World Journal of Educational Research
ISSN 2375-9771 (Print) ISSN 2333-5998 (Online)
Vol. 11, No. 5, 2024
www.scholink.org/ojs/index.php/wjer

Original Paper

Practice and Exploration of Gamification in Teaching Number Concepts in Middle Class of Kindergarten X

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Received: August 29, 2024 Accepted: October 12, 2024 Online Published: October 29, 2024
doi:10.22158/wjer.v11n5p237 URL: http://dx.doi.org/10.22158/wjer.v11n5p237

Abstract

Number concept is one of the important contents in kindergarten mathematics. It is the "central concept structure" for the development of mathematical life and thinking ability of preschool children and the foundation of mathematical knowledge. In addition, gamification of teaching activities has become an inevitable trend in the development of preschool education. Carrying out mathematics teaching activities in the form of games can enable preschool children to initially perceive number concepts through direct perception, personal experience and practical operation.

This study aims to explore the practice and exploration effects of gamification in the teaching of number concepts in middle-class children, and to try to integrate gamification elements into the interactive teaching of number concepts in middle-class children, in order to improve the learning interest and effect of preschool children.

Keywords

gamification, digital concept teaching activities, kindergarten mathematics teaching, middle-class digital concept teaching activities

1. Introduction

1.1 Research Background

The "Guidelines for Kindergarten Education (Trial)" clearly states that kindergartens should use games as the basic activity. Educational activities should focus on comprehensiveness, fun, and activity, and integrate education into life games. (Ministry of Education of the People's Republic of China, 2001) Gamified teaching advocates integrating game forms and game elements into the "teaching" and "learning" of kindergartens, guiding preschool children to enjoy education through games. (Liu, 2022)

Most preschool children aged 3 to 6 are in the stage of intuitive and figurative thinking. During this period, preschool children can gain a preliminary understanding of number concepts through direct perception, personal experience, and practical operations, thus laying the foundation for their

development in mathematics. (Xiong, 2022)

1.2 Definition of Gamification in Kindergarten Teaching of Number Concepts

The gamification of kindergarten number concept teaching activities means that teachers purposefully and systematically create game scenarios based on the learning characteristics of preschool children, and introduce gamification elements into all aspects of number concept teaching, thereby increasing the participation of preschool children. At the same time, this teaching method supports preschool children to learn through practical operations and experiences, further cultivates their understanding of numbers, and enhances their number perception ability. This not only stimulates the curiosity and desire to explore of preschool children, but also helps them build basic number concepts and promote the development of mathematical thinking and experience. (Zhao, 2016)

1.3 Research Significance

When discussing the combination of number concepts and gamification strategies, most of the literature usually only sporadically incorporates these concepts into the gamification content of preschool mathematics education, lacking a comprehensive and systematic theoretical framework. In addition, current research mainly focuses on experience summary and theoretical discussion, and is rarely put into practice. In view of this research gap, the author plans to go deep into practice and directly enter kindergartens to carry out gamification action research on number concept activities. By designing and implementing innovative teaching strategies, this study not only provides practical strategies for the gamification of number concept activities for preschool children, but also aims to enrich and expand relevant practical experience. This will help fill the gaps in existing research and improve the quality of teaching.

1.4 Purpose

Preschool children in the middle class are able to solve basic problems and reason at this age. At the same time, their imagination begins to develop and they show great interest in creative games. The implementation of gamification in teaching number concepts in the middle class by different regions and teachers at different times still faces great difficulties. Preschool children themselves have problems such as low participation and distraction in the process of participating in number concept activities. Therefore, further in-depth research is conducted on these difficulties. [5] In order to provide reference suggestions for kindergarten teachers to carry out such activities.

2. Research Design

This study takes the number concept teaching activities in the middle class of Qingdao X Kindergarten as the object, and conducts a comprehensive investigation and practice on the implementation of gamification teaching through literature research, action research, interview and observation methods.

As a universal private kindergarten, the kindergarten is representative in terms of teaching staff, hardware facilities, and the physical and mental development level of children. This is not onl y conducive to our in-depth investigation and problem diagnosis of the actual situation, but als

o provides strong support for subsequent action research; secondly, the kindergarten has comple te educational and teaching facilities and living facilities. In such an environment, we can mor e conveniently conduct research activities such as observation, experiment and interview, and m ore effectively promote the progress of action research.

2.1 Investigation and Interviews

In this interview, six teachers from four middle classes in X Kindergarten were randomly selected, including the director of teaching and research, the head of the teaching and research group, the main class, the deputy class, ordinary teachers, and interns, most of whom had college degree.

The interview mainly focused on three aspects:

First, in terms of teachers' cognition of the value of gamification of number concepts in middle-class teaching, most preschool teachers agree that games should be integrated into number concept teaching activities, but they have narrow channels for understanding gamification of teaching activities and do not have a deep understanding of the connotation of gamification;

Second, the practice of gamification in number concept teaching activities by preschool teachers. The interviews showed that preschool teachers used a single game method when organizing number concept teaching activities, mostly simple game methods such as cards, sticks, and role-playing. Games usually appeared in a certain link of teaching activities and it was difficult to run through the entire teaching process.

The third is the difficulties and challenges that preschool teachers encounter in the process of gamification of number concept teaching activities. Teachers said that there is a lack of systematic knowledge of gamification in education and training, and there is a large gap between the design and implementation stages of games and knowledge acquisition. Another major problem is that some parents do not understand the gamification teaching process.

2.2 Implementation of the Action Plan

Based on the background of gamification of kindergarten teaching activities on number concepts and the actual interview results, the researchers decided to implement, reflect and improve three rounds of action plans, and together with the cooperating teachers, use observation and discussion methods to deeply analyze the effectiveness of each activity and continuously adjust the teaching strategy. Choosing "the actual meaning of numbers" as the research topic, the research team and the cooperating teachers jointly designed and adjusted the teaching activities, and through repeated practice, explored how to effectively gamify the concept of numbers in middle-class teaching.

Activity implementation as the Table 1:

Table 1. First Round of " Little Goldfish"

Learning Activities	Gamification elements	Application	Preschool children's performance

	scene	The activity uses little goldfish as the introduction scenario and the number of goldfish is used throughout the whole process.	At first, preschool children can focus on the goldfish and follow the rules carefully, but five minutes after the activity starts, they become distracted and start running around.
Participation Phase	Target	1. Learn the number 5 and recognize the number 5 2. Be able to explain the actual meaning of 5 3. Initially develop interest and creativity in learning numbers	In terms of achievement, most preschool children achieved the first two goals, some problem children had low achievement levels, and the third goal was generally not achieved at a high level.
	award	In the part of counting goldfish and recognizing the number " 5 ", teachers mainly used verbal rewards, and the reward tools were not fully prepared.	Preschool children who received praise from teachers showed great confidence. On the one hand, they were positive about the following steps; on the other hand, they were more focused.
Immersion Phase	challenge	When learning the number " 5 ", the teacher explains the rules and lets the preschool children draw patterns of 5 on their own.	This stage is difficult for middle-grade preschool children, who do not know much about shapes, and many children help each other to draw all five patterns.
	control	Teachers use rules to control discipline but do not completely force or rush children.	Preschool children do not have very good self-control and do not follow rules very well.
	Interaction	When asking questions, the interaction between teacher and students was very good. During the goldfish counting session, the teacher also joined the discussion with students.	preschoolers see their peers completing tasks, they will express envy and solve problems quickly and well. In addition, peers communicate more with each other in language and will seek help from others to solve

			problems.
Feedback	Reflection	During the teaching session, teachers lead preschool children to reflect.	When preschool children give incorrect answers, teachers will carefully guide them and the children will be able to respond positively.

This activity is in line with the age development characteristics of middle-class preschool children and basically achieved the first two goals. However, there are many problems in the implementation process. First, in the formulation of goals, teachers only focus on the acquisition of knowledge of number concepts and do not emphasize gamification; second, in the selection of content, teachers involve fewer gamification factors in activity design; finally, during implementation, there is less interaction between teachers and preschool children, and the coherence of each link is not strong, so the implementation of the activity did not achieve the expected results.

The second activity implementation as the Table 2:

Table 2. A Few Dwarfs

Learning Activities	Gamification elements	Application	Preschool children's performance
Participation Phase	scene	The activity uses the dwarfs, fairy tale characters that are of interest to preschool children, as an introduction scenario.	Preschool children show interest as soon as they see the pictures of dwarfs, they pay close attention to the set dwarf scenarios, and the interaction effect is good.
	Target	1. Learn the formation of 7 and recognize the number 7 2. Able to correctly count objects within 7, improving counting power 3. Form preliminary mathematical thinking and	In terms of achievement, most preschool children have achieved the first two goals very well, but some problem children have not achieved them to a high degree.

		increase the logical ability of logarithmic concepts	
	award	In the stages of helping the dwarfs count apples and giving gifts to Snow White, the teacher mainly used small stickers as rewards.	The preschool children who received stickers from teachers showed great confidence. On the one hand, they were positive about the following steps; on the other hand, their answers were more correct.
Immersion Phase	challenge	In the stage of learning the number " 7 ", the teacher first helped the dwarfs pick apples, and then increased the difficulty by designing a plan to give gifts to Snow White.	preschool children who usually don't like to participate in activities also actively participated. During the activity, everyone listened carefully and thought about the game's gameplay and rules.
	control	In each link, teachers use rules to control on-site discipline and also remind individual preschool children who have difficulty concentrating.	After clarifying the tasks and rules, most preschool children were able to actively raise their hands to answer and actively do the hands-on operations. Some children showed that their understanding of the concept of fraction was very simple.
	Interaction	When asking questions, teacher-student interaction was achieved to a great extent, and the teacher strengthened the discussion session among students.	When preschoolers see their peers completing tasks, they will ask teachers for help. In addition, peers communicate with each other using more language.
Feedback	Reflection	The teacher adds a summary and reviews the number concepts learned in this session in concise language.	With the teacher's careful guidance, the children are able to respond actively, cooperate with each other and negotiate on their own.

The participation and interest of preschool children in this round of activities have been significantly improved, and the problem of focusing only on knowledge acquisition in the previous activities has been basically avoided. However, there are still some problems. First, after the introduction of fairy tale characters, preschool children show strong interest in the class, which leads to too long time to maintain discipline and the whole activity process. Second, fairy tales and games are not practical, and preschool children cannot have a good connection with real life. Third, the teaching of knowledge is very complicated and unsystematic, resulting in low goal completion.

The third activity implementation as the Table 3:

Table 3. Forest Games

study Activity	Gamification elements	Application	Preschool children's performance
Participation Phase	scene	The activities are based on the theme of small animals that preschool children are interested in.	When preschool children hear it, they show great interest, connect each link closely and pay close attention.
	Target	1. Cognitive goal: Understand the actual meaning of numbers within 10 through the corresponding relationship between animals and number plates. 2. Ability goal: Be able to use multiple senses such as hearing and seeing to correctly count numbers within 10. 3. Emotional goal: Be willing to actively develop mathematical thinking and apply it.	In terms of achievement, most preschool children are able to use their various senses to complete the tasks assigned by teachers.
	award	Teachers' praise and verbal rewards have been present throughout every aspect of the activity, and this time, group	The preschool children showed great enthusiasm in the teacher's praise, especially in the group cooperation record sheet session, where all

		cooperation rewards have also been added.	children were able to participate in the cooperation.
Immersion Phase	challenge	This activity adds a hands-on observation record sheet for preschool children.	This stage is difficult for middle-grade preschool children, and it requires group cooperation. At the beginning, the preschool children discuss how to operate. After the teacher announces the rules, everyone is very serious and hopes that their group can fill in the questions more accurately.
	control	In every link, teachers use rules to control discipline and take into account different types of preschool children through questioning.	From the very beginning when the teacher announced the rules, the preschool children were very abiding by the rules and were able to communicate and negotiate during the teamwork process.
	Interaction	In addition to teacher-child interaction, this activity also incorporates interaction between preschool children working in groups.	Preschool children showed great interest in the group cooperation and competition method, and the sense of team honor prompted everyone to be very serious.
Feedback	Reflection	Gamification runs through the entire teaching activity with clear objectives. The addition of observation record sheets and group collaboration are the highlights of this activity.	In this activity, preschool children used multiple senses to grasp the "practical meaning of numbers within ten" and were active in the activity.

Compared with the previous two events, this event was relatively well completed. First, in terms of learning effects, teachers' teachings are compact and coherent. Preschool children have significantly improved their skills through independent operation and mutual cooperation; secondly, the scenario setting and games of this activity are close to the actual life of preschool children. A pattern observation record sheet suitable for middle class preschool children is also included to test the learning results by

themselves. It can focus more and consolidate learning results; thirdly, the teacher noticed the individual differences of preschool children during the interaction process, and paid more attention to children who are prone to distraction when asking questions. This activity achieved the expected results.

2.3 Activity Summary

The researchers designed three rounds of gamification activities, focusing on a core area of preschoolers' number concept learning - "the meaning of numbers". These activities took into account the sequence and characteristics of preschoolers' number concept development, and each activity was designed around the goals, situations and performances of gamification. In order to support preschoolers' interaction and learning, the researchers provided rich material resources, such as images, headgear, actual props and record sheets. These materials enable preschoolers to learn the meaning of numbers happily through hands-on operations, exploration and practice, and deepen their understanding of the concept. In the first round of activities, although the game factors were biased and the implementation effect was not good, preschoolers mastered the actual meaning of 5 through gamification activities. During the second round of activities, after adjusting the series of problems existing in the first round of activities, further increasing the difficulty to help preschoolers recognize the actual meaning of 7, adding game factors, the participation in teaching activities was significantly higher than the first practice; the third round of action research had the best effect, and achieved the expected results in terms of goal setting and implementation process.

After three rounds of action research, it was observed that preschool children had a significant understanding and mastery of the core concept of “the meaning of number” in a gamified environment. They show enthusiasm for gamified situations. They not only actively participated in the activities, but also actively followed the rules of the game and boldly shared their operating processes and results during the reflection session of each game. These activities significantly improve their learning of basic mathematical concepts. Through these three rounds of gamification design and implementation, the researchers gained a deeper understanding of the impact and potential of gamification teaching, identified and reflected on multiple improvement points in actual teaching, and provided valuable insights into future gamification teaching strategies. insights and more innovative ideas.

3. Research Results and Analysis

The researchers designed three rounds of gamification activities, focusing on a core area of number concept learning for preschoolers - "the meaning of numbers". These activities took into account the sequence and characteristics of the development of number concepts in preschoolers, and each activity was designed around the goals, situations and performances of gamification. The core of gamification of teaching activities is to design the entire activity process in the form of a game, rather than just being limited to a specific link or form. This approach aims to fully integrate the rules, tasks and other elements of the game into the teaching objectives, especially teaching content such as number concepts.

The researchers call this method of comprehensive integration of games and teaching "game-based teaching", highlighting the integrity and coherence of games in the entire teaching process.

Research innovation: First, this study added seven elements of gamification when conducting three rounds of action research on the gamification of the concept of number in the middle class. Each element is closely linked. The researcher is also the implementer. After each round of activities, a reflection and summary of the seven elements are made; second, the difficulty of the three rounds of activities is progressive, and a graphic observation record sheet is added to allow preschool children to operate by themselves and exercise their autonomy. The researcher summarized the experience of the gamification design and implementation of this number concept activity, and provided reference suggestions for kindergarten teachers to carry out such activities.

Research reflection: First, the kindergarten selected in the first round of research was not the implementer of the activity, so there was a certain deviation in the implementation of the teaching plan; second, the game materials and on-site control were not good enough during the implementation of the activity; third, the game was not innovative enough, and the games used were relatively traditional. Although this study has shortcomings, in the follow-up, the researchers will increase their practical experience, continuously enhance their professional ability and comprehensive quality, expand the application scope of number concepts, continuously innovate game models, and improve the learning strategy of number concept gamification in middle classes.

Research recommendations:

First, at the kindergarten level, we can enhance teachers' theoretical and practical training, and use expert resources to improve teachers' ability to design and implement gamified teaching activities. We need to pay attention to and support teachers' participation in research activities on gamified teaching, and create opportunities for teachers to go out for learning and exchanges. We should also do a good job of communicating and exchanging with parents, popularize the significance of gamified teaching through parent open days, parents entering the classroom, daily sharing, etc., realize home-school co-education, and jointly promote the development of preschool children.

Second, at the teacher level, teachers should actively learn related theories of number concepts and even learn mathematics teaching activities. Continuously practice and improve, actively sort out the specific number concept knowledge points of preschool children in the middle class, strengthen gamification design and practice, and find the fit between the core mathematical knowledge points and the game interest points; consciously improve their own professional ability and comprehensive quality, create a relaxed and pleasant learning atmosphere, mobilize the learning interest of preschool children, and awaken the active state of preschool children to participate in activities; at the same time, teachers should also create a good interactive atmosphere among students, and encourage preschool children to learn number concepts in a fair and orderly environment.

4. Conclusion

This study found that by integrating gamification elements into the learning of mathematical concepts, preschool children were exposed to diverse and interesting teaching strategies. These strategies significantly enhanced their learning engagement and multi-sensory experience. The introduced gamification link effectively changed the children's learning attitude and improved their possible problems such as inattention, insufficient interaction and non-learning behavior. Not only do children become more actively engaged in learning, they also inadvertently develop key learning qualities such as independent thinking, diligent reflection and excellent collaboration skills. The research results further verify that gamification teaching not only improves preschool children's understanding and cognitive development of mathematical concepts, but also improves their learning attitudes and behavioral performance. Overall, gamification strategies have shown great potential and benefits in improving teaching effectiveness and stimulating preschool children's enthusiasm for learning. To a certain extent, this study can prove that gamification elements in number concept activities can improve the enthusiasm, participation, and interactivity of middle-class preschool children in acquiring knowledge. It also provides teachers with opportunities to organize gamification of number concept activities. Some ideas.

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