action feedback. As to action feedback, besides the manipulation of the movement of puppets, most of the subjects expected the feedback of bumping instead of penetration. The bumping effect included that between puppets and between puppets and the background. According to some subjects, the most interesting part of glove puppetry was the emotion of different characters interpreted by the puppets' actions. The fighting was less effective due to the lack of bumping. In addition, as to sound, although there was background music, the proper sound effects showed that the simulation of the performance of realistic puppets and the experience of the game could adhere to reality.

5.5. Related Themes of the Game Effectively Enhanced Intergenerational Communication and the Parent-Children Relationship

Most of the elderly people had never played with young people in a game. Thus, in participating in the interactive game, the interaction between the elderly and young people was positive. They all were relatives or friends. Young people made efforts to help the elderly be familiar with the environment and operation of the game, and the elderly thus successfully played with them. In addition, most of the subjects restarted after the end of the game and discussed with each other regarding the combination of different characters and scripts. Most of the groups were familiar with the rule of the game by the second or third round, and in the process, they further discussed with each other and showed in-depth experience.

These discussions were mostly derived from the elderly who shared their childhood experiences and memory of glove puppetry. They discussed the content and stories with the young people as well. The interesting interaction mostly did not originate in the process of the game, but rather it was accumulated in the interactive game, and their topics were developed in the interview after the end of the game. Some young subjects suggested that in the past, they did not know that the family members liked glove puppetry. Through the game, they realized the families' different interests. Thus, the elderly people's resistance or lack of confidence in the VR game did not influence their interaction in the game, but it in fact enhanced their relationship. Therefore, most of the subjects suggested that cooperation in the interactive game, the accomplishment of common tasks, and the accumulation of points could strengthen the parent-children relationship, and they developed different topics by the themes of the games.

6. Conclusions

Although the VR game emphasized the reality constructed by the virtual environment, the operation of the game still relied on the menu instructions, and thus the players could successfully play the game. However, this was challenging for the elderly who showed inferior reading competency. For the elderly with a demand for different dialects, the lack of

a voice function increased the obstacle of operation. Nevertheless, most of the respondents gave positive affirmation to the intergenerational relationship between the elderly and the younger generation in the game, especially after the game was over, there are more parent–child topics. Most of the subjects nevertheless recognized the intergenerational relationship between the elderly and younger generation in the game. After the end of the game, topics of discussion increased between parents and children.

Noticeably, the interaction in the game was successively developed a while after the end of the game, which might reflect the reality that people rely on different mediums that lead to different topics and relations. It shows in the environment of the virtual game that people can construct dialogues by new identities and relations instead of their roles in reality. Although not all subjects could successfully play the game, unexpectedly they developed interesting topics and interactions and thus learned from and comprehended each other. Therefore, combining the traditional culture familiar to the elderly into the game theme can indeed effectively help the elderly adapt to the game content and operation more quickly. The key factor lies in the design, which not only strengthens the self-confidence of the elderly, but also allows the two generations to achieve a balance in knowledge sharing. In addition, through the virtual puppets and game design, a new way of communication was established between generations, allowing the elderly to gradually improve their digital technology ability while enjoying the interactive process of the game.

Finally, some subjects proposed different views and argued that a virtual interactive game is similar to the present social networks. Although there are interactive functions such as voice communication, video communication, and games, they cannot replace realistic interpersonal connections. This shows the gap in the interaction. However, the purpose of the development of digital technology is not to weaken the relationship between humans and society. In the current global pandemic, person-to-person human relations have been negatively affected. However, for many people, digital technology maintains such relationships and reduces distance, thus becoming indispensable for life and work. Virtual interaction might not totally satisfy human beings' needs for affection, but it is certainly the present option to maintain relations and exchange affections. It can pass on knowledge such as culture to different generations.

Therefore, this study has some potential limitations. First, due to the pandemic, considerable difficulties were encountered in the selection and willingness of participants. The main subjects were not to be situated in the same institution or community, but from different regions; they also had to match the age combination. Therefore, in addition to the willingness to participate in the empirical study, the same group of subjects had to be able to provide a good health certificate to participate in the two stages of the empirical study and interview. In addition, the research adopted intensive interviews and conducted individual interviews with eight subjects. The amount of data in the subsequent oral analysis was relatively large. For the quality of interviews and data analysis, only eight ideal and suitable respondents were selected in the end.

Secondly, as to the gesture function of VR, although it simulated the operation of glove puppetry, it led to new problems. The subjects' experience could not last long due to the fatigue in their hands. In addition, in VR network games the quality and stability of the network significantly influence the gaming experience. Thus, this study encountered problems and challenges in terms of the server's stability.

The study did not discuss the acceptance or attitude of different genders. In the future, further research can be conducted regarding the number of subjects and gender to explore even more diverse issues of intergenerational communication, and also add new perspectives for more development possibilities. Taiwanese puppetry had a significant effect in the study of cultural inheritance and intergenerational communication. Therefore, in the future, intergenerational interventions can be combined with reminiscence therapy to leverage the elderly's memories and experiences to achieve treatment goals, which can be beneficial for connecting within society and improving quality of life.

This study has been reviewed by the Institutional Review Board (IRB) of Nation Changhua University of Education Research Ethics Committee with consent No. NCUERE109-046.

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