A Study on Improving Children's Sex Education Cognition with Animation

Tiancong Chen[*], Julina Binti Ismail @ Kamal

School of The Arts, Universiti Sains Malaysia,11800,USM Pulau Pinang, Malaysia
Email: julina@usm.my
Corresponding Author Email: ctccong@163.com

Abstract
This study addresses the urgent need for sex education for children in China, particularly given the frequent occurrence of child sexual abuse cases and the significant shortcomings of traditional teaching methods. It explores interactive animation as an innovative medium for sex education for digital native children aged 6–8, aiming to enhance their sexual safety awareness and self-protection capabilities. The study employed a mixed-method design. First, the Delphi method was used to solicit opinions from 10 experts to evaluate appropriate teaching methods. Then, interactive animations were developed based on constructivist learning theory and the ARCS motivation model. A randomized controlled trial was conducted to compare the learning outcomes of the interactive animation group (n=30) with those of the traditional animation control group (n=30). Finally, pre- and post-tests were conducted on 120 children, and the Children's Behavior Scale (CBCL) was used to determine the children's views on the sex education interactive animations. The results showed that experts highly recognized the feasibility of interactive animation. Furthermore, the experimental group scored significantly higher than the control group in all knowledge dimensions in the post-test (p < 0.01). McNemar's test further indicated that children showed significant improvements in gender role cognition, sexual physiology knowledge, and emotional understanding (p < 0.001). This study found that interactive animation not only effectively improves children's sex education knowledge but is also very popular with children. Therefore, incorporating interactive animation into sex education courses is an effective approach that aligns with children's cognitive development characteristics and combines fun with education, offering important reference value for sex education practice and policy formulation in China.
Keywords: Children's Sex Education, Interactive Animation, Delphi Method, Arcs Motivation Mode, Constructivist Learning Theory

Introduction
Sex education is the education that uses scientific knowledge about sex, correct sexual concepts, and appropriate teaching methods to cultivate healthy sexual attitudes, promote

harmonious relationships between men and women, and ultimately promote the healthy physical and mental development of children (Chuang, 2009).Sex education is vital in child development(Unesco, 2021).

At present, various disturbing incidents of child sexual abuse are occurring frequently, leaving an indelible shadow on children's lives.Surveys have reported that, globally, more than 370 million girls and women have been raped or sexually assaulted as children(UNICEF, 2024).This figure reveals the severity of sexual abuse of adolescent girls globally, and that the experience of victimisation can cause lasting trauma. According to Girl Child Protection(protection, 2023),In China, in 2020, there were 322 cases of child sexual abuse (under 18 years of age) publicly reported by the media, with 846 victims. Of these cases, 114 were in the primary school age group of 6-12 years old, accounting for 46.91 per cent of the total.In 2021, there were 233 cases of child sexual abuse (under 18 years old) publicly reported in the media, with 569 victims in 2021, of which more than 70 per cent were children under 14 years old. Of the 202 cases in 2023, there were 114 victims under 14 years of age (excluding 14 years), or 59.06 per cent.According to statistics on child protection, the proportion of child victims at primary and junior high school age is high, the victim group continues to show a trend towards a younger age group, and the number of cases involving acquaintances has increased, making the situation of children being sexually abused a very serious one. Today's children lack self-protection awareness and ability, and lack complete and systematic knowledge of sex, so they need more attention.

Traditional methods of teaching sexuality education are limiting to children of digital natives who are exposed to a variety of digital technologies, and harnessing the power of technological applications that appeal to the younger generation, such as animation, games, etc., may be an effective way to teach sexuality education (Haruna et al., 2021).Animation and games are two of children's favourite forms of entertainment, and the theory is that the best entertainment can simultaneously inspire, educate, entertain and help our children grow. It helps children understand themselves and others, and learn about the world around them(Wright, 2013). Through animation, children can more accurately and intuitively grasp its connotation, thus achieving educational purposes. The diversified forms of animation, such as colour, image design, action, audio-visual design, language and humour, are in line with the aesthetic and psychological characteristics of children. When watching animation, children's vision, hearing and body movement can be developed and their senses stimulated.

The aim of this study is to use the medium of animation to disseminate children's sexuality education and to raise children's awareness of sexuality education. Some studies have found that children have the cognitive ability to understand most of the content areas of sex education (Goldman & Goldman, 1982),Children's sexual psychology will mature with age. Guiding primary schoolchildren to understand sex education through animation will help them to establish correct sexual choices and attitudes. A number of studies have shown that animation has proven to be a viable communication medium in the area of sex education for children. For example, the effectiveness of using the Ramayana animated movie to support children's sexuality education to improve personal safety skills has been validated by scholars in 2022, and this research is recognized(Sukadari, 2022);In 2021 an academic, developed an animated video based on the protection of children aged 4-6 years from sexual violence, which has been tested to be effective in providing children with help in understanding

sexuality (Zuhriyah & Ndari, 2021). Other scholars have investigated the use of animation to disseminate sex education, and that children can achieve the aims of the animation regarding early childhood sex education (Maulia, Rakhmawati, & Murti Dewanto, 2020),etc.

Research Objectives
i.To determine the opinions of survey experts on which current teaching methods are more suitable for teaching children sexual health knowledge.
ii. To develop interactive animations for children's sex education.
iii.To analyze the impact of interactive animation on children's academic performance in sex education.
iv.To determine children's opinions on interactive animations for sex education.

Literature Review
Sex education refers to the education that uses scientific knowledge about sex, correct sexual concepts, and appropriate teaching methods to cultivate children's positive attitudes towards sex, promote harmonious relationships between men and women, and guide children's healthy development at the physiological, psychological, and social levels(Chuang, 2009).

The level of sex education for children is influenced by many factors. Firstly, the unique nature of sex education often leaves parents and teachers confused about how to communicate effectively. Some children are too young to understand the information conveyed by the media. Therefore, sex education can be better disseminated through diverse media channels (Wang, 2022). Studies have shown that digital parenting is highly effective and plays a vital role in protecting children from sexual violence (Wahyuni, Fitroh, & Risnasari, 2021).

For this reason, many scholars will use animation to disseminate sex education knowledge to children, attract children's interest, so as to achieve the effective dissemination of sex education. Currently, there are a lot of experiments to prove that children can learn about sex with the help of animation. Animated videos are more attractive than pictures and more effective in improving children's knowledge of sex education(Tirtayanti & Ristayani, 2021). Some scholars had 28 children watch sex education animations for sex education purposes(Maulia et al., 2020) confirming that animation media can promote adolescent sexual health and is a very appropriate way to reach adolescents (Bailey et al., 2015), enabling children to understand various aspects of sex education(Ndari, Hasanah, & Rosyidi, 2019).

Research integrating interactive animation with sex education remains scarce, with studies typically focusing on adolescents, while research targeting children aged 6–8 is virtually nonexistent.Krungkraipetch (2019) developed an interactive media product aimed at providing sex education tools for Thai teenagers. Through storytelling using cartoon animations, the study found that teenagers gained a better understanding of the relevant knowledge.A study by Mariana (2024) shows that developing animation-based interactive learning media for reproductive health literacy education among adolescents has yielded significant results.Furthermore, several studies have successfully demonstrated that interactive animated videos, as a health promotion medium, can effectively improve secondary school students' awareness and attitudes towards sexual violence prevention (Widodo, 2024).These studies indicate that interactive animation is necessary for

popularizing sex education, and its use in sex education provides a novel and engaging learning method that can overcome many obstacles present in traditional teaching.

Methodology

Research Design and Approach

This study employed a mixed-methods approach to examine the impact of animation-based teaching methods on sexual awareness among children aged 6 to 8. The selection of this methodology demonstrates clear appropriateness and rationality. This is because mixed methods facilitate the collection of more comprehensive data, multi-perspective arguments, or additional evidence, thereby enhancing the understanding of the research topic(Heigham & Croker, 2009). This study employs a mixed-methods approach to address four research objectives, each of which adopts a corresponding specific research design:

Research Objective 1: To determine expert opinions on appropriate teaching methods for imparting sexual health knowledge to children.

Using the Delphi method, ten experts in the field of education were invited to participate, and their opinions were collected through multiple rounds of Likert questionnaires. In educational research, especially in areas such as curriculum development, assessment system design, and predicting emerging educational challenges, traditional experimental methods are often limited by insufficient data; in this context, the profound professional knowledge and insightful perspectives of subject matter experts can provide valuable judgment and analytical basis (Branscum, Sallee, Allen, & Baker, 2020). The Delphi method provides a structured approach that brings together the collective experience and subjective evaluations of multiple experts, promoting consensus while minimizing interpersonal bias and group influence.(Dalkey & Helmer, 1963).

Research Objective 2: Develop interactive animations for children's sex education

A three-dimensional instructional design framework was constructed, with constructivism (scaffolded instruction) at its core, the ARCS motivational model(Keller, 1987) as its driving force, and situated cognition theory as its scenario carrier. Based on classical theories and relevant international research findings in recent years(Brown, Collins, & Duguid, 1989), this framework integrates tiered knowledge scaffolding, light gamification design based on the ARCS model, and immersive interaction in life-like scenarios. It aims to achieve the dual goals of sex education knowledge delivery and the cultivation of children's self-protection abilities, making the interactive animation both educational and highly interactive and fun.

Research Objective 3: The Impact of Assessional Educational Interactive Animations on Academic Performance

A true experimental design was used to evaluate the impact of evaluative interactive educational animations on children's learning outcomes. Participants were randomly assigned to either the experimental group (interactive animation) or the control group (traditional animation), and the knowledge scores of the two groups were compared after the intervention.

Research Objective 4: Exploring children's views on interactive sex education animations.
A quasi-experimental single-group pre- and post-test design was adopted, with the Child Behavior Checklist (CBCL) as the main measurement tool to record changes in children's behavior and attitudes before and after the intervention.

Research Location
This research was conducted at Tongxin Primary School in Xinle City, Hebei Province. The selection of the research samples and the implementation of the experimental intervention were all carried out at this school.

Research Sample
i. To determine the teaching methods preferred by experts, purposive sampling was used to select 10 experienced education experts in the fields of sexual health and child education to participate in a Delphi method questionnaire survey.
ii. Animation development relied primarily on theoretical frameworks and existing literature, rather than directly recruiting participants.
iii. To assess learning effectiveness, purposive sampling was used to randomly assign 30 children aged 6–8 years to an interactive animation group and 30 children to a traditional animation group.
iv. Using random sampling, 120 children were selected, and their views on interactive sex education animation were measured using the Child Behavior Checklist (CBCL) before and after the intervention.

Research Instruments
i. The primary tool used in this study was the Child Behavior Checklist (CBCL), combined with observation as a source of qualitative data. This checklist is designed as a general tool for assessing children's behavioral and emotional problems and ability levels. It is a multi-dimensional assessment tool capable of integrating data from multiple sources (i.e., data provided by children, parents, and teachers) (Achenbach & Edelbrock, 1991)to observe, record, and compare changes in 6- to 8-year-old children before and after sex education training.

ii. In the Delphi method study targeting research Objective 1, the Likert scale questionnaire was used to collect opinions from experts in the field of education.

iii. Learning Performance Test: This test objectively measures learners' academic performance. The test consists of three questions: identify the private parts in the picture, identify the bad guy in the picture (but don't tell anyone), and so on. The scoring criteria for the learning performance test are based on the actual situation of this study and are determined according to the Yuqing (2024)scoring criteria: 4 points for all correct answers; 3 points for correct answers after a second selection; 2 points for correct answers after a third revision; 1 point for correct answers after rewatching the animation; and 0 points for incorrect answers or unselected answers after rewatching the animation.(Yuqing, 2024)

Date Collection and Analysis

In this study, a phased and multi-method strategy was adopted for data collection based on different research objectives: For research objective 1, multiple rounds of Likert scale questionnaires were distributed to 10 invited educational experts to collect their opinions on the feasibility of different teaching methods; for research objective 3, data collection was completed by comparing the learning outcomes of the experimental group (interactive animation intervention) and the control group (traditional non-interactive animation intervention) after the intervention.

For research objective 4, data collection was conducted using the Child Behavior Checklist (CBCL), with a pretest implemented before the project design and a posttest conducted after the completion and implementation of the project training; inspection records were completed by researchers or assistant teachers to ensure the authenticity and objectivity of the data. Meanwhile, observational methods were integrated to record children's performance during the intervention process, which served as qualitative data to supplement the research results.

In the data analysis phase, SPSS 25.0 statistical software was used to analyze and process the quantitative data collected after the animation test in the study; meanwhile, various types of quantitative data (such as questionnaire data, learning outcome data, and CBCL scores) were sorted out and statistically analyzed to explore the differences and correlations between variables. Qualitative data (such as observational records and experts' subjective opinions) were coded and analyzed to deeply interpret the research phenomena. Finally, a comprehensive and systematic research conclusion was formed by integrating the results of quantitative and qualitative analyses.

Through the achievement of the aforementioned research objectives, this study aims to improve Chinese children's cognitive level of sexual education and their self-protection abilities, provide strong support for the prevention of child sexual abuse, and meanwhile offer solid theoretical references and feasible practical paradigms for the exploration of new teaching methods and the improvement of the teaching practice system in the field of Chinese children's sexual education.

Results

Research objective 1

Research objective 1 focused on investigating experts' opinions on which current teaching methods are more suitable for imparting sexual knowledge to children. To address this research objective a combined research method of the Delphi method and fuzzy theory was adopted.

As a standardized anonymous expert consultation method, the Delphi method organizes experts in relevant fields to express independent opinions through multiple rounds of consultation, gradually converges and forms expert consensus, which can effectively integrate experts' experience and professional cognition. Fuzzy theory, further improved by Zadeh in 2023 (Zadeh, 2023), its core logic is consistent with the decision-making thinking mode of human beings when facing fuzzy and non-digital information. It can scientifically solve research objective on the basis of comprehensively integrating all available research

data and considering various types of fuzzy information, effectively making up for the limitations of traditional quantitative methods in dealing with uncertain information.

Table 1 presents the results of the expert questionnaire survey conducted for this research objective. The respondents of this questionnaire were 10 senior experts in the field of children's sexual education and related fields, and the survey data provided basic support for subsequent research and analysis.

Table1
Summary of expert answers

Expert	Picture Books	Games	Traditional Teaching	Interactive Animation
1	3	4	5	2
2	3	5	4	2
3	3	4	5	2
4	5	2	4	2
5	3	4	5	3
6	4	3	5	3
7	3	5	3	4
8	3	4	4	3
9	3	4	5	3
10	1	5	4	3

The expert's answer will then be transformed using fuzzy theory, based on the corresponding fuzzy map in Table 2, to obtain Table 3

Table2
Associated Fuzzy Scale

FUZZY likert				
Very Unsatisfied	1	0	0	0.2
Unsatisfied	2	0	0.2	0.4
Neutral	3	0.2	0.4	0.6
Satisfied	4	0.4	0.6	0.8
Very Satisfied	5	0.6	0.8	1

Table 3
Convert the experts' answers into vague numbers

Expert	Picture Books			Games			Traditional Teaching			Interactive Animation		
	A	B	C	A	B	C	A	B	C	A	B	C
1	0.2	0.4	0.6	0.4	0.6	0.8	0.6	0.8	1	0	0.2	0.4
2	0.2	0.4	0.6	0.6	0.8	1	0.4	0.6	0.8	0	0.2	0.4
3	0.2	0.4	0.6	0.4	0.6	0.8	0.6	0.8	1	0	0.2	0.4
4	0.6	0.8	1	0	0.2	0.4	0.4	0.6	0.8	0	0.2	0.4
5	0.2	0.4	0.6	0.4	0.6	0.8	0.6	0.8	1	0.2	0.4	0.6
6	0.4	0.6	0.8	0.2	0.4	0.6	0.6	0.8	1	0.2	0.4	0.6
7	0.2	0.4	0.6	0.6	0.8	1	0.2	0.4	0.6	0.4	0.6	0.8
8	0.2	0.4	0.6	0.4	0.6	0.8	0.4	0.6	0.8	0.2	0.4	0.6
9	0.2	0.4	0.6	0.4	0.6	0.8	0.6	0.8	1	0.2	0.4	0.6
10	0	0	0.2	0.6	0.8	1	0.4	0.6	0.8	0.2	0.4	0.6

In Table 3, each of the three columns can be combined into a single column by using the square function for each set of A, B, and C values. Specifically, take the first expert value for Picture Books, where the values for A, B, and C are 0.2, 0.4, and 0.6, respectively. These values will be computed and converted to a final value by using the formula: once this value has been obtained, the average and the total average are computed by column, as shown in Table 4. If the difference between the average distance in a column and the experts' assessment is less than or equal to the threshold of 0.2, consensus is considered reached. Next, the percentage satisfied in each group is calculated and the average function is applied to calculate the total percentage for all groups.

Table 4 represents the calculated mean difference in fuzzy values. As shown in Figure 5, these values are acceptable when the average group consensus is greater than 85%, as in the case of Picture Books and Interactive Animation.

Table 4

Mean Difference of Calculated Fuzzy Value

| Expert	Picture Books	Games	Traditional Teaching	Interactive Animation
1	0.061	0.153	0.087	0.153
2	0.244	0.153	0.345	0.153
3	0.061	0.153	0.234	0.153
4	0.061	0.228	0.083	0.153
5	0.061	0.153	0.345	0.458
6	0.061	0.153	0.841	0.153
7	0.061	0.228	0.081	0.153
8	0.061	0.153	0.237	0.153
9	0.061	0.228	0.081	0.153
10	0.061	0.153	0.345	0.153
Aveagre	0.0793	0.1755	0.2679	0.1835
Accept each item has dK=0.2	Accepted	Accepted	Rejected	Accepted
Percentage of Each Item d<=02	90%	90%	90%	60%
percentage	85%			
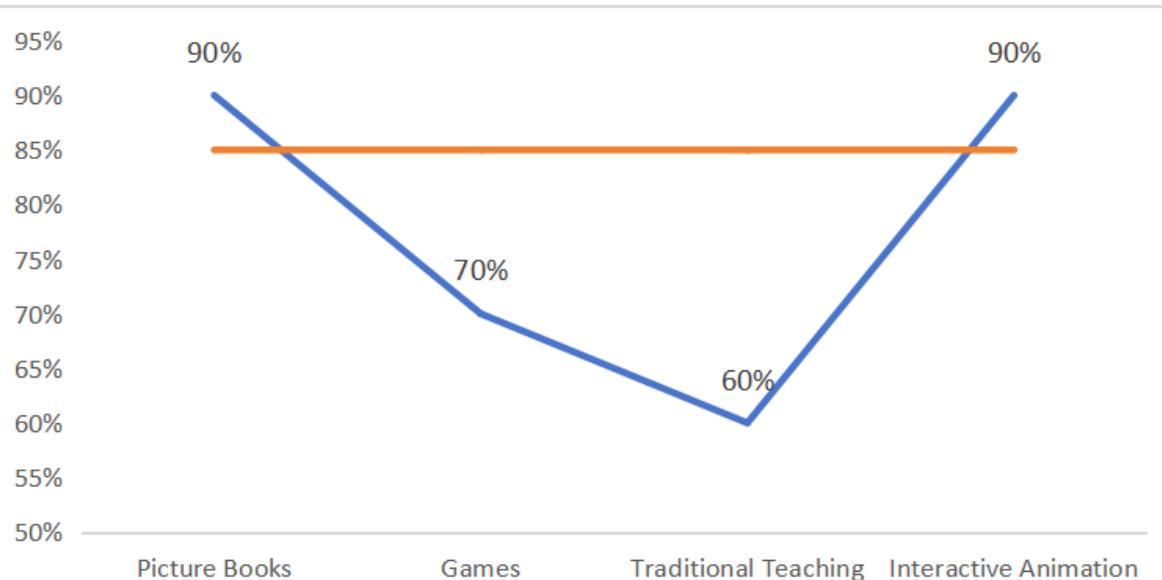
Figure 5.Plotted Graph of Final Result's Fuzzy Theory Validation

Next, we need to calculate a value that can represent the distance between the average fuzzy view and the expert view, the threshold d value. This requires the calculation of a decision based on this d-value.

This parameter is acceptable if the d value is less than the threshold of 0.2; This parameter needs to be rejected if the d value is greater than the 0.2 threshold. According to Figure 6, the categories that obtained a score threshold of less than 0.2 are:Picture Books、 Games and Interactive Animation. Thus the parameters of these categories proved to be valid and these three pedagogical methods can be shown to be viable pedagogical methods when teaching sex education to children. However, since the score for Traditional Teaching exceeded the threshold of 0.2, the parameters associated with this category were considered invalid and a non-adopted teaching method when teaching child sexuality.
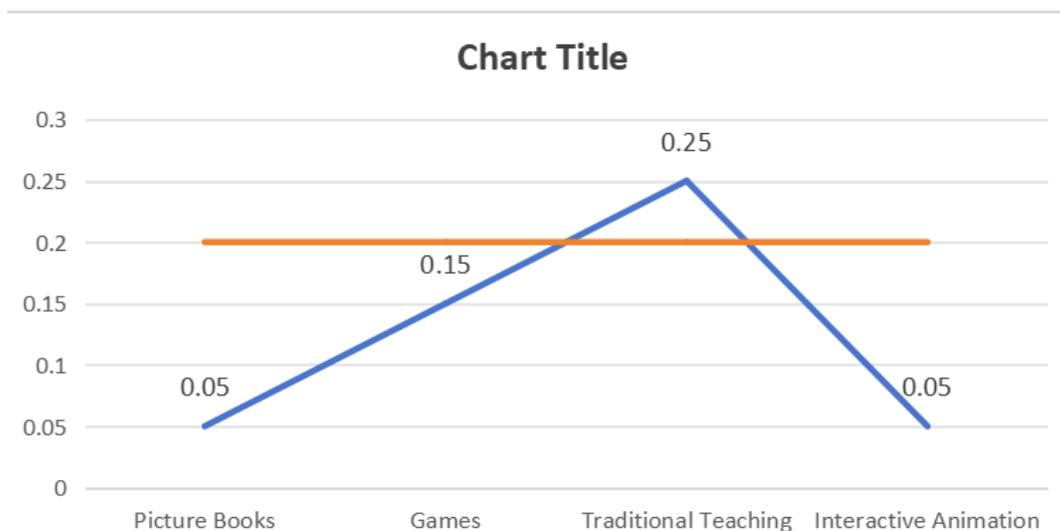
Figure 6.Plotted Graph of Threshold Value for Each Category

Research objective 3
The purpose of research objective 3 is to determine the impact of the interactive educational animation on children's academic performance in sexual education. To address this research objective, a purposeful sampling method was adopted for sample selection and investigation.

It should be noted that there are 50 students in each first-grade class. We purposefully selected two classes and used the following formula (Krejcie & Morgan, 1970) to calculate the sample size. By setting the parameters as p = 0.5 (estimated proportion), x = 1.96 (the critical value of the 95% confidence interval), and ME = 0.05 (margin of error), these values were substituted into the formula for calculation. Based on the calculation results, 30 students were selected from the intervention class with interactive animation and 30 students from the non-intervention class with interactive animation as the participants of this study.

Sample Size Formula:

$$n = \frac{X^2 \cdot N \cdot P \cdot (1 - P)}{(ME^2 \cdot (N - 1)) + (X^2 \cdot P \cdot (1 - P))}$$

Where:

- n = sample size

- X^2 = Chi-square for the specified confidence level at 1 degree of freedom

- N = Population Size

- P = population proportion (0.50 in this table)

- ME = desired Margin of Error (expressed as a proportion)

Table 7
Results analysed by t-test

	groups(Mean±standard deviation)		*t*	*p*
	Interactive animation(n=30)	animation(n=30)		
Question 1(fractions)	3.86±0.48	2.99±1.32	3.446	0.001**
Question 2(fractions)	3.81±0.32	2.85±1.09	5.383	0.000**
Question 3(fractions)	3.75±0.46	2.46±1.47	5.171	0.000**

*p<0.05 ** p<0.01

According to Table 7, the t-test (all known as independent samples t-test) was utilized to study the variability of the groups for question 1 (scores), question 2 (scores), and question 3 (scores) for a total of three items, and it can be seen from the table that: the samples of the different groups for question 1 (scores), question 2 (scores), and question 3 (scores) all showed significance (p<0.05), which implies that the samples of the different groups for Question 1 (scores), Question 2 (scores), Question 3 (scores) all have differences.Specific analysis can be seen:

Groups presented a 0.01 level of significance (t=3.443, p=0.001) for question 1 (scores), as well as a specific comparison of the differences to show that the mean of the interactive animation (3.83), would be significantly higher than the mean of the animation (2.97).
Groups presented a 0.01 level of significance (t=5.375, p=0.000) for question 2 (scores), as well as a specific comparison of the differences to show that the mean of the interactive animation (3.87), would be significantly higher than the mean of the animation (2.80).
Groups presented a 0.01 level of significance (t=5.162, p=0.000) for question 3 (scores), as well as a specific comparison of the differences to show that the mean of the interactive animation (3.80), would be significantly higher than the mean of the animation (2.40).
To summarize, it can be seen that the different groups of samples show significant differences for all questions 1 (scores), 2 (scores), and 3 (scores). Therefore, there are significant differences in the learning outcomes of sexual education between the interactive animation group and the traditional animation group. The application of interactive animations in children's sexual education can have a positive and beneficial impact on children's academic performance in sexual education.

Research objective 4
Research objective 4 In order to demonstrate that interactive animation is more effective in raising children's awareness of sex education.

In this study, McNemar's test was conducted using SPSS 25.0 on the pre-test and post-test results of the "gender roles" dimension of the behavioral test form to assess the changes in this dimension before and after the gender roles course. The results are shown in Table 8 and 9.

Table 8

Pre- and post-test cross-tabulations (gender roles)

| title | name | Group(%) | | total |
		pre-test	post-test	
options	no	29(48.33)	0(0.00)	29(24.17)
	yes	31(51.67)	60(100.00)	91(75.83)
total		60	60	120

Table 9

McNemar's test for pre and post-tests(Gender roles)

item	name	value
Group*Options(2*2)	Person chi-square	38.242(p=0.000**)
	Continuous correction of Yates chi-square	35.650(p=0.000**)
	likelihood ratio chi-square	49.607(p=0.000**)
	Cnt	4
	n	120
	Degrees of freedom values	1

 *p<0.05**p<0.01

The above table shows that the chi-square value of the pre- and post-tests is 49.67 and the level of significance is 0.000, which is less than 0.05, so there is a significant difference between the results of the pre- and post-tests. Specifically, 29 of the children who chose "No" in the pre-test chose "Yes" in the post-test, which indicates that there was a significant change in the children's choices after the gender roles program.

 In addition, McNemar's test was performed on the pre-test and post-test results of the "Sexual Physiology" dimension of the behavioral checklist to assess the changes in this dimension before and after the sex physiology course. The results are shown in Table 10 and 11.

Figure10.Pre- and post-test cross-tabulations (sexual physiology)

| title | Name | Group(%) | | total |
		pre-test	post-test	
options	no	42(70.00)	6(10.00)	48(40.00)
	yes	18(30.00)	54(90.00)	72(60.00)
total		60	60	120

Table 11

Pre- and post-test McNemar test (sexual physiology)

item	name	value
Group*Options(2*2)	Pearson chi-square	45.000(p=0.000**)
	Continuously corrected Yates cardinality	42.535(p=0.000**)
	likelihood ratio chi-square	49.209(p=0.000**)
	Cnt	4
	n	120
	Degrees of freedom df values	1

 *p<0.05**p<0.01

The above figure shows that the chi-square value of the pre and post-tests is 49.209 and the level of significance is 0.000, which is less than 0.05, so there is a significant difference between the results of the pre and post-tests. This is evident from the fact that 36 of the children who chose "No" in the pre-test chose "Yes" in the post-test, which shows that there is a significant change in the choice of the children after the Sexual Physiology Program.

Finally, the pre-test and post-test results of the "Love and Affection" dimension of the behavioral scale were performed using the McNemar test to assess the changes in this dimension before and after the "Love and Affection" course. The results are shown in Table 12 and 13.

Table12
Pre-and Post-Cross-tabulationgs(Love and Emotion)

| title | name | Group(%) | | total |
		pre-test	post-test	
options	no	20(33.33)	1(1.67)	21(17.50)
	yes	40(66.67)	59(98.33)	99(82.50)
total		60	60	120

Table 13
Pre- and Post-test McNemar Test (Love and Emotion)

item	name	value
	Pearson chi-square	20.837(p=0.000**)
	Continuously corrected Yates cardinality	18.701(p=0.000**)
Group*Options(2*2)	likelihood ratio chi-square	24.741(p=0.000**)
	Cnt	4
	n	120
	Degrees of freedom df values	1
*p<0.05**p<0.01		

As can be seen from the above figure, the chi-square value of the pre and post-tests is 24.741 and the significance level is 0.000, which is less than 0.05, so there is a significant difference between the results of the pre and post-tests. Specifically, 19 of the children who chose "No" in the pre-test chose "Yes" in the post-test, which indicates that there is a significant change in the children's choices after the Love and Emotion Program.

Conclusion
This study, targeting Chinese children aged 6-8, investigated the application of interactive animation in children's sex education against the backdrop of frequent child sexual abuse and the inadequacy of traditional sex education methods. A mixed-method approach was employed to explore this application. The study found that experts, using the Delphi method and fuzzy theory analysis, highly recognized the feasibility of interactive animation as a medium for children's sex education, believing it to be more suitable for the cognitive characteristics of digital native children than traditional teaching methods and to effectively convey sex education knowledge. A randomized controlled trial demonstrated that interactive animation developed based on relevant theories such as constructivist learning theory, the ARCS motivation model, and situated cognition theory showed significant effects. Children in the experimental group scored higher than those in the control group on post-

tests in the knowledge dimension, and showed significant improvements in core dimensions such as gender role cognition, sexual physiology knowledge, and emotional understanding. Children's behavior scales and observational methods showed that interactive animation is popular among 6-8 year old children, improves learning attention, and has a dual promoting effect on children's sex education cognition and behavior.

This study has both theoretical and practical significance. Theoretically, it fills a gap in research on interactive animated sex education for children aged 6-8, and expands the interdisciplinary application of relevant theories in the design of sex education media for young children. Practically, it provides a basis for optimizing children's sex education policies and curricula, helps improve the effectiveness of educational practices, and can serve as an auxiliary tool for home-school collaboration in sex education, addressing the problem of uneven distribution of sex education resources. However, the study also has certain limitations. It was conducted only in one primary school in Hebei Province, the sample area is limited, and it does not cover children of different age groups, so the generalizability of the conclusions needs to be verified. In addition, there is a lack of long-term follow-up data, making it difficult to assess the long-term impact of interactive animation on children's sex education cognition and behavioral transformation. In actual educational scenarios, there are many confounding variables that may affect learning outcomes, requiring more rigorous design to eliminate interference. Future research could expand into areas such as the needs and adaptability of children of different ages (3-5 years, 9-12 years) and cultural backgrounds (urban and rural areas, ethnic minority areas, etc.) to interactive animated sex education; developing more immersive interactive animations using VR, AI, and other technologies; exploring parent-child collaborative use models; and conducting multi-province pilot studies to optimize animation content and teaching processes, promote the inclusion of interactive animations in national sex education curriculum standards, and improve the child sexual abuse prevention system.

Ethics Approval and Consent to Participate
This study strictly adhered to all ethical procedures involving human participants. All participants signed informed consent forms, their identities were kept confidential, and all responses were handled with strict confidentiality. Furthermore, they were informed that the study carried low risk and that they could withdraw from participation at any time without any consequences.

Conflict of Interests
The authors declare no conflict of Interest.

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