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Research Article

Application of Augmented Reality Technology in the Teaching of Literacy at Low Learning Stage

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In primary school Chinese education, literacy is a very important work. Literacy is an important part of primary school Chinese and also an important part of primary school Chinese. At present, literacy education is increasingly valued by teachers. However, there are still many problems to be solved in China's literacy education. In traditional education and teaching, teachers should let students recite a large number of concepts, formulas, and rules in order to improve students' learning effect. However, due to the lack of practical support, this has become a major obstacle in education and teaching. Therefore, the main purpose of this paper is to use augmented reality (AR) technology to explore the literacy teaching of junior students. From the result of the test of students' literacy teaching, it can be seen that the number of people who scored 81–100 points in the experimental class and the control class before the experiment was 9 and 4, respectively. After the experiment, the number of people who scored 81–100 points in the experimental class and the control board was 15 and 7, respectively. Therefore, it is very necessary to use AR technology to carry out applied research on literacy teaching at the low learning stage.

1. Introduction

At present, literacy education has become the main curriculum in the lower grades, and there is a scientific basis to focus literacy education on the lower grades. Literacy is not only the basis for students to read and write but also the first step to cultivate and improve cultural literacy. At the same time, it is also a difficult problem for Chinese teaching in the lower grades of primary schools. A large number of literate and boring learning contents have brought more difficulties and burdens to students. The teacher is very hard to teach, and the students are also very hard to learn. "Classroom-based" literacy education ignores students' independent reading ability and mainly focuses on memorizing, reading, memorizing, and writing. Teachers rarely guide students to learn Chinese characters by themselves after class. The generation rate of Chinese characters is high, but the learning of Chinese characters is divorced from students' daily life, which makes them feel that the learning of Chinese characters is meaningless and uninteresting, so they have little interest in classroom teaching. Therefore, under the guidance of the existing instructional design model and combined with AR's interaction, immersion, interest, autonomy, and other characteristics, this paper discussed the organic combination of AR technology and literacy teaching, with a view to enlightening and helping future peer scholars in exploring relevant issues.

At present, the study of literacy teaching at the low learning stage has been one of the hot topics of research. Nils examined how teachers link literacy teaching with their general subject teaching in a professional development environment. The research results showed that when designing the content and form of the professional development plan, priority should be given to the differences in text use and interpretation of different school subjects to better support subject teaching [1]. The purpose of Ilhan's and Kesik's research was to determine the parents' views on their experience of primary school literacy teaching in distance education [2]. Gezer Melike proposed that early literacy skills are all prerequisite knowledge, skills, and attitudes necessary for successful reading and writing during formal education. Early literacy skills are expressed as several

subskills, including phonological knowledge that determines the level of primary reading [3]. However, due to the lack of data sources, the above research studies are only at the theoretical stage and have no practical significance.

It is innovative to use augmented reality technology to study the teaching of literacy at low learning stages. McHardy and Chapman aimed to determine the strategies used by adult readers with lower skills that can best predict the word reading performance in standardized reading tests and determine the word reading strategies used by adult readers with lower skills [4]. Lynn and Deb put forward negative media comments about the lack of primary teacher education, especially in the teaching of reading and writing, which is increasing the overall assumption that literacy teachers fail [5]. Barnes used the digital sociological description of the online events related to the 2018 phonetics debate sponsored by the Australian Education Research Center and the Independent Research Center of the Think Tank, which aimed to clarify and challenge the contemporary understanding of literacy teaching politics [6]. However, due to the traditional thinking and definition, the two cannot be highly integrated and give full play to their advantages.

AR technology combines virtual objects with the real world through computer vision technology to make the seamless connection between virtual reality and the real world. It has three major features: virtual reality fusion, real-time interaction, and 3D registration. The innovation of this paper is as follows: through the discussion of the advantages of AR technology in literacy teaching and the process of teaching design and taking A Primary School in Z City as an example, this paper designed a classroom teaching example based on AR and carried out teaching practice with teachers. In addition, this paper used AR technology to design the application level of the teaching system under the background of constructivism.

2. Exploration of the Application of AR Technology in the Teaching of Literacy at the Low Learning Stage

2.1. Design Mode of Learning-Centered Teaching System. Some scholars have proposed a "learning-based" instructional design model, which aims to solve the problem of "overemphasizing the learning environment" and ignoring "autonomous learning." The specific process and steps are shown in Figure 1.

The idea of this kind of teaching design is to determine the teaching objectives, formulate the teaching plans, implement and evaluate according to the teaching environment and needs from the overall perspective, and effectively adjust the feedback of the teaching system, so that the teaching system can be comprehensively optimized. The model has been used in this paper to study the three university subjects of "literacy," "reading," and "composition." The results showed that this model is feasible and effective and has had a huge impact on the education field of various schools at all levels.

2.2. Feasibility Evaluation of the Application of AR in Elementary School Literacy Teaching. AR teaching can create an immersive learning atmosphere. According to the rules of the structure of Chinese characters, the information of Chinese characters is displayed intuitively and then the teaching ideas, teaching strategies, and teaching content are integrated into this situation. This allows students to interact naturally in this situation and makes the learning process easy and pleasant, thus improving the effect and depth of learning unconsciously. Compared with traditional literacy, AR has many advantages, with five aspects as shown in Figure 2.

It can be seen from Figure 2 that five aspects are described as follows.

2.2.1. Meeting the Characteristics of Students' Learning Situation. The age of low school age is generally between 6 and 7 years old. According to the rules of children's recognition of Chinese characters, children in this period mostly understand the surrounding environment with general sense, and their ability to recognize details is not strong. When reading, they tend to recognize and remember Chinese characters with clear fonts, so they tend to ignore some details. In terms of the way of memory, most of the children in this period are rote memorization because of their poor memory and have a certain tolerance for Chinese characters and nursery rhymes. In terms of concept, children are better at remembering specific things and words, and their vision is more developed. Their memory is mainly through vision and then through repeated practice to maintain memory [7, 8]. In addition, the students in the lower grades have weak self-control abilities. Their attention is related to their interests. They like interesting pictures and vivid scenes, but they pay little attention and are easily distracted. If there are only monotonous explanations and repetitive mechanical reading and writing exercises in the teaching process, students would have resistance to Chinese characters, which would increase the learning pressure of Chinese characters. Over time, a vicious circle would be formed. The teaching courseware made by AR technology or other immersive teaching media can give students a certain sense of existence and improve their perception ability, so that they can concentrate. AR courseware used in reading teaching can improve students' sense of existence and attention.

2.2.2. Learning Content Visualization. Chinese characters are abstract characters that evolved from different forms of characters. Many Chinese characters are difficult to find corresponding pictographic features. The Curriculum Standards stipulate that teachers should follow the rules of the formation of Chinese characters in reading teaching to make the teaching content more intuitive and vivid. AR is an immersive medium, which can intuitively display the meaning and word-forming process of Chinese characters through video, 3D simulation, and other methods. It would be more obvious to transform obscure knowledge into intuitive and vivid visual stimulation, which can fully mobilize students' multiple perception abilities. The use of teaching

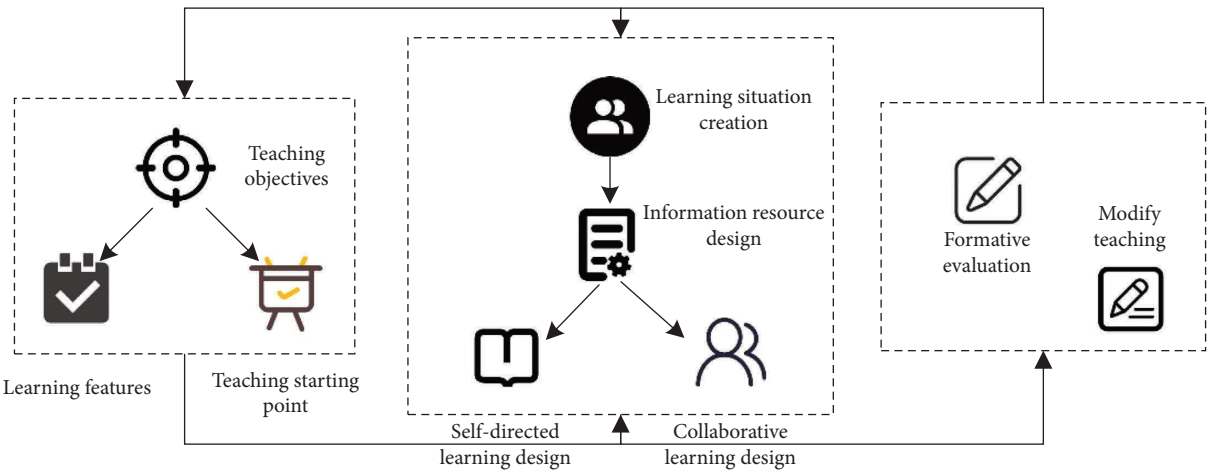

Figure 1: The learning-centered teaching system design model based on constructivism.

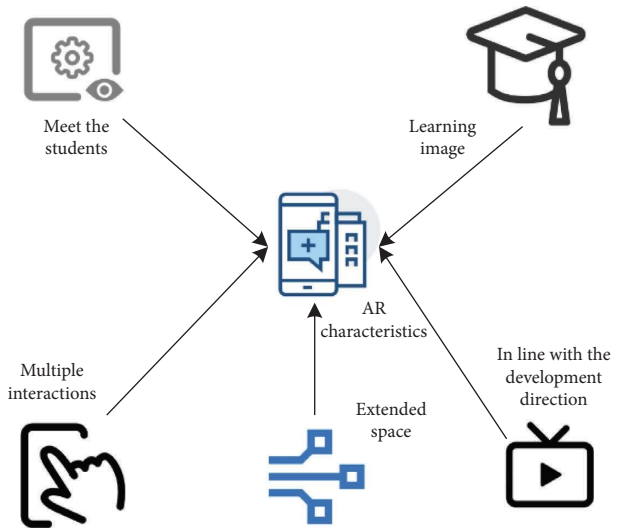

Figure 2: Advantages of AR technology.

resources made by AR reduces the process of teachers repeatedly explaining the shape and meaning of characters in traditional teaching. The visual, auditory, and other sensory stimuli brought by the concrete content to students would be more obvious, thus comprehensively mobilizing students' multiple sensory organs for knowledge learning. At the same time, the feedback given to students is also timely, accurate, and effective, which consolidates students' memory of knowledge points.

2.2.3. Supporting Situational Learning in Multiple Interactive Ways. The objects simulated by AR technology can not only support students' multiple interactions but also make corresponding changes according to learners' behaviors, so that learners have a sense of "seeing" reality. The virtual learning interface created by AR technology shows the pronunciation, shape, and meaning of Chinese characters, so that learners can connect abstract and intuitive information one by one and improve learners' understanding and mastery of Chinese characters. AR technology is used to establish a situational teaching environment, which allows students to learn by hand, brain, and mouth, so that teachers can not only teach them to read and write but also teach them how to understand its meaning. Students can gradually understand and master the composition rules of Chinese characters through observation, independent inquiry, cooperative learning, independent learning, and learning to read by themselves according to this rule [9].

2.2.4. Expanding the Learning Space and Blurring the Boundaries inside and outside the Class. The ultimate goal of literacy is to master its use, so that students can accurately express what they have learned, and consolidate what they have learned through the practical operation. According to the principle of situational teaching, practice can also promote the absorption of new knowledge. Therefore, for primary school students, the learning of Chinese characters should be carried out not only in the classroom but also after class. The cultivation of reading ability should be extended to extracurricular activities of primary school students. AR technology has the characteristics of convenience, situational, interactive, connectivity, and personalization. Now, there are many AR teaching applications on the market, which are developed for children's extracurricular activities. It is the nature of pupils to love play. The teacher integrates the after-class homework into AR teaching and lets the first-grade students complete the review and consolidation of Chinese characters with the help and supervision of their parents. The combination of AR games and literacy teaching creates a good after-class learning environment for students. On the one hand, when using AR teaching software to review and consolidate students, if they encounter problems that cannot be solved, they can be dealt with in a timely and standardized manner to avoid adverse consequences caused by parents' educational level and other reasons. On the other hand, the use of virtual reality technology has changed the traditional arrangement of homework after class, enabling students to learn actively. AR technology has broken through the restrictions inside and outside the classroom, which makes Chinese character learning ubiquitous [10, 11].

2.2.5. Conforming to the Current Development Direction of Virtual and Real Integration of Learning Resources and Environment. AR technology can perfectly combine virtual resources with real scenes. Using AR technology for teaching requires only smartphones such as mobile phones and tablets, which can be used independently without network support. The interaction between learners and devices is mainly natural, easy to operate, and more suitable for students' application. In addition, AR technology has been partially applied to other areas of life, and teachers and students have some experience in using it, so application skills are easier to transfer from other areas to learning.

2.3. Instructional Design Process of AR Application in Literacy Teaching at the Lower Stage of Primary School. The teaching design of AR applied to literacy teaching at the lower stage of primary school should not only reflect the characteristics of literacy teaching but also give full play to the advantages of AR [12]. Under the guidance of the learning-centered instructional design model based on constructivism, this paper proposed the basic process of instructional design, as shown in Figure 3.

As can be seen from Figure 3, this course is divided into three parts: analysis, design, and evaluation. The analysis part includes the goal analysis of the primary school curriculum and the analysis of students' characteristics. The design of this course mainly includes creating a learning environment, designing and providing information resources, and autonomous/cooperative learning. The evaluation module includes the evaluation of students' learning effects and summary.

The purpose of teaching objective analysis is to clarify the "theme," that is, the knowledge points to be learned in this course. The "theme" is included in the teaching content (that is, knowledge points). When the teaching content is completed, the teaching purpose is completed. Therefore, it is necessary to analyze the teaching objectives and find out all the knowledge to learn, so as to find out the "theme."

In instructional design, learners are the most critical link and also the starting point and end point of all instructional design activities. This paper analyzed students from two perspectives: the current situation of students and their characteristics.

The research object of this paper is first-grade students, who are still in infancy, and their thinking development is relatively slow, mainly abstract thinking. Their attention is often related to their interests and is easily attracted by the visualization and situational teaching. With the development of science and technology and network technology, the children in this article are very receptive to new things.

"Learning situation creation" is to create a complete and real problem background for students to connect new and old knowledge with new knowledge and develop their thinking, so as to create the necessary environment for students to create meaning. The first is the rich, high-quality, and novel teaching environment, which gives students the full power of free choice. Students can approach the truth of science from different perspectives according to their interests. The second is to express their views and explore the disciplines of history and values, such as Chinese and history. The characteristic of this discipline is that in addition to the basic knowledge structure, students also need their own ideas, which provide an idea for the creation of scenes. Through simulation, students are exposed to the natural environment and combined with the characters and represented by the characters. After the scene simulation is completed, the designer should analyze the students' language and thinking and provide different ways of thinking, so as to guide the students to establish a correct worldview, history view, and values and realize the understanding of knowledge.

The development and supply of information resources refer to providing learners with knowledge and methods related to learning topics in the learning process. It includes the design and supply of software resources and software systems to support the learning process.

Based on AR, this paper should design information resources from three perspectives.

Students need to have a certain understanding of the learning materials related to Chinese characters. It mainly includes Chinese character storybook, Chinese character microclass, and various Chinese character teaching software.

Students need to understand how to obtain resources and information. Teachers should teach learners how to obtain effective information resources. The process of building knowledge is to rely on resources for self-exploration. When students encounter problems, teachers should give help.

The information obtained needs to be selected and processed. Students need to be taught to correctly identify useful information and eliminate redundant information, so as to achieve effective use and share the results with others.

2.4. Literacy Teaching Feature Extraction Based on Augmented Reality Algorithm. In augmented reality technology, feature point matching is the key to realizing augmented reality technology. Through the matching of feature points, the rotation and translation matrix between the current frame and the keyframe is obtained, so as to realize the tracking of the camera attitude and accurately register it in the actual scene. Feature point matching includes feature point detection, feature point description, and feature point matching. On this basis, the feature point matching algorithm was deeply studied, and a feature point matching algorithm suitable for literacy teaching was proposed.

2.4.1. Detection of Characteristic Points. Feature extraction is the basis of augmented reality tracking and registration and is also an important topic in the field of computer vision. In the augmented reality system, extracting the most accurate features from multiple sequence images is an important link to realize the virtual scene of virtual reality.

Point of interest and corner are two commonly used feature points. The point with obvious characteristics is called "point of interest." For example, it has different color and gray scale from the surrounding area. The place of interest may be a small area or a region. Corner is the corner

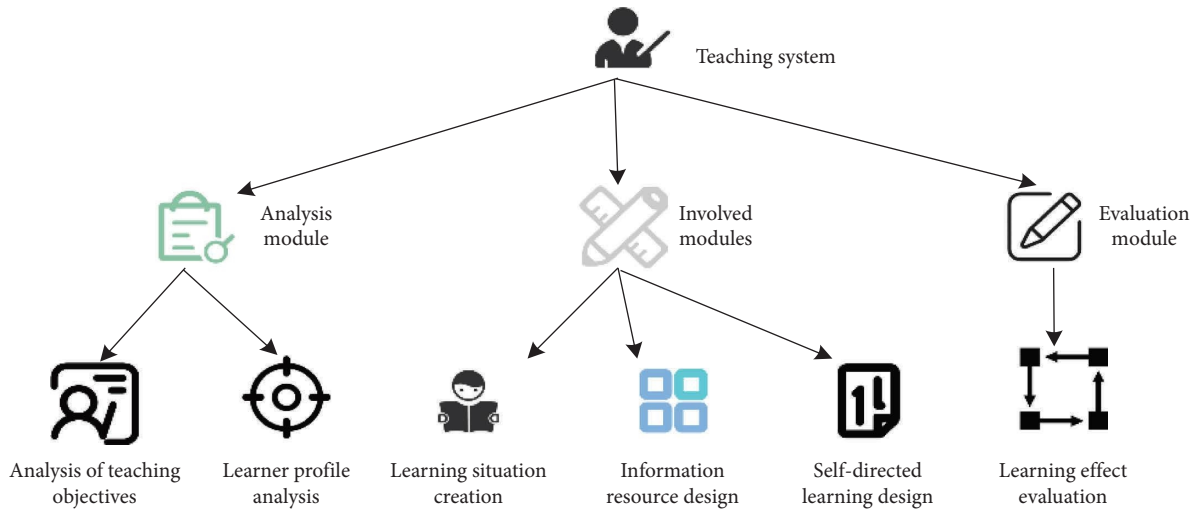

Figure 3: Instructional design of AR applied to literacy teaching in the primary school.

of an object or the intersection of a straight line in an image, which is characterized by constant rotation and light. However, the antinoise performance of the point of interest is better than the corner position and more stable. All points are referred to as feature points to ensure consistency. Feature extraction is the key technology to implement an augmented reality system. The following is the basic principle of common feature point extraction.

(1) SIFT Feature Point Detection. SIFT (scale invariant feature transform) is a kind of invariance feature transformation based on scale space. The SIFT method takes the feature points of two-dimensional plane space and multiscale space as the main feature points, and the obtained feature points have good stability and scale invariance. The following is an analysis of the algorithm.

For a two-dimensional image $I(x, y)$ and Gaussian kernel convolution, its representation in a certain scale space can be obtained.

$$J(x, y, \delta) = G(x, y, \delta) * I(x, y). \tag{1}$$

The two-dimensional Gaussian kernel is as follows:

$$G(x, y, \delta) = \frac{1}{2\pi\delta^2} e^{-(x^2+y^2)/2\delta^2}. \tag{2}$$

In Formula (3), (x, y) represents the pixel position of the image and δ is called the scale space factor. The large scale corresponds to the general features of the image, and the small scale corresponds to the detailed features of the image: I represents the scale space representation of the image. The multiscale space operator DoG is defined as the difference between two Gaussian kernels with different scales as follows:

$$D(x, y, \delta) = [G(x, y, k\delta) - G(x, y, \delta)] * I(x, y). \tag{3}$$

The SIFT algorithm can calculate the response of the DoG operator on each scale. When searching for feature points, SIFT compares the points on the DoG scale with the points on the adjacent scale one by one. It is necessary to search both in the adjacent area and near the scale and compare it with the DoG response value of the adjacent point. Specifically, the measured points are compared with eight neighborhoods on the same scale and nine points in two adjacent neighborhoods. If the point to be measured has the largest or smallest DoG response among the 26 neighborhood points, then this point is the characteristic point of the image under this scale.

(2) SIFT Characteristic Descriptor. The basic idea of SIFT feature descriptor is to assign a main direction to the detected feature points, which is described by the main direction. This method uses the histogram in the gradient direction of each point in the neighborhood of the feature point, so that the feature point has the direction parameter, thus forming the rotation invariant property. Formula (4) can be used to express the gradient of pixel points in the scale space.

$$G(x, y) = \left(\frac{\partial I}{\partial x}, \frac{\partial I}{\partial y}\right). \tag{4}$$

The gradient amplitude is expressed by the following formula:

$$m(x, y) = \sqrt{(I(x+1, y) - I(x-1, y))^2 + (I(x, y+1) - I(x, y-1))^2}. \tag{5}$$

Therefore, the gradient direction is obtained, as shown in the following:

$$\theta(x, y) = \arctan\left[\frac{I(x, y+1) - I(x, y-1)}{I(x+1, y) - I(x-1, y)}\right]. \quad (6)$$

According to the above formulas, three kinds of information are given, including position, scale, and orientation, from which the characteristic area of SIFT can be determined. In the actual calculation, the gradient histogram is used to count the gradient of adjacent pixels by sampling adjacent windows, so as to determine the direction of feature points. The gradient histogram ranges from 0° to 360°. Each 10° dimension is divided into 36 dimensions, and the gradient amplitude and direction of each pixel are calculated in the window near the feature point according to formula (4).

2.4.2. Feature Point Matching. In current feature point matching algorithms, Euclidean distance is often used to match high-dimensional features in pairs, and Hamming distance is used to match low-dimensional features in pairs.

(1) Euclidean Distance Matching. Euclidean distance matching is applicable to point matching between high-dimensional feature descriptors such as SIFT and SURF (speed up robust features). It is assumed that the feature vector $X = [x_1, x_2, ..., x_n]$ in image A and the feature vector $Y = [y_1, y_2, ..., y_n]$ in image B, and the distance between the two images is as follows:

$$D = \sqrt{|x_1, y_1|^2 + |x_2 - y_2|^2 + \cdots + |x_n - y_n|^2}. \quad (7)$$

The distance between a point in image A and a point in image B is calculated by Formula (7). However, if the shortest distance is used as the feature matching point, it would lead to a large number of errors. By calculating the ratio of the nearest neighbor to the next nearest neighbor, the error matching can be effectively reduced.

(2) Hamming Distance Matching. Among binary descriptors such as BRIEF (binary robot independent element features), Hamming distance matching is the most suitable. The XOR (exclusive OR) operation of these two feature descriptors shows that the shorter the Hamming distance, the better the match. The shorter the Hamming distance, the better the match.

$$D = \sum_{i=1}^{k} x_i \oplus y_i. \quad (8)$$

Hamming distance matching is very suitable for recognition teaching. It is suitable for running on mobile terminals. Because of its small amount of computation and fast matching speed, it can better ensure the real-time and efficient matching.

3. Exploration of the Application of AR in the Teaching of Literacy at the Lower Stage of Primary School

3.1. Exploration Methods. At each stage of the study, according to the needs of the study, a variety of research methods have been adopted, such as literature research, investigation research, quasi-experimental method, and so on.

3.1.1. Philology. On the basis of reading a large number of documents, this paper preliminarily collated and summarized the application of AR technology in China's education and analyzed the feasibility of combining AR technology with literacy teaching. On this basis, the design process of literacy teaching supported by AR technology can be discussed [13].

3.1.2. Method of Simulation Test. The experimental class used AR teaching software for teaching, while the control class used traditional teaching tools to test the two classes. Through the statistics and analysis of the experimental data, the differences between the two classes before and after the experiment were analyzed, and the function of the AR application and the hypothesis of the experiment were tested.

3.1.3. Questionnaire. The research object of this paper was the "Emotional Table of Literacy of Primary School Students in Lower Grades" and the "Questionnaire of Literacy Learning Attitude of Primary School Students in Lower Grades." Using the data of the questionnaire, this paper compared the changes in emotion and attitude of the two groups of students before and after the experiment and further expounded the role of AR technology in the experiment. Based on the Self-perception Scale of Classroom Learning, this paper examined students' acceptance of AR technology. In view of the literacy level of primary school students, all the questions in the questionnaire were marked in words and guided by the teacher.

3.2. Determination and Evaluation of Experimental Objects and Process. A Primary School is a high-quality and modern public primary school in Z City. According to the previous survey, each class is equipped with touch teaching equipment, which has been put into use. School teachers have good basic operation ability of information equipment and generally have a high acceptance of modern educational technology, which can meet the implementation conditions of this study. On this basis, according to the examination results of Grade 1 of Primary School A, students from Class (1) and Class (2) were selected, with Class (2) as the control class and Class (1) as the experimental class. The number of the two classes was equal, a total of 100. The details of the two classes are shown in Table 1.

In this paper, two teachers with high teaching experience and similar teaching levels were selected as the experimental class and control group, with similar differences in number and gender. Choosing these two classes as subjects can better grasp the unrelated experimental variables.

After the experiment, the experiment lasted more than two months. The experimental class adopted AR technology, and the control class adopted the traditional literacy

Table 1: Statistics of the number of people in the experimental class and the control class.

Serial number	1	2
Class	Class one	Class two
Types	Test group	Control group
Boys	26	23
Girl	24	27
Total people	50	50

Table 2: Independent sample t-test of experimental class and control class.

Type	Comprehensive intelligence level	
Class	Experimental class	Control class
Average	41.1463	40.2536
Standard deviation	4.2745	4.2944
Standard error	0.3367	0.3549

teaching mode. The number of courses per week was basically the same as the experimental courses, and the specific teaching content and time were fixed. In the experiment, this class used AR technology to study literacy teaching and adopted the student-centered independent exploration and team cooperation. AR software is used to carry out independent exploration after class, review, and consolidate knowledge points. The teacher made a comprehensive analysis based on the actual situation of the class and the independent exploration after class and adjusted the following literacy teaching appropriately. The teacher in the control class introduced new words into the storytelling and used word cards to teach.

3.3. Evaluation of Experimental Results and Data. Students in the experimental class and the control class were arranged to take the Raven Intelligence Test. The test sheet was scored according to the standard table, with 1 point for each correct answer and 0 point for each wrong answer. The scores of columns A, B, C, D, and E of the test were 12 points, respectively, and the total score of the five tests was 60. Two independent sample t-tests of SPSS were used to determine whether the overall average difference between the two classes was significant. The test results of the experimental class and the control class are shown in Table 2.

It can be seen from Table 2 that the average values of the experimental class and the control class were 41.1463 and 40.2536, respectively. The standard deviation of the two was 4.2745 and 4.2944, respectively. In terms of standard errors, the standard errors of the experimental class and the control board were 0.3367 and 0.3549, respectively.

3.3.1. Data of Students' Literacy Learning Attitude. In order to study the differences in literacy learning attitude between the experimental class and the control class before and after the experiment, the literacy learning attitude scale was distributed to the students of the two classes before and after the experiment, and the data were collected and analyzed. The statistical analysis chart is shown in Figure 4.

In Figure 4(a), in terms of learning attitude, 6 people felt excellent before the experiment and 7 people felt good; there were 22 people who thought it was average; 8 people who thought it was not good; and 7 people thought it was very bad. After the experiment, 16 people thought it was excellent and 17 people thought it was good; there were 11 people who thought it was average, and 4 people who thought it was not good; there were 2 people who felt very bad. In Figure 4(b), there were 5 people who felt excellent and 4 people who felt good; there were 18 people who thought it was average and 12 people who thought it was not good; there were 11 people who felt very bad. After the experiment, 7 people felt excellent and 9 people felt good; there were 22 people who thought it was average and 7 people who thought it was bad; there were 5 people who felt very bad. Therefore, it can be seen that the application of AR technology in literacy teaching has played a relatively good effect.

3.3.2. Data on Students' Literacy Achievements. Through the statistics of the literacy scores of the two classes, the difference between the literacy scores of the experimental class and the control class before and after the experiment can be known, and it is also an important indicator that can best reflect the application effect of AR technology. The pre-and post-analysis of literacy scores in the experimental class and the control version are shown in Figure 5.

In Figure 5(a), the results of the experimental class were 3, 6, 14, 18, and 9 in the range of 0–20, 21–40, 41–60, 61–80, and 81–100 before the experiment. After the experiment, there were 0, 2, 7, 26, and 15 students in the experimental class in the range of 0–20, 21–40, 41–60, 61–80, and 81–100. In Figure 5(b), before the experiment, there were 4, 10, 17, 15, and 4 students in the control class in the range of 0–20, 21–40, 41–60, 61–80, and 81–100. After the experiment, there were 2, 9, 10, 22, and 7 students in the control class in the range of 0–20, 21–40, 41–60, 61–80, and 81–100. Therefore, it can be seen from Figure 5 that AR technology plays a great role in improving students' literacy performance.

3.3.3. Self-Perception Data of Course Learning. After the end of the experimental study, the students in the experimental class were surveyed on their self-perception of course learning, and a total of 50 valid questionnaires were received. The questionnaire results of AR tool perceived usefulness are as follows.

There are two topics in the Course Learning Self-perception Questionnaire to measure the perceived usefulness of the AR tool, that is, whether students think that the use of the AR tool in teaching has helped their academic performance, which objectively reflects students' satisfaction with the use of the AR tool [14, 15]. The statistics of the options for each topic are shown in Figure 6.

In Figure 6(a), 6 students were very satisfied with AR's help to self-learning and 24 students were a little satisfied; 8 people felt average, and 7 people were dissatisfied; 5 people were very dissatisfied. In Figure 6(b), 16 students were very satisfied and 19 were a little satisfied with the question of

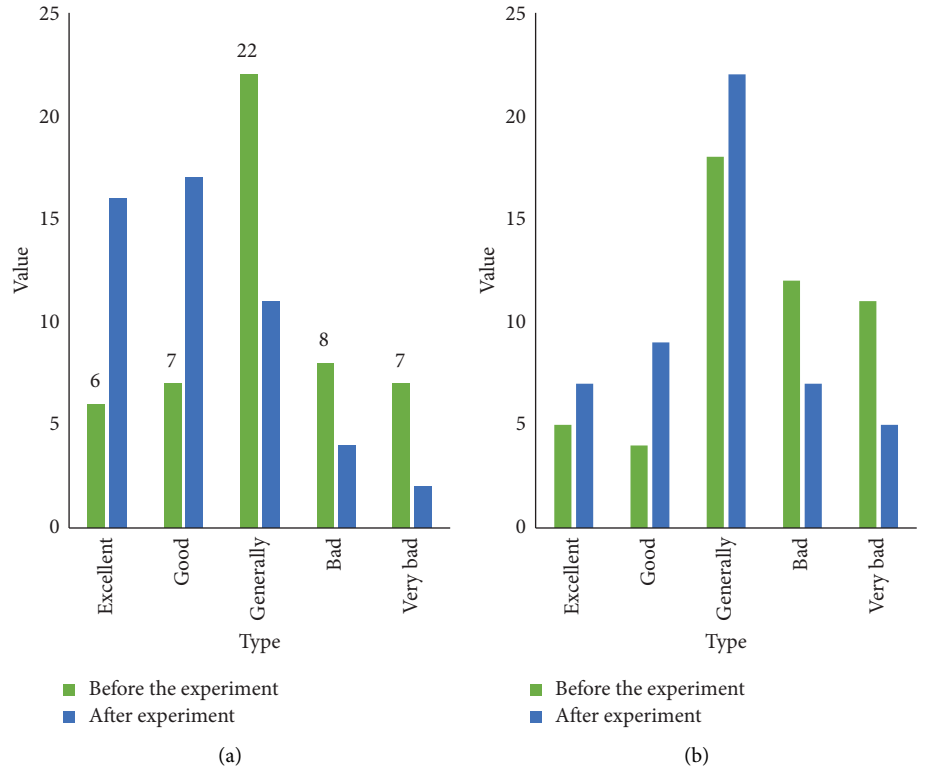

Figure 4: Statistical table of learning attitude survey. (a) Learning attitude of the experimental class. (b) Learning attitude of the control class.

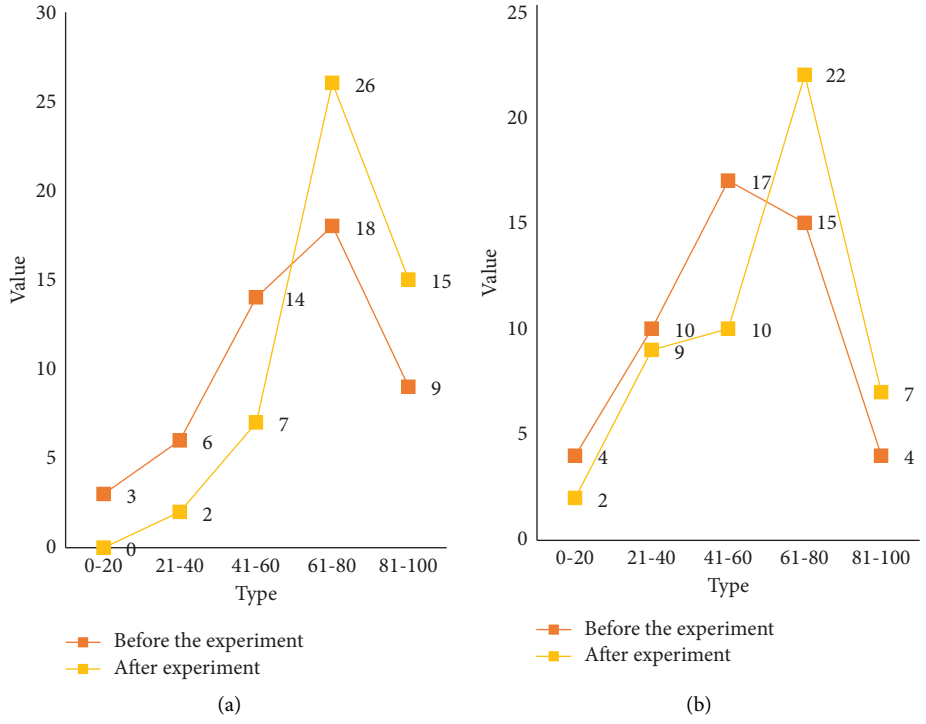

Figure 5: Statistical chart of students' literacy achievements. (a) Grade of experimental class. (b) Grade of the control class.

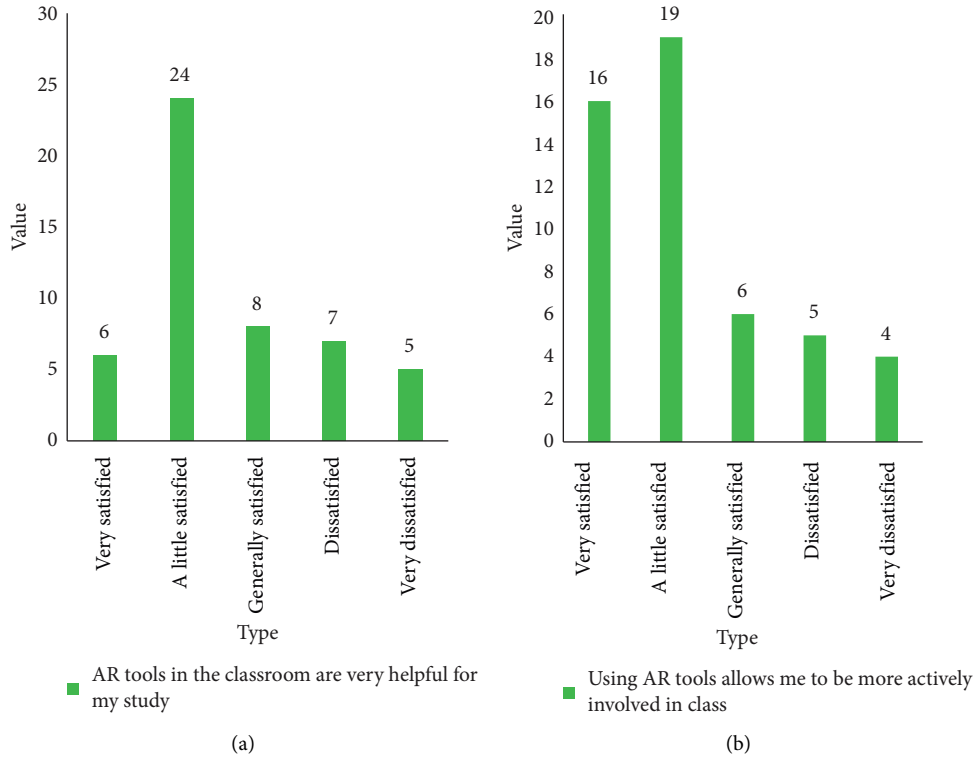

Figure 6: AR tool perceived usefulness statistics. (a) AR is helpful for self-learning. (b) After using AR, self-participation in classroom activities is more active.

more active participation in classroom activities after using AR; 6 people felt average, and 5 people were dissatisfied; 4 people were very dissatisfied.

Through the comprehensive analysis of the above two questions, the results showed that students have a high evaluation of their understanding of AR tools and believe that AR learning tools can effectively improve their learning efficiency and participation, thus helping to improve classroom autonomy [16].

4. Conclusions

In view of the problems existing in the current primary school Chinese classroom teaching, this paper carried out a series of teaching practices through the discussion of the advantages of AR technology in literacy teaching and the teaching design process, combined with the actual situation of A Primary School in Z City. The application of AR technology in literacy teaching in the lower grades of primary school can effectively improve the classroom teaching of Chinese and can promote students' reading interest and attitude. It can enhance the communication between teachers and students, thus creating a harmonious and interesting cultural classroom. With the support of AR technology, the interaction between teachers and teachers creates a good, free, and interactive atmosphere, which makes the traditional boring literacy classroom full of vitality and vitality. The interaction between teachers and teachers is smoother and more efficient, so that students can concentrate on the classroom. At the same time, AR technology can also provide a strong guarantee for students' autonomous learning, autonomous inquiry learning, preclass preview, in-class learning, and after-class review.

Data Availability

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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References

[1] K. Nils, "Improving literacy and content learning across the curriculum? How teachers relate literacy teaching to school subjects in cross-curricular professional development," *Education Inquiry*, vol. 10, no. 4, pp. 368–384, 2019.

[2] P. Ilhan and C. Kesik, "Parents' views on initial literacy teaching in the distance education process," *Cukurova University Faculty of Education Journal*, vol. 51, no. 1, pp. 443–472, 2022.

[3] U. Gezer Melike, "Storybooks, songs, and games: tools to boost early literacy development in primary English classrooms," *International Online Journal of Education and Teaching*, vol. 8, no. 4, pp. 2683–2700, 2021.

[4] J. McHardy and E. Chapman, "Adult literacy teachers' perspective on reading difficulties and the origins of these perspectives," *Adult Literacy Education*, vol. 1, no. 1, pp. 6–18, 2019.

[5] D. Lynn and B. Deb, "The sophisticated literacy practitioner and the global pandemic," *Australian Educational Researcher*, vol. 49, no. 2, pp. 347–365, 2022.

[6] N.. Barnes, "The social life of literacy education: how the 2018# phonicsdebate is reshaping the field," *Australian Educational Researcher*, vol. 49, no. 2, pp. 243–260, 2022.

[7] W.-J. Lee and H.-J. Baek, "A study on research trends in literacy education through a key word network analysis," *Journal of Digital Convergence*, vol. 20, no. 5, pp. 53–59, 2022.

[8] V. J. Risko and L. Reid, "What really matters for literacy teacher preparation?" *The Reading Teacher*, vol. 72, no. 4, pp. 423–429, 2019.

[9] B. Plaatjies, "Investigating principal capacity in literacy instructional leadership at selected primary schools," *Journal of Social Studies Education Research*, vol. 10, no. 3, pp. 136–160, 2019.

[10] S. S. Zuilkowski, B. Piper, and S. Ong'ele, "Are low-cost private schools worth the investment? Evidence on literacy and mathematics gains in nairobi primary schools," *Teachers College Record*, vol. 122, no. 1, pp. 1–30, 2020.

[11] G. Silinskas, M. Torppa, M.-K. Lerkkanen, and J. E. Nurmi, "The home literacy model in a highly transparent orthography," *School Effectiveness and School Improvement*, vol. 31, no. 1, pp. 80–101, 2020.

[12] R. Sibanda and L. Kajee, "Home as a primary space: exploring out-of-school literacy practices in early childhood education in a township in South Africa," *South African Journal of Childhood Education*, vol. 9, no. 1, pp. 1–10, 2019.

[13] B.. Plaatjies, "Perceptions of foundation phase teachers on principals as literacy leaders in selected primary schools," *International Journal of Learning, Teaching and Educational Research*, vol. 19, no. 7, pp. 1–22, 2020.

[14] F.. Serafini, "What still matters in literacy education?" *Practical Literacy: The Early and Primary Years*, vol. 25, no. 1, pp. 18-19, 2020.

[15] V. Saba Khan, "Elementary literacy teachers change the underlying story through transformative read-aloud curricula," *Journal of Children's Literature*, vol. 48, no. 1, pp. 33–44, 2022.

[16] B. Kasa and A. Ates, "Problems experienced in the literacy teaching process by foreign students in the first grade of primary school," *International Journal of Educational Methodology*, vol. 7, no. 2, pp. 319–334, 2021.