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Development of MAKAR Database and Its Learning Effects in Learning Centers

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Abstract

This study develops Make Augmented Reality (MAKAR) database combining tablets and teaching aids to inspire children's learning and record their learning path. Are children more interested in MAKAR teaching? Thirty-seven 4~6 years old were randomly selected. This study used tablet to develop nine emotional theaters and four points of interest each theater. Findings indicated that children are more interested in MAKAR teaching. MAKAR teaching has extremely significant effect on emotional ability (p=0000). The overall reliability analysis showed a 74.7% consistency.

Key words: MAKAR, database, learning centers

Introduction

This study has three main goals. (1) Develop a MAKAR database, nine emotional theaters, and various theaters to develop QTTS for creative thinking scaffolding questions and a total of 36 interactive games. (2) Generate big data to understand the interests of young children and how to trigger learning motivation. (3) Explore factors that affect learning, such as improving emotional intelligence and problem-solving skills. Research data was collected by the MAKAR database. When the child makes a choice, the system automatically record the user's operational information (answer options, time and frequency of use, etc.). After being uploaded to the database for analysis by MAKAR, the user's learning files be exported or used as the basis for future revisions and improvements. One useful tool of the MEP (MAKAR Editing Platform) is Miffy Multimedia's learning area in the kindergarten area, which provides a convenient teaching aid development tool for teachers. Virtual and real integration can also improve learning motivation and help increase children's interest in learning through sensory stimulation. This research studies virtual and real-world integration applications in kindergarten classrooms, and it designed nine emotional teaching theaters based on nine abilities to understand student emotions. In the above study also asked 4 children between 4-6 years old four questions according to QTTS's creative thinking teaching process. The post-production instructional film contains the content of QTTS. The results support the extreme importance of MAKAR to enhance children's emotional ability to achieve p = .000 ***. The overall reliability analysis of Cronbach's Alpha value is .747. The learning outcomes of the experimental group reached a very significant level (p = .002 **). In addition, this result also supports the positive support for this study. Using Vuforia AR (hereinafter referred to as AR) technology can help improve the learning experience of children and the understanding of complex problems. [1]
Another study stated that AR had the benefits of: When subjects easily learn computer concepts from maze games with AR immediate feedback, they gain confidence and interest. The tool is low cost, intuitive and portable. [2] In this study AR supported by the combination of actual objects and AR teaching, which greatly help the subject to understand complex concepts. [3] According to the literature, the following factors affect children's learning: parent's marriage, parent-child interaction, companionship of friends, gender, ranking in the family, demonstration by adults, children's own emotions and personality [4], language used in the family, number of children in the family, having had a major illness, interpersonal relationships, group activities, parental education, parental occupations, pregnancy or birth problems, whether native or foreign language is used at home, and country of residence[5]. This study finds that the following factors affect learning by young children: child-centered learning method (study area, theme course, program course, teacher's scaffold questioning technology), and creative mind and teaching methods (questioning, thinking, doing, commenting, and intelligence). This study records this information in the early childhood learning development database to understand how a child's identity affects its learning.

Research method

A. App system architecture development

1. Child data parser module: For follow-up actions this module analyzes data returned from the Child Database such as text of the question, name of the scaffolding voice file, name of the image file, video file name, and AR identification file name.
2. Layer Controller module: This module changes the scene layout according to instructions transmitted by the Trigger Event Management module.
3. Trigger Event Management Module: This module detects the trigger of all buttons or images to generate corresponding program actions. For example, clicking on an image triggers the Camera Controller module to scan, and transfer the scanned image to the MAKAR server via the MAKAR SDK to compare the AR identification of the same image. If the comparison is correct, the image file responds to the corresponding AR display content (such as 3D object display), otherwise it responds to the message "Unrecognized, can't find the corresponding AR content".
4. MAKAR SDK: The SDK tool is provided by the MAKAR Company, and it is integrated with the system design of this research. It can return corresponding AR identification points

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such as link URL, mailbox, community forum, display video and 3D objects. (Fig. 1).

B. Test process

The program running process of the study is illustrated as follows.

1. Theater Learning Center

There are three steps in this area. First, the child needs to create an identification ID shown in Fig. 1. Secondly, the child go to the theater area to scan pictures for study (Fig. 2, 3). During the learning process, children answer questions of question, think, trial, and share (QTTS) (Fig. 4~8). Step 3: In the process of children learning and answering questions, the system records the child's learning time, the time and the score to answer the question. The answer time is up to five minutes, and the child's score is one or zero points according to the right or wrong. The time to answer the question is stored in the learning data according to the "year", e.g. 20181123.

Fig.1-10

2. Language Learning Center

There are also three steps in this area. First, the child needs to first establish an identification ID to record for analysis (Fig. 11). Step 2: Children can scan pictures in the language area to learn (Fig. 12, 13). During the learning process, children need to find pink clothes according to the prompts. Scan the main characters in the picture and put on pink clothes. If the answer is correct, Continue the story, the error is kept the same situation and use the voice, error message to remind the child (Fig. 14~16). Step 3: In the process of children learning and answering questions, the system records the child's learning time, the time and the score to answer the question. The answer time is up to five minutes, and the child's score is one or zero points according to the right or wrong. The time to answer the question is stored in the learning data according to the "year", e.g. 20181123.

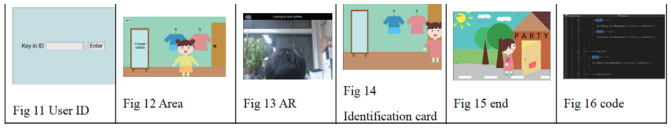

Fig. 11-16

3. Paly Center

There are also three steps in this area. First, the child needs to first establish an identification ID to record data for analysis (Fig. 17). In step two, the child can scan the picture in the language area for learning (Fig. 18, 19). During the learning process, the child needs to help the rabbit find the correct food card and scan, and then the animation is played, if the correct food card is selected. The rabbit eats food forward (Fig. 20~23). Step 3: In the process of children learning and answering questions, the system records the child's learning time, the time and the score to answer the question. The answer time is up to five minutes, and the child's score is one or zero points according to the right or wrong. The time to answer the question is stored in the learning data according to the "year", e.g. 20181123.

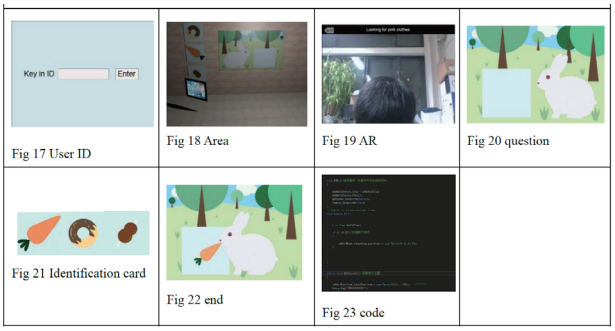

Fig.17-23

4. Art Learning Center

In this area, children get five story cards, representing people, things, time, place and object. Each story card gives the children a minute to draw a picture, then 30 seconds to tell the story, after the story is finished, use AR to scan, the picture drawn by the child becomes a 3D object on the screen (Fig. 24). In the process of children's painting to telling stories, the system records the time of the children's use, the story content, and analyze the children's learning situation. The yellow color in the figure is the average value, and the left field pair can be checked. Each data is filtered and analyzed. The available fields are: filter the children, filter the study area, filter the level, filter the question number, filter the score, filter the time spent, filter the time when the quiz was started and ended. It is used to analyze the average time that the child used to answer the question correctly within five minutes.

TABLE 1
ART LEARNING CENTER

Who	What	When	Where	Object

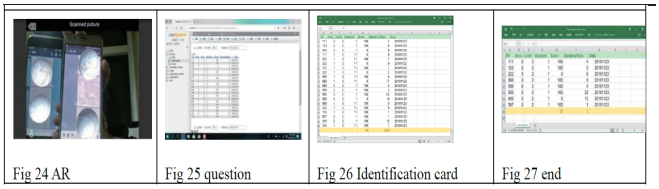

Fig. 24-27

Results

A. The study develops an innovative MAKAR database, Unity platform, and Vuforia AR.

The study uses the MAKAR Augmented Reality Editing Platform to understand the teacher's experience of using the MAKAR platform, and to complete the factor analysis and establish validity through questionnaires and Structured Equation Model applications. It generates big data to understand children's interests and trigger learning motivation

Previous research related to early childhood education has not provided a database, nor has it applied used big data analysis for early childhood learning needs and teacher development. It can be defined as a large amount of unstructured or structured data from a variety of sources. The use of big data has led to novel research on a wide range of topics. Big data analytics is becoming more common due to recent technological advances around the world.

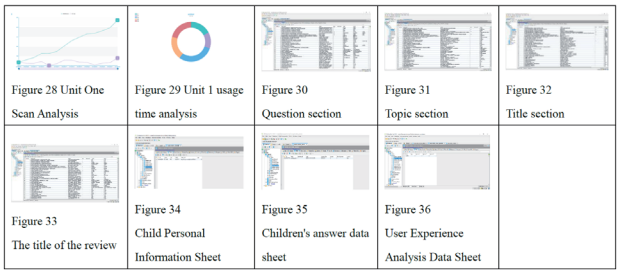

Fig. 28-36

Therefore, this study uses big data to analyze the learning needs of young children and to facilitate teachers' development. Fig. 28 and 29 are values that illustrate which course the user is more often used to learn, and when and how often they are used. Each unit theater has its own data analysis, which can also understand the children's interest in different units.

According to the research purpose of the research project, build a database of questions in the four blocks of questioning, thinking, doing, and evaluation for use at the front end of the system. Each of the following data sheets has the title id, the problem to be analyzed for each question, and the analysis of emotional ability which based on emotional ability scale. Contains questions, answers to questions, number of question options, and topic options. This information is used for subsequent analysis (Fig. 30~33).

B. Child-Related Personal Data Sheet

1. Child Personal Information Sheet

This records the basic information for each child: child's identity card number, name, age, parental education, parental occupation, number of children at home, problems with pregnancy or birth, language at home, place of residence,parents' marital problems, if child has had a major disease, interpersonal relationships, participation in group activities, child-centered learning methods, scaffolding techniques that teachers have implemented for them, and creative thinking methods for their implementation. Figure 34 are used for follow-up enquiries regarding identity and analysis of factors that influence early childhood education.

2. Children's Answer Data Sheet

This records conditions of the child's answering questions, including recording which child is asking, thinking, doing, select which area to answer, answering which question, whether the answer is correct, and how long it takes to answer and start the answer. Analysis which child's date and time when questioning, thinking, doing, and commenting is helpful. It can be used to evaluate which area is more popular with children. Analyze how long it takes for children to answer questions can know whether it is too difficult for young children to improve the use of the platform experience (Fig. 35).

3. User Experience Analysis Data Sheet

User experience is recorded in order to give feedback to teacher after using the MAKAR technology in seven major aspects: teacher knowledge, user interface design, MAKAR technical readiness, perceived usefulness, perceived ease of use, sex, MAKAR technical satisfaction and recommendation intention. The columns have names, ages, and answers to each question for subsequent analysis to assess whether the MAKAR technology is appropriate for early childhood learning (Fig. 36).

C. Factors Affecting Learning, Emotional Ability, Creative Problem-Solving Skills

In order to understand whether there are significant differences between traditional teaching and MAKAR teaching in children's creative problem-solving ability, this study used the mean difference test (t-test) to compare the creative average before and after the experiment. Results are shown in Table 2.

TABLE 2
GROUP STATISTIC

	ID	Number of people	Average	SD	Standard Error
Finexam	1.00	15	15.933	6.25033	1.61383

The results show that the average between the two is different 15.9333 and 16.5333. The average number of children who use MAKAR to teach problem-solving is higher. Although there is no significant difference, some micro-positive effects can still be found.

1. Analysis on MAKAR Teaching Effect of Emotional Ability

The study used the average difference test (t-test) to compare the average emotional ability of the subjects before and after the experiment.

TABLE 3
SUMMARY TABLE OF RESULTS OF ANALYSIS OF DIFFERENCE IN EMOTIONAL ABILITY

		Pairwise variable difference					t	Degrees of freedom	Significance (two-tailed)
		Average	SD	Standard Error	95% confidence interval for difference				
					Lower Bound	Upper Bound			
Paired 1	Pre-post test	-7.93333	5.71105	1.04269	-10.06587	-5.80079	-7.609	29	.000

As can be seen from the table, the MAKAR teaching has extremely significant effect on the teaching of emotional ability. The difference between the averages pre-test and post-test calculated by pairwise variables is -7.93333. After dividing by the standard error, the value of t is obtained and the significance

is .000 which is statistically significant. This indicates that the subject used the MAKAR textbook developed by the research institute to develop the learning effect of the emotion-related course.

2. Reliability Study

How is the overall reliability analysis on the effectiveness of MAKAR in learning? Findings are shown in Table 4.

TABLE 4
SUMMARY OF THE RESULTS OF THE RELIABILITY ANALYSIS OF EMOTIONAL ABILITY

Cronbach's Alpha	Cronbach's Alpha value based on standardized projects	Number of items
.747	.710	37

Table 4 shows that the reliability coefficient is Cronbach's α.747, and the normalized reliability coefficient is .710. The normalized α represents the influence of the unequal variation of each subject, and the corrected coefficient. For the 37 randomly selected participants, the overall reliability analysis showed a 74.7% consistency.

D. Virtual and Real Integration to Improve Children's Learning Interests

In order to understand whether Augmented Reality affect children's learning interest, this study compares the traditional teaching theater and the MAKAR teaching theater children's preferences to the average difference test (t-test). Results are shown in Table 5.

TABLE 5
TEACHER PREFERENCE TEACHING METHOD ANALYSIS TABLE

Group	Number	Average	SD
Traditional teaching	9	11.8889	3.21887
MAKAR Teaching	9	17.6667	3.42783

The results show that the average between the two is different (11.8889 and 17.6667), the lower data is significantly higher, indicating that children are more interested in MAKAR teaching.

Discussion

Related study showed that virtual 3D representation of complex objects can help children understand concepts [6]. Therefore, we can think that the use of MAKAR for AR teaching makes it easier for children to understand what the teacher wants to convey. In addition, the study also shows that this form of book reading is more attractive and interesting than static 2D images, especially for children. Furthermore, AR's interactive teaching methods also allow children to learn by doing. In this learning process, young children can choose to study on their own or work with their peers in a collaborative learning environment that provides them with the curiosity needed for problem-solving skills. The results of the classroom implementation show that this multimedia and interactive digital learning platform motivates young children to learn, and through practical operation, children gain experience. According to feedback after the experience, most of children like this type of learning, especially the practice process, which gives them the opportunity to try different things. On the other hand, in terms of curriculum design, teachers can integrate this interactive learning platform in a timely manner, formulate learning activities in various disciplines, expand the breadth of learning content, and diversify teaching materials, consolidate classroom interactive education activities and ultimately improve overall teaching effectiveness. This study finds evidence that the "question, thinking, doing, and evaluation" in this study is significantly better. Children's prefer MAKAR teaching over traditional forms of teaching, and it supports creativity and emotional expression.

Related studies also show that AR has a fast learning process that includes AR exercises or virtual Teachers can increase the interest of young children to learn, and the use of this multimedia content to surpass the traditional test is more attractive for young children [6] [7]. In actual classroom teaching, it is also found that AR interaction and multimedia content can help children learn quickly. The results of this study are positively related to the "QTTS" used in this study.

Research found that mixing a virtual environment is mixed with reality is more attractive to children, and this enhanced enjoyment speeds the learning process, even for children who have never used it [7]. They can get good feedback from it and use this app with the help of a virtual tutor. Therefore, we believe that the use of realistic emotional teaching theaters on interactive platforms can increase children's interest and willingness to learn. Used in this study that virtual and real integration can improve learning motivation and help children learn more interested.

References

[1] J. Yip, et al., Improving Quality of Teaching and Learning in Classes by Using Augmented Reality Video, *Comput Educ,*128, pp. 88-101, 2019.

[2] Q. Jin, et al., AR-Maze: A Tangible Programming Tool for Children Based on AR Technology. In: Proceedings of the 17th ACM Conference on Interaction Design and Children, 2018. [*Digest the 17th ACM Conference on Interaction Design and Children,* pp. 611-616, 2018]

[3] F. Min, et al., Block Talks: A Tangible and Augmented Reality Toolkit for Children to Learn Sentence Construction, 2018 [*Digest CHI Conference on Human Factors in Computing Systems.* ACM, LBW056, 2018]

[4] J. D. Berryman, Use of the Revised Preschool Language Scale with Older Preschool Children, *Language, Speech, and Hearing Services in Schools,* 14(2), 1983, pp. 79-85.

[5] J. A. Hedwig, et al., Parenting and development of one-year-olds: Links with parental, contextual, and child characteristics. *Child Development,* 73(1), pp. 256-273, 2002.

[6] R. C. Chang, A Novel AR-Based Interactive E-Learning Platform, *Advanced Materials Research. Tran Tech Publications,* 2012, pp. 1244-1248.

[7] H. Martínez, et al., Augmented Reality Based Intelligent Interactive e-Learning Platform, In: Proceedings of the 3rd International Conference on Agents and Artificial Intelligence (ICAART-2011), pp. 343-348 [*Digest the 3rd International Conference on Agents and Artificial Intelligence*, 2011] http://doi.org/10.5220/0003181503430348