

ARTICLE



Virtual world-supported contextualized multimodal EFL learning at a library

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Abstract

This study aims to investigate the influence of story creation on young EFL learners' reading performance. Action research was adopted to examine the effects of two different story reading projects in a library setting in Taiwan. Each project comprised a group of 19 young EFL learner from Grades 4 to 6 (aged 10–12). The first group's activities consisted of picture storybook reading and word games. The results obtained from the pre- and post-reading tests on the learners' performance revealed an increase in their English reading scores. But the results of the learners' motivation and anxiety questionnaire were unsatisfactory. To overcome this discrepancy, a 3D virtual construction task using Omni-immersion Vision, an online VR construction tool, was added to the reading activity. This let the students express their ideas through multimodal resources including text and images in their stories and their 3D virtual contexts. The results showed that the second group made improvements not only in their English language reading but also in their learning motivation, and they demonstrated lower levels of anxiety than the first group. It appears that a combination of multimodal stories and context construction in virtual worlds benefited EFL learners.

Keywords: *Virtual Reality, Story Creation, Semiotics, Multimodality*

Language(s) Learned in This Study: *English*

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Introduction

In order to enhance its global competitiveness, the Taiwanese government has developed plans to turn the country into a bilingual nation by 2030 (Ferrer & Lin, 2021); thus, learning English has become essential in Taiwan. However, young learners do not see the urgent necessity of English outside the school, so they have low motivation in learning the language (Lo & Lin, 2020). Picture books containing a storyline and colorful pictures could be interesting and appealing to young learners. These books use multiple modes such as color, design, and text, and simplify the concepts for learners' understanding of a foreign language (Suhardiana & Lestari, 2020). A variety of storybooks and activities have been adopted to enhance learners' literacy skills. Among the commonly used approaches, reading picture storybooks is effective for EFL learners (Harji et al., 2016). Listening to picture storybooks read by adults, either teachers or parents, can be a source of language and knowledge input for young learners, thereby improving young learners' literacy skills and reading development. In addition, advanced technologies also play an important role in supporting EFL learners. Among the various forms of emerging technology, virtual technology provides an authentic context which is highly suitable for language acquisition (Lan, 2015). For example, Lan (2015) created an authentic context in virtual worlds, within which young EFL learners were engaged in self-directed learning through exploration, resulting in a significant increase in their English performance and motivation.

Furthermore, learning resources need to be as accessible as possible (Harisanty & Anna, 2020), and a library is a suitable option for its rich resources in language learning and digital materials. This learning space is especially important for learning outside the classroom. Libraries today seek ways to promote the use of their English learning resources, especially by their younger visitors (Kelly & Bolanos, 2020).

Given the positive impact of reading picture storybooks and exploring or creating 3D virtual worlds on young EFL learners, more attention deserves to be given to how to integrate these two approaches into language learning within libraries. Therefore, this study aimed to examine young learners' English performance and their learning motivation and anxiety under the new instructional method. To this end, action research was adopted to address the following three research questions:

- 1) What effect does the integration of 3D creations into storybook reading have on young EFL learners' vocabulary acquisition?
- 2) What effect does it have on the motivation and learning anxiety of young EFL learners?
- 3) What effect does it have on young EFL learners across different modes of literacy?

Literature Review

Language Learning in Libraries

Public libraries are buildings which contain collections of books, periodicals, and sometimes music and films. Libraries have a traditional role as a place to read and as an agent to promote reading. Among the services available in public libraries, providing language learning programs is among the most critical ones because they allow young learners to develop their literacy skills (Grossman et al., 2021). In Taiwan, public libraries offer foreign language learning courses to promote bilingualism in support of the government's policy to develop the country into a bilingual nation. Taipei City Library held story-reading sessions in both Chinese and English languages (Taipei City Library, 2020). The Main Library in New Taipei City established three storytelling programs in the fall of 2021: Rainbow Picture Book Reading, Big Picture Book Reading, and English Story Train (New Taipei City, 2021). English language programs play an important role in developing interest in English, especially if they are held outside school (e.g., in libraries). Learning that takes place in libraries is considered informal learning as it is not guided by a rigid curriculum (Bin-Hady & Al-Tamimi, 2021).

Just as they have been agents for the expansion of literacy in the past, public libraries must continue to be agents of change in their communities (Nuridin & Saufa, 2020). To keep up with the rapid developments in technology, public libraries continue to adapt and evolve, providing access to emerging digital technologies alongside more established ones (Nicholson, 2017). There are studies which have examined learning beyond the classroom through utilizing library resources (e.g., ChanLin, 2017; Ma & Yu, 2019). Erich (2019) focused on services that strengthen reading literacy, and Rhinesmith and Stanton (2018) examined services that improve media literacy. There are also studies which have examined the implementation of other programs such as English classes (Mota, 2019), reading clubs (Tso, 2016), and readers' theaters (Samuelson et al., 2018) in libraries to promote the use of the English language. Libraries also provide digital virtual tours to help increase users' digital literacy (Khan & Waheed, 2015). Ross and Furno (2011) explored the use of a clicker in library instructional sessions to engage students and capture their attention.

Libraries were even quick in responding to technological advancements by utilizing 3D models and augmented reality (AR) to help users locate books (Siregar & Dewiyana, 2018). Libraries have adopted 3D printing creation programs and makerspaces to help library users explore knowledge and skills (Moorefield-Lang, 2014). Although there is much research about library learning in the development of language and technology literacy (Inayati & Lestiono, 2019; Rhinesmith & Stanton, 2018), few have examined library courses featuring virtual construction for EFL reading. Hence, there is a need to include the voice of practitioners who organize potential activities in the context of libraries (Fujita & Maeda, 2016).

Integration of Virtual Technology in EFL learning

The rapid development of various forms of technology in recent years has raised the possibility of combining the physical world with virtual environments. Virtual Reality (VR) is the use of computer technology to create a highly realistic three-dimensional world in a fully or nearly 360-degree virtual environment that allows users to explore in a visual, auditory, and even tactile way. The application of VR in teaching and learning, including English language teaching and learning, is becoming more and more prevalent.

Language learning requires a meaningful context and ample practice (Nation, 2001) and learners can immerse themselves and use the target language in natural situations in VR. The authenticity of the virtual environment motivates learners to explore and arouses their desire to learn a foreign language (Lan, 2015). Chen (2016) reported that the learners who used in-voice communication with an avatar in Second Life retained their engagement and motivation for completing the tasks. In a study comparing the construction of tourism sites using webpage and VR technologies, Guo and Lan (2021) found that learners' intrinsic motivation improved because of the visual presentation and multi-operative applications available in the virtual environment. According to Qiu et al. (2021), among the articles published from 2008 to 2013 and from 2014 to 2019, researchers' attention to VR research for enhancing students' motivation has increased by more than 90%, indicating a zealous interest in the subject. Learning anxiety is another key concern which has turned the attention of researchers towards VR research. While anxiety is a threat to language learning (Qiu et al., 2021), it is significantly reduced in a VR environment (Gruber & Kaplan-Rakowski, 2022).

In the systematic review of 25 prominent scholarly papers on VR, Parmaxi (2020) examined several experimental studies on the effectiveness of VR within the school curriculum. The researcher called for a need to conduct experimental studies on VR in language learning outside the classroom. This study intended to address the growing interest in the literature on learning English through VR technology in an informal environment (i.e., a public library) and to inquire about its effect on reading and content creation.

Semiotics and Learning

Semiotics is the systematic study of sign processes (semiosis) and meaning making (Damaskinidis, 2021). Halliday (1978) suggested that language has a semiotic system which contains functions of meaning. Kress and van Leeuwen (2006) explained that images convey information that can be analyzed for meaning. They proposed the visual semiotic theory to interpret images from representational, interactive, and compositional dimensions. According to this theory, besides languages, images are also a form of representation for visual communication. The representation dimension includes the people, the objects, and the places in an image; the interactive dimension is the meaning created through the interaction with the participants; and the compositional dimension contains factors such as value, salience, and framing, looking at visuals as a whole and how the representation and the interaction are related to each other.

Additionally, semiotic analysis has become a new territory for further understanding of the creation of meaning by students (Mills & Brown, 2021). For instance, a draw-a-picture technique was utilized in a semiotic analysis of students' drawings regarding the conception of learning (Hsieh & Tsai, 2016; Wang & Tsai, 2012). The draw-a-picture technique comprised six main themes including subjects, people, locations, activities, objects, and emotions/attitudes which reoccurred in the collected drawings. The interpretations of semiotics in the students' drawings reflected mainly the learning experiences in a traditional classroom setting. The collection and analysis of images created by students facilitate a deeper understanding of students' conceptual learning and development in different dimensions (Hsieh & Tsai, 2016).

Furthermore, in the view of semiotic technologies, there are similarities between images and concepts, making images essential in knowledge learning (Lacković & Olteanu, 2021). People use different modes to communicate or to explicate knowledge using various forms such as texts, speeches, paintings, images, numbers, sounds, and other symbols. Even young learners can express messages through dialogue, role-playing, drawing, and marking (Short et al., 2000). Consequently, teachers and designers tend to draw from

different modes of resources to create learning materials (Bezemer & Kress, 2016). Since the expansion of oral and written literacy into digital literacy, transmediation between modes has become prevalent. VR is one such advanced multimedia technology, using images, texts, sounds, videos, animations, and so forth to deliver concepts and make meaning. VR creates a sense of presence as in the real world (Barricelli et al., 2016) by offering multimodal learning resources and the opportunities to improve and expand the effectiveness of learning (Mills & Brown, 2021). VR affords users the ability to use different modes of presentation (Bezemer & Kress, 2016). For example, images creating meaning through their visual presentation are considered visual literacy (Kress & van Leeuwen, 2006).

Mills and Brown (2021) recently explored semiotics in virtual reality. They examined how traditional ideas were transferred to the virtual mode while writing and drawing. They found new ways to shift semiotic content across different media. Meanings are shifted between writing, drawing, and virtual creation. The 3D environment brings dynamic resources into a representation of meanings. There are research studies on semiotic representations in traditional media; however, the representation of the semiotic features in VR technology, whether they are visual, auditory, or tactile, has not been sufficiently explored in the field of language learning.

Given that making creations in a virtual 3D environment has its complexities and challenges, the process of story creation in VR for realizing the concepts is complex. How do young learners generate concepts? How are characters, scenes, and events formed? What are the changes in the process of transmediation? How are concepts generated from ideas to texts, and then to their multi-modal forms? Undoubtedly, these questions need to be explored in more practical research.

Method

Research Design

Since action research is often utilized by teachers and researchers as a method to evaluate a teaching task or procedure for a better solution (Chou et al., 2012), this study adopted it to investigate whether applying the 3D creation model to picture storybook reading may assist young EFL learners in English learning in an informal learning setting such as a library. Two different reading projects were conducted at different stages: (a) storybook reading, and (b) storybook reading integrating 3D creation. Furthermore, a mixed methods study was adopted to collect both quantitative (students' scores on English tests) and qualitative data (students' paper-based drawings and VR constructions) during the two stages.

Participants

The participants were two groups of 19 readers, totaling 38 participants. These readers attended the community English-reading projects hosted by a public library in northern Taiwan. They were young EFL learners from the fourth to the sixth grade (aged 10-12), studying at different elementary schools throughout northern Taiwan.

Research Instruments

Reading Materials

Five picture books (See [Appendix C](#)) were used in this study. Two of them, titled "Look What I've Got" and "The Rat and the Tiger," were read by all the participants while the other three books, titled "The Odd Egg," "Piranhas," and "Elmer and the Wind" were only read by the first group participants.

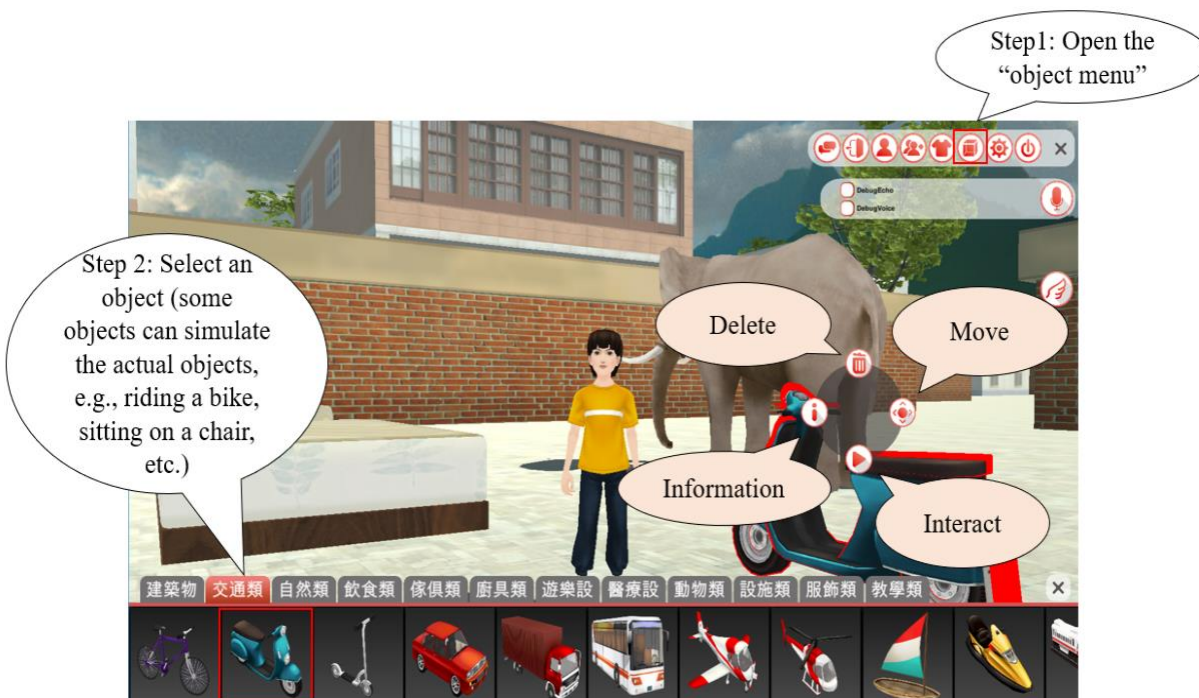
The OIV system: A 3D authoring tool

Omni-immersion vision (OIV) is a 3D authoring tool which can be installed on a desktop computer. It allows learners to navigate the virtual site and create their own virtual spaces without goggles, and learners above nine years old can use it to create authentic contexts in virtual worlds. OIV contains a variety of objects and scenes to choose from, such as buildings, vehicles, animals, and more. Moreover, most of the

objects are interactive. For example, learners can “ride” a bicycle and “drive” a car in the OIV world. It is worth noting that the contexts created are multimodal and can be shared publicly. Figure 1 shows how to release and manipulate objects from the vehicle category.

Figure 1

How to Release and Manipulate Objects From the Vehicle Category



In addition to the objects seen in daily life, teaching objects are also available to fulfill educational purposes by embedding the learning materials in the selected teaching objects. After the contexts are constructed, learners can not only interact with the environment by clicking on the objects but also communicate with other players in the oral or text modes. In other words, social interaction can proceed easily and smoothly in the OIV world. Thus, OIV is not just a general authoring tool with construction functions but a tool with great potential for language learning and teaching.

Reading Tests

Two tests (English tests A and B, Appendix A) based on the two stories, “Look What I’ve Got” and “The Rat and the Tiger,” were created by the authors and reviewed for content validity by two English teachers with at least ten years of teaching experience in the subject area. The two tests were equivalent and were used as the pre-and post-tests, respectively.

Questionnaire

The questionnaire (Appendix B) contained items that measured the participants’ motivation, learning anxiety, and the use of technology on a five-point Likert scale in which 5 stood for *strongly agree* and 1 *strongly disagree*. The 6 items which examined motivation were adapted from the study by Wang and Chen (2010). Three of the items were on intrinsic motivation and the other three were on extrinsic motivation. The three question items on anxiety were adopted from the study by Horwitz et al. (1986). The three question items on technology usefulness were adopted from the study by Hwang et al. (2013). The inter-item reliability of the questionnaire for the constructs of intrinsic motivation, extrinsic motivation, learning anxiety, and technology were .86, .90, .87, and .82 respectively.

Research Procedures

The first reading project was held on January 30, 2019, and the second on March 23, 2019. Each reading project lasted for six hours and was completed in a single day. After completing Project 1, the instructors reflected on the reading project for enhancing young EFL learners' learning outcomes, learning anxiety, and motivation, and decided to integrate VR into the original reading project to improve the results obtained from Project 1.

As shown in Figure 2, both group participants, who experienced different reading formats, completed an English reading test and a questionnaire before and after the learning activities. The learning activity in the first reading project for the two groups was identical: reading two picture books. The stories they read were shown in PowerPoint (PPT) slides and were read aloud by instructors. In the second half of the reading session, Group 1 (Picture book, PB group) ($N = 19$) continued doing the English learning activities while Group 2 (PB+VR group) ($N = 19$) received OIV operation training unrelated to English learning. In the last session, Group 1 attended the typical English learning activities, including reading picture books, reading Q&A, and playing English games such as memory games and charades. In contrast, Group 2 worked in small teams to first create their own stories on posters, and then in OIV.

Figure 2

The Description of the Time, Participants, & Content in the Reading Projects

	(Picture book reading + practices and games)	(Picture book reading + VR creation)
<i>N</i>	19	19
Grades	Grade 4~Grade 6	Grade 4~Grade 6
Pre-test (0.5 hours)	English reading test A Questionnaire	English reading test A Questionnaire
Session 1 (1 hour)	1. Warm-up 2. Picture books 1) <i>The Rat and the Tiger</i> 2) <i>Look What I've Got</i>	1. Warm-up 2. Picture books 1) <i>The Rat and the Tiger</i> 2) <i>Look What I've Got</i>
Session 2 (1 hour)	English learning activities	OIV system instruction
Session 3 (2 hours)	1. Picture books reading 1) <i>The Odd Egg</i> 2) <i>Piranhas</i> 3) <i>Elmer & the Wind</i> 2. Reading Q & A 3. Activities* (memory game, Charade, etc.)	1. Creating stories Story structures Story elements 2. VR creation 3. VR experience
Posttest (0.5 hours)	English reading test B Questionnaire	English reading test B Questionnaire

Note. *Activities were based on the motivational strategies proposed by Dörnyei and Csizer (1998) to motivate

learners and familiarize learners with the target language.

Results and Discussion

Although the results were obtained from different reading projects as described in the [Method](#) section, the results of the two projects were put together for comparison and discussion as shown in the following sections.

English Language Performance and Motivation

[Table 1](#) shows the test results of the two groups obtained from the pre- and post-tests as well as the improvements made by the two groups. It is found that both groups made improvements in the English tests. The average improvement in the English test made by the young learners in the PB group is 21.58 with $SD = 14.53$ with a full score of 100. Compared with the PB group, the PB+VR group (stage 2) made a bigger improvement on average ($M = 26.84$, $SD = 16.68$), although the difference in the improvement between the two groups is not statistically significant ($t = 1.03$, $p = .31$).

Table 1

English Test Results and Improvement

Groups	Pre-test		Post-test		Improvement	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PB ($N = 19$)	27.79	21.94	47.37	30.52	21.58	14.53
PB+VR ($N = 19$)	39.47	20.41	66.32	25.87	26.84	16.68

The results showed that the traditional reading program and the reading program with VR both had an impact on the development of young learners' English literacy. Picture books contain rich vocabulary, grammar, and content which can develop learners' linguistic skills, particularly when teachers or book readers emphasize the printed text (Massaro, 2017). On the other hand, through the combination of reading and VR creation, young EFL learners also made progress. Several studies (e.g., Wu et al., 2019; Yeh & Lan, 2018) showed that the involvement in VR creation increased students' learning performances in class learning activities and their competencies. As depicted in Lan's review study (2020), user-created virtual content with various online tools generates positive learning results and enhances learner engagement.

The Learning Survey

In addition to the analysis of the young learners' English performance in the reading programs with different treatments, a questionnaire was administered to determine whether integrating VR technology increased the young learners' motivation, reduced their anxiety, and improved their attitude toward technology.

[Table 2](#) shows the pre- and post-test results on different dimensions of the questionnaire for each group. Based on the results, although minor, Group 1 made improvements in all dimensions, except in intrinsic motivation which dropped from 3.70 to 3.56. The results also showed that the EFL learning anxiety remained high in Group 1, although it decreased from 4.05 to 3.91. This result led to the trial of combining VR and the picture book reading activity in Group 2. The young EFL learners in the PB+VR group demonstrated higher motivation (both intrinsic and extrinsic), lower anxiety, and a more positive attitude toward technology used in the reading activity. Furthermore, the significant improvement in extrinsic motivation ($t = -2.36$, $p < .05$) indicated that creation in VR effectively motivated young EFL learners during the learning process.

Table 2*The Results of the Pre-test and Post-test on Different Dimensions of the Questionnaire by Each Group*

Dimensions	Groups	Tests	N	M	SD	t	p	Improvement	
								M	SD
Intrinsic	PB	Pre	19	3.70	.75	.95	.35	-.14	.64
		Post	19	3.56	.88				
	PB+VR	Pre	19	4.17	.78	-1.35	.19	.21	.68
		Post	19	4.38	.59				
Extrinsic	PB	Pre	19	3.82	1.04	-.61	.55	.17	1.25
		Post	19	4.00	.94				
	PB+VR	Pre	19	4.07	.89	-2.36	.03*	.32	.58
		Post	19	4.39	.65				
Anxiety	PB	Pre	19	4.05	.97	.86	.40	-.14	.71
		Post	19	3.91	.80				
	PB+VR	Pre	19	3.33	1.28	.49	.63	-.21	1.86
		Post	19	3.12	1.12				
Technology	PB	Pre	19	3.60	.92	-.46	.65	.04	.33
		Post	19	3.63	.91				
	PB+VR	Pre	19	3.84	.91	-1.74	.10	.46	1.15
		Post	19	4.30	.75				

Note. * $p < .05$

The results of this study on increased motivation echoes Dolgunsöz et al.'s (2018) finding that the presentation of foreign language materials using VR motivates learners. It also reflected Yeh & Lan's (2018) result that the use of VR fosters engagement (Yeh & Lan, 2018). The VR technology provided a visually rich representation of the context of the story in which young learners could experience and navigate the objects and events created in the scenario. VR provided an opportunity for immersion; thus, young learners became intrinsically more motivated. Albus et al. (2021) also explained that the visual presentation and interactivity in the VR environment provide an intrinsic stimulus.

Since the reading programs were extra-curricular activities without the pressure of getting a good score, Group 1 started with medium intrinsic motivation but dropped after the reading program. However, their extrinsic motivation improved slightly. It seems game-based learning as in session 3 (Figure 2), whether or not it is an electronic one, increases learners' motivation, as is also explained by Acquah and Katz (2020). However, further studies are needed to be able to better explain the reasons.

In terms of English language learning anxiety, the post-test anxiety level of the young learners in the PB+VR group ($M = 3.12$, $SD = 1.12$) showed a lower mean score than that of the PB group ($M = 3.91$, $SD = .80$). This suggests that the young learners who utilized VR to learn were less tense or nervous compared to the young learners who learned in the conventional way. When these learners were constructing their VR scenes, they were excited about the visual effects of the VR technology, and they could navigate between different sites through their avatars. The VR technology served as a stimulus for decreasing their anxiety about foreign language learning. During the construction task, the learners in this study showed congruent results with those of previous studies reporting that the virtual world prompted users to have

greater enjoyment and less stress (Soyka et al., 2016), and their anxiety about using the foreign language was reduced (Wehner et al., 2011). Regarding the relatively high anxiety in Group 1, whether the three books which were not read by Group 2 made young EFL learners feel anxious is worthy of further examination.

When asked about their attitude toward the technology used in the program, the young learners in the PB+VR group utilizing VR reported a more positive attitude toward technology ($M = 4.30$, $SD = .75$) compared to the young learners in the PB group ($M = 3.63$, $SD = .91$). The student feedback from a previous study using VR for language learning indicated that VR technology encouraged learning and held a promise for more engagement and a greater learning experience (Kaplan-Rakowski & Wojdyski, 2018).

Based on the quantitative results, the young learners from both groups benefited from story reading offered in the library. However, the second group with the picture book reading activity in combination with the VR creation performed better than the first group with the regular picture book reading activity. In addition, the second group also had higher intrinsic motivation and showed lower anxiety compared to the first group. Regarding the attitude toward technology, the VR group had a more positive attitude toward technology. These results were similar to the previous research findings that language learning embedded in the VR setting generated promising outcomes (Lan, 2020), including an increase in learning achievements and motivation (Huang et al., 2021). Anxiety is one of the affective factors that negatively influence foreign language acquisition. The results of this study revealed that VR technology reduces learners' anxiety when students focused more on the environment rather than language learning and production (Xie et al., 2019). VR removes the concerns of an embarrassment of presence in a real setting (Lan, 2020). As for using virtual technology to assist language learning, young learners from the second group expressed a positive attitude toward VR technology. This result is in line with Kaplan-Rakowski and Wojdyski's (2018) study which showed students had a positive attitude about using VR for language learning.

The Qualitative Analysis of Students' Works in the PV+VR group

The PB+VR group first created their VR environments on posters. The researchers examined the three VR sites created by the three teams of young learners and their translation of the ideas from drawings to VR construction. The quantitative results showed that these young learners were intrigued by the VR technology and their anxiety over learning a foreign language was reduced. It is also important to understand these children's VR creation process, as well as the potential and constraints of VR technology. Any choices or changes made across modes and technologies to retain and convey meaning is a notion of transmodal redesign (Mavers, 2011). The features, including selections and arrangements, are important elements in meaning interpretations. Thus, students' works, from non-digital drawings to multimedia digital modes, are worth exploring. To analyze the semiotic representation, the number of the materials created in the written format, the drawings, and the VR sites were all recorded by two trained evaluators. The two evaluators agreed on the number of written texts on the posters. The kappa values of the inter-rater reliability of the drawings and VR were .85 and .91 respectively.

Stages of Planning

These young learners went through different stages of creating their VR sites. First, they used the written texts to jot down their ideas as they brainstormed and then drafted their ideas on a poster. Similar to the students in the VR creation project conducted by Lin and Wang (2021), these young learners also had to plan, selected images, and wrote scripts for their VR projects. Because the young learners worked collaboratively on the VR site, it would be more efficient if everyone in the group followed the plan, so that when they worked on the VR system on their personal computers, they would all have a better sense of what they had to do. The creation process revealed that these young learners relied first on the written format to record the ideas and then transferred their ideas to drawings and then into the VR format. As stated by Ahmad et al. (2021), crafting a 3D virtual world is complex and challenging; thus, it is easier to begin with textual descriptions.

As illustrated in [Tables 3](#) and [4](#), participants used more written texts in writing (20 messages) and posters

(17 messages). However, when using VR, their reliance on the written format drastically decreased. Only one-third of the included features were written texts (7 messages) because more tools and images were available for visually expressing their thoughts and ideas. They also included a far greater variety of items in VR, including buildings, creatures, vehicles, objects, and natural items. These items appeared in excess in the VR environment they created. Without the support of the VR authoring tool, it was unlikely for these participating young learners to create story scenes with such a high degree of rich content.

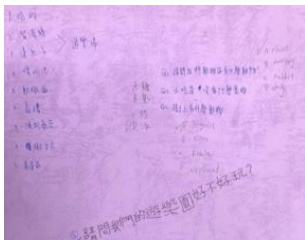


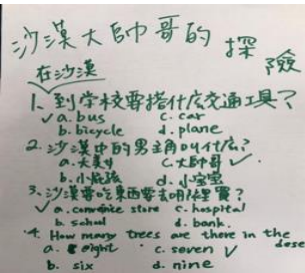
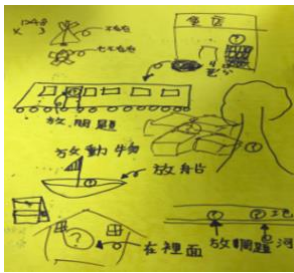

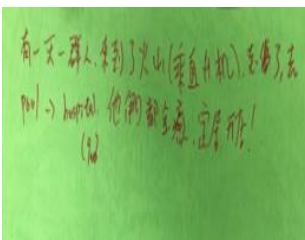


Table 3

The Materials Included in the VR Creations

	Texts	Creatures	Buildings	Nature	Furniture	Objects	Vehicles	Interactive Questions
Written	20	X	X	X	X	X	X	X
Drawing	17	1	5	8	0	9	7	13
VR	7	109	12	66	221	97	73	16

Table 4

The Stages of Creation

Teams	Written Text	Drawing	VR
T1			
T2			
T3			

Using Multiple Modes

In the process of story creation, it was observed that the young learners translated their ideas across different modes. The transformation from ideas to drawings and VR creations covers three dimensions: representation, interaction, and composition (Kress & van Leeuwen, 2006). While constructing the VR scenes, the young learners dexterously utilized the features available in the VR system. They adopted dynamic resources such as texts, pictures, and 3D objects to illustrate the concepts and the details of their stories. They incorporated an interactive question-posing feature to add interactivity for the audience, broadening the scope and dimension in a way that could not be achieved by print or drawings. In the VR environment, young learners could include more visual effects and amplify such effects. The VR environment contained multimodal features which enabled the students to adopt different modes and shift meanings across modes as argued by Mills and Brown (2021). Furthermore, these young learners utilized a combination of texts and visual images in both their drawings and VR to clarify their meanings or directions. As Lacković and Olteanu (2021) stated, meaning-making involves both language and non-linguistic elements. Team 1 used texts to guide themselves in the process of creation as shown in [Table 4](#). However, when constructing the VR scene, they had the audience in mind, providing directions and instructions to make their intentions clear. For example, Team 1 directed users to go to the playground to find an elephant ([Figure 3](#): left) and to look over the picnic table for items ([Figure 3](#): right). They also used both Chinese and English to facilitate users' understanding in VR ([Figure 4](#)). Since their VR scene would be visited by other teams, these young learners had a stronger sense of the actual audience in the process of the creation, whereas such a sense was not apparent during the drawing stage because the drawing was not the final product ([Table 4](#)).

Figure 3

Giving Players Directions



Figure 4

Information in Different Languages



In addition, these young learners also utilized the question-posing feature in VR interactivity. They posed questions asking the audience to probe into the environment and to look for information or instructions given in the bulletin text. For example, Team 2 asked the audience where people could get food. The users had to look around the desert to identify the exact place where food was available (Figure 5). This echoes Light's (2019) finding that users' engagement depended on multiple forms of feedback. Therefore, the young learners utilized different resources including texts, images, and questions to engage the user audience.

Figure 5

A Question Requiring Players to Explore the Scene



Using Volume for Intensity

The participants drew their ideas on a B3 poster (545x 393mm), so their drawings were simple and concise. On the other hand, the VR site was like an open canvas allowing young learners to create their scenes on a much larger scale, with objects scattered around the buildings. VR technology enabled young learners to easily add objects to their scenes. Due to the constraint of space on the poster, these young learners could not draw as many objects including furniture. They drew mostly lines for walls and were not able to include details. On the posters created by the three teams, there were seven vehicles, while in the VR settings, there were 73. There were also a lot more animals, furniture, objects, and trees. In addition, all three teams used

a large number of copies of the same objects to show intensity (Figure 6) similar to Yeh and Lan's (2018) study that young learners liked to move objects around and stack them on top of one another. This interaction with objects showed engagement and the presence of the players in the virtual world, as suggested by Nacke and Lindley (2008). In line with Mavers' (2011) study, the process of a transmodal redesign strengthened young EFL learners' ability and effort to make new meanings using new semiotic sources. These young learners were not able to create such an intense effect on a piece of paper. Furthermore, young learners' creation behavior in the current study is similar to that of the students in Mills and Brown (2021)'s study. They also discovered that students used many more elements and added more details in their VR creation project. Similar to Hsu et al.'s (2018) study, it is also found that VR designers sometimes use exaggeration to highlight a certain element. As designing and answering interactive questions required more thinking and planning, there was not much difference in the total numbers of the embedded questions on the posters (13) and in the VR (16) settings.

Why do students rely on pre-existing objects in their creation, resulting in an excessive number of objects in the scene? It does not seem to be solely due to their curiosity. The participants of Yeh et al. (2018) also intended to use pre-existing objects in their creation although their study lasted for a semester. The lack of meta-cognitive ability for careful and logical planning and monitoring may be a reasonable cause of this phenomenon. To answer this question, a further in-depth study is necessary.

Figure 6

A Large Volume for Intensity



3D Spatial Skills

The VR environment is three-dimensional. Materials on the site need to be positioned based on three dimensions to fit in the environment. In comparison to creating drawings in the 2D format, constructing scenes in a VR space requires extensive effort and skills. Spatial skills are required to walk around and place items in the 3D environment. Moreover, the VR scene is vast, serving as a big canvas for learners to expand their concepts and unleash their creativity. Students also need to be aware of the arrangement in the 3D dimensions so that visitors to their VR sites do not get lost. These spatial forms are related to the composition dimension identified by Kress and van Leeuwen (2006). In Figure 7, young learners strategically placed a bulletin with the text or a picture to signal the directions which guided the users to move around in the 3D space. These echo Cowin's (2020) finding that in an immense VR environment, users tend to use purposeful vocabulary to point out objects and Albus et al.'s (2021) that the signals or guiding instructions help learners process much more information.

Figure 7

A Bulletin Board Showing Instructions



Constraints of the Virtual Technology

The VR system's built-in items included buildings, indoor and outdoor furniture, vehicles, animals, and many miscellaneous items. Although the young learners enjoyed creating their VR sites and experimenting with multi-modal built-in features, the available items in the system may still not satisfy all of their needs. As Mills and Brown (2021) stated, the features in VR enable but sometimes constrain the learning experience when trans-mediating content in different modes. As a result, young learners sometimes had to simplify their design. Moreover, in a VR environment, creators must note the position of every item in different dimensionalities. It was found that several items like buildings and furniture were not properly attached to the ground but appeared at an elevated position. Whether this result is caused by young learners' learning styles or insufficient practice time needs further study to confirm.

Conclusion

Public libraries are important spaces for accessing information, knowledge, and after-school education for the community. Although there are studies on informal learning in libraries, this study filled the gap in the literature by investigating different story reading programs integrating a virtual creation project in the informal learning setting of a library. The results of the study confirm that the incorporation of VR technology effectively facilitates language learning, even when learning takes place in informal settings. VR not only strengthened English vocabulary skills but also increased young EFL learners' motivation, lowered learning anxiety, and improved their attitude towards technology integration in language learning.

VR technologies open up a new way of presenting language concepts and content. A semiotic approach provides a lens for understanding multiple presentations including language and drawing (Fujita et al, 2019). The semiotic inquiry of this study helps to understand young learners' meaning-making processes and their semiotic choices. Based on the students' drawing and VR creations, the written language served as a springboard to reach other forms of communication. The VR technology provides new semiotic resources allowing learners to redesign and reconstruct their meaning and helps young EFL learners translate their ideas and concepts into a variety of modes, including texts, posters, and a variety of digital multimedia content. This process seems to heighten students' interest and engagement in learning.

Informal learning in public libraries has gained much attention. Researchers have begun to take notice of language and digital literacy programs in informal learning settings. As VR technology becomes more accessible, it will be worthwhile to investigate how VR can effectively enhance foreign language learning, particularly in informal learning contexts such as libraries. Given the small amount of research related to

the effects of VR creation on the reading performance of young EFL learners in libraries, the findings obtained from the current study reveal the potential of VR applications in informal learning.

Due to the constraints of time and space, the two reading programs were held two months apart and for only one day. Empirical studies that last for a longer period are needed to further confirm the results obtained from the current study. Moreover, this study included only 38 young EFL learners. For informal settings, it may not be a sufficient number of participants and could weaken generalizability. Although social research sometimes has to handle small sample sizes, particularly in the subtlety of issues such as distinctive disciplines or methods (Valentine & Cooper, 2003), more participants should be recruited for future research. Additionally, future studies are also needed to investigate the semiotic representation in 3D creation using different platforms or technologies. Moreover, it is difficult for the participating students to place objects in a precise position in relation to three spatial dimensions in the VR environment. Thus, future research can look into whether these phenomena are general in VR creation or if they are caused by learners' different learning styles.

Acknowledgements

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Appendix A. English Test

Test A

Picture Stories Group: _____ Name: _____ 1

I. Matching 配合題

lion lollipop flower tiger gorilla rat



II. Please write the Chinese meaning of the English words 請寫出下列字的中文意思

文意思

1. bicycle _____

2. window _____

3. jump _____

4. castle _____

5. cowboy _____

Test B

Picture Stories Group: _____ Name: _____

I. 配合題

gorilla

rat

pirate

lollipop

hippo



II. 請寫出中文意思或是拼出英文字

1. kick _____

2. doughnut _____

3. castle _____

4. park _____

5. bicycle _____

Appendix B. Questionnaire

Intrinsic Motivation					
1. In a class like this, I prefer course material that really challenges me so I can learn new things.	5	4	3	2	1
2. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.	5	4	3	2	1
3. When I have the opportunity, I choose course assignments that I can learn from even if they don't guarantee a good grade.	5	4	3	2	1
Extrinsic Motivation					
5. Getting a good grade in this class is the most satisfying thing to me.	5	4	3	2	1
6. If I can, I want to get better grades in this class than most of the other students.	5	4	3	2	1
7. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.	5	4	3	2	1
Anxiety					
8. I feel nervous when I have to speak in English in this class.	5	4	3	2	1
9. It worries me when I don't understand what the teacher is saying in class.	5	4	3	2	1
10. I worry that I may not do well in this class.	5	4	3	2	1
Technology					
1. Technology enriches the learning activity.	5	4	3	2	1
2. Technology is helpful to me in acquiring new knowledge.	5	4	3	2	1
3. Technology smooths the learning process.	5	4	3	2	1

Appendix C. Picture Books Used in the Study

1. Kasza, K. (2007). *The rat and the tiger*. Puffin Books.
2. Browne, A. (2010). *Look what I've got!* Walker Books.
3. Gravett, E. (2009). *The odd egg*. Simon & Schuster.
4. Blabay, A. (2019). *Piranhas don't eat bananas*. Scholastic Press.
5. McKee, D. (1997). *Elmer and the wind*. Andersen Press.

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