Research on Activity Design and Application of AR Gamification Resources To Promote Children's Second Language Learning

Min-Sheng FAN, Zhen-Hua LIU* & Xian-Ping JIN

School of Educational Technology, Northwest Normal University, China
xmanfms@126.com, 2020212889@nwnu.edu.cn, 364905079@qq.com
*Zhen-Hua LIU@corresponding.author

Abstract: The application of gamified learning resources based on AR technology in the field of early childhood education can support children's learning in a way that is more in line with the laws of children's cognitive development. Using AR learning resources to design children's learning activities and carry out teaching activities can effectively improve children's language level and learning ability. Compared with traditional teaching methods, the use of AR learning resources for children's activity teaching has a more significant effect on language learning.

Keywords: Augmented Reality, Activity Design, Early Childhood Education, Language Learning

1. Introduction

In January 2022, the Ministry of Education and other three departments issued the "Implementation Plan of the National Common Language Popularization and Improvement Project and the Promotion of Rural Revitalization Program". The "Implementation Plan" accurately analyzes the outstanding problems of unbalanced and insufficient popularization of the national common language and script, adheres to the unity of objectives, methods and effects, and implements the "three major actions". Action 1: Focus on provinces where the penetration rate of Putonghua has reached 85% and urban areas with good foundations and carry out high-quality popularization of the national common language. Arrange the tasks of improving the education and teaching of the national common language and words, the standardization of language and words in the social field, the empowerment of language technology, and the service capacity of language and words. Augmented reality (AR) technology is based on virtual reality to virtualize physical things, and then perform physical simulation, that is, a technology that combines virtual images with the real world. AR technology has the characteristics of combination of virtual and real and real-time interaction. Users can increase the sense of presence and real experience through human-machine sensing equipment (Wang, 2021). China is a multi-ethnic country. For Tibetan children whose mother tongue is Tibetan, Chinese is their second language. This study takes Tibetan children as the research object to conduct research on children's second language learning activities based on AR resources, in order to verify the learning resources and the effect of activities.

2. DESIGN OF CHILDREN'S LEARNING ACTIVITIES BASED ON AR LEARNING RESOURCES

2.1 Theoretical Research Basis

2.1.1 Flow theory

In 1957, Dr. Mihaly Csikszentimihalyi of the United States first proposed the flow theory, that is, users carry out activities independently and spontaneously in a certain environment. When people engage in

an activity, they are highly focused, fully engaged in the situation, and completely filter out all irrelevant feelings (Li & Ma, 2022). AR technology builds this kind of "realistic" experience environment for users, so that the user's immersive experience is similar or identical to the real physical environment. This kind of "realistic" experience allows users to build a "real" environment, which can more easily integrate into the virtual and real scene, and better complete the corresponding learning tasks.

2.1.2 Embodied cognition theory

Plato believed that mind and body are inseparable, and the study of embodied cognition involves perception, thinking, emotion, etc. (Chen, et al, 2014) Embodied cognition theory holds that the way and steps of the cognitive process are actually determined by the physical properties of the body; the content of cognition is provided by the body; cognition is embodied, and the body is embedded in the environment. (Ye,2010). The embodied environment includes the physical environment that provides the place of embodied perception, the resource support environment containing teaching resources, cognitive tools, and teacher-guided resources, and the social and cultural environment composed of interpersonal relationships, learning atmosphere, students' thinking patterns and behavior habits (Li, et al, 2018). Through embodied cognition, students can deeply construct cognition in immersive experiential learning, so as to improve the learning effect.

2.1.3 Resource design

The "Learning and Development Guide for Children Aged 3-6" proposes that language is a tool for communication and thinking. Early childhood is an important period for language development, especially oral language development. At the same time, make educational suggestions: give young children more opportunities to listen and talk. For example: often talk to the young child about topics he is interested in, or read books and tell stories together. The design and development of AR resources follows the principle of language listening and conforms to the laws of cognitive development of children in Tibetan areas. Make local social entity cards, and embed voice prompts for nouns such as "cow", "goat", "bus", and "watermelon" for children to follow and learn.

2.2 Gamification Resources Based on AR Technology

2.2.1 AR technology features and educational advantages

AR technology can realize direct interaction between users and the environment through computer generation of multi-mode virtual environment integrating sight, hearing, force and touch, that is, using technology to present the virtual world in the real environment and enhance people's perception of things (Weng, 2022). Therefore, AR technology has the characteristics of integration of real world and virtual information, real-time interaction, and positioning of virtual objects in three-dimensional scale space.

With the rapid development of new information technology, the integration of AR technology and education is getting closer and closer. Compared with traditional education, integrating AR technology into education can show the real things to learners in a three-dimensional and intuitive way. The Tibetan children in this study live in remote pastoral areas and have regional restrictions on the utilization of various social resources. Therefore, the use of AR technology can make abstract things more concrete and help improve children's cognition and understanding of social resources. In addition, AR technology integrated education has the advantages of strong interaction and participation, which is in line with children's hands-on and playful personality. AR gamification resources can allow children to participate in game interaction and improve children's hands-on ability and learning efficiency. In early childhood education activities, game activities are the most common way of learning. Using the unique advantages of AR technology, three-dimensional 3D motion pictures can be designed to attract children's interest. Realize that children learn through play, find fun in learning, and achieve effective teaching (Shen & Zhang, 2021). It is also the most effective way for children to subtly learn life skills.

Figure 1. AR Card Example.

On the one hand, AR cards can meet the needs of children's language and reading learning, and on the other hand, using AR devices to scan the cards will show the three-dimensional shape of things, so that children can more intuitively recognize the specific shapes and characteristics of things, and improve children's cognitive ability. At the same time, interesting human-computer interaction methods can attract children's attention and improve learning efficiency.

2.3 Learning Activity Design

The design of children's language learning activities based on AR resources should follow the principles of gamification and development.

Because resource design is playful, the basic form of activity design and organization should be game activities. Children's language learning is a process of actively accepting experience, and children can gain experience through practical operations (Chen, 2016). Therefore, the design of activities needs to follow the principles of children's own gamification practice operation, so that children can actively participate in activities, so that children can get the greatest activity experience in activities and achieve the purpose of activities.

The principle of development is that kindergarten education design activities are based on the comprehensive development of children (Wang, 2017). The design of children's activities needs to flexibly guide the development of children's language, society, art, health, science and other aspects. Development is a step-by-step process. Therefore, the design of activities for Tibetan children should follow the actual development needs of the local area, and use known knowledge to lead to unknown areas, making it easier for children to accept.

Based on the above principles, this study designed corresponding learning activities for young children.

3. IMPLEMENTATION OF LEARNING ACTIVITIES

3.1 Research objects, methods and implementation

This research is based on Gannan X Kindergarten, Gansu Province. There are 15 children in both the experimental class and the control version. The experimental class uses learning activities based on AR gamification resources for teaching, and the control version is taught according to the conventional teaching mode. Before the experiment, the experimental group and the control group were subjected to pre-test analysis, and after 6 weeks and 18 teaching activities, the post-test data were collected and analyzed.

This research uses the quasi-experimental method to test children before and after learning, and conducts interviews with children and teachers through the interview method to understand the real experience of teachers and children on the use of resources, and to better optimize AR learning resources.

Figure 2. Teaching Implementation Example.

According to the interviews with children and teachers in the early stage of the experiment, the main reason for the insufficient language learning of children in Tibetan areas is the lack of an environment that supports children's language learning in family life; The learning method based on recitation and memory leads to insufficient understanding of children's language; The group teaching-based teaching practice leads to the lack of communication opportunities and hands-on ability for young children.

3.2 Assessment and Data Collection

In the early stage of teaching implementation, the "Children's General Language Proficiency Test Questions" are used to pre-test children's language proficiency, and the pre-test data are collected. After the teaching activities are completed, post-processing is performed to collect the final data. And in the process of teaching implementation, real-time recording and observation of children's state is carried out.

Test example: Guide children to say the names and numbers of the following animals, and tell us which animals are most abundant and which are least abundant. (1 point for each correct answer to the name and number, 3 points for the relationship between the quantity.)

Figure 3. Example of an assessment scale

This test scale is aimed at three aspects: the test of children's oral language ability, the test of children's listening and comprehension ability and the test of children's ability to read and write. The test scale consists of 8 items with a total score of 100 points. Among them, the Children's Oral Ability Test contains 4 items with a total score of 48 points; the Children's Listening and Comprehension Ability Test contains 3 items with a total score of 40 points; the Children's Follow-up Reading Ability Test contains 1 item with a total score of 12.

3.3 Result analysis

By collecting and arranging the data of the test scale and analyzing the average value, from the overall level, the experimental group and the control group showed improvement from pre-experiment to post-experiment. On average, there was almost no difference between the experimental group and the

control group in the pre-test, but a great difference in the post-test.

Table 1. *Average Statistics Table*

	Pre-test	Post-test
Experimental-group	19.8667	61.26667
Control-group	17.1333	33.53333

3.3.1 Paired samples t-test analysis

According to Table 2, 15 students in the experimental group and 15 students in the control group were analyzed by paired sample T test.

Table 2. *Paired Sample T-Test in Experimental Group and Control Group*

	N	M	SD	df	t	Sig.
Experimental group pre-test	15	19.87	11.10	14	-7.758	0.000
Experimental group post-test	15	61.27	18.02			
Control group pre-test	15	17.13	12.11	14	-5.833	0.000
Control group post-test	15	33.53	20.20			

The pretest and posttest sig values of the experimental group and the control group is 0.000, which is less than 0.05, indicating that there is a significant difference between the pre-test and post-test values of the experimental group and the control group. Comparing with the mean results in Table 1, it can be found that the language level of students has been significantly improved after the implementation of teaching.

3.3.2 Independent sample t-test analysis

In order to verify the differences between the experimental group and the control group in the pre-test and post-test, the independent sample T test was used for analysis, as shown in Table 3 below.

Table 3. *Pre- Test and Post-Test Independent Samples T-Test*

		N	M	SD	df	t	Sig.
Pre test	Experimental group	15	19.87	11.10	28	-0.644	0.525
	Control group	15	17.13	12.11			
Post test	Experimental group	15	61.27	18.02	28	-4.236	0.000
	Control group	15	33.53	20.20			

It can be seen from the first group of data in Table 3 that through the homogeneity test, the significance of the pre-test data is 0.272, which is greater than 0.05, indicating that the variances are equal. Then according to the mean test, the sig value of the mean comparison between the two groups was 0.525, which was greater than 0.05, indicating that there was no significant difference in pretest data between the two groups. It can be concluded that there is little difference between the mean values of the experimental group and the control group at the beginning of the experiment, indicating that the ability levels of the subjects in the two groups are basically on the same level.

From the second group of post-test data, we can see that through the homogeneity test, the pre-test data is significant at 0.618, which is greater than 0.05, indicating that the variances are equal. Then according to the mean test, the sig value of the mean comparison between the two groups was 0.000, which was less than 0.05, indicating that the two groups of children had significant differences in the post-test data.

From this, it can be concluded that the mean difference between the experimental group and the control group is large after the end of the experiment, indicating that there has been a large difference in the level of children's language ability between the two groups, and the effect is obvious.

4. CONCLUSION

This study proves that AR-based children's learning activities can effectively improve children's language learning level. From the perspective of the resources themselves, AR-based children's learning resources are intuitive, interactive, interesting, and are more in line with the laws of children's cognitive development. Using multi-modal AR resources to design learning activities can stimulate children's multi-sensory, promote the development of spatial cognition, and improve children's attention. There is less practice and research in the field of AR technology empowerment education, and less application in the field of early childhood education, so there is still huge room for exploration in this area. On the contrary, the use of AR resources requires the use of electronic devices such as tablets, mobile phones, and all-in-one computers. Using these devices for a long time has a certain negative impact on children's bodies (especially the development of children's eyes). Therefore, the length of resource use should be strictly controlled.

AR resources can satisfy children's curiosity and stimulate children's interest in learning, so as to achieve the effect of promoting language development. Realize children's game learning. With the development of new technologies, it is highly feasible to carry out education and teaching in a way of combining virtual and real. A rich pragmatic environment plays an important role in children's language development. Through AR and other new technologies, we can create a richer pragmatic environment for children to learn a second language and promote their language development.

Acknowledgements

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