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The Effects of Situational Teaching Method on the Achievement and Interest of Lower Primary School Students in Mathematics

[1]Zuo Ruijia, [2]Othman Talib, [3]Nur Aimi Nasuha binti Burhanuddin, [4]Li Wenling

[1, 3, 4]Department of Foundations of Education, [2]Department of Science and Technical Education, Faculty of Educational Studies, Universiti Putra Malaysia
43400 Serdang, Malaysia
Email: [1]zuoruijiasylvia@gmail.com, [2]otalib@upm.edu.my, [3]aiminasuha@upm.edu.my, [4]gs58941@student.upm.edu.my

Abstract

The Situational Teaching Method is a teaching method in which teachers purposefully create emotionally rich, vivid and concrete scenes to induce students' attitudinal experiences and help them understand the material. Its core lies in stimulating students' emotions. In this study, sixty second grade elementary school students in a city in southwest China were used as subjects to investigate the effects of situational teaching method on mathematics achievement and interest in mathematics learning. The results of the quasi-experiment revealed that the situational approach can significantly improve students' mathematics achievement and learning interest compared with traditional teaching methods. In the follow-up study, we should pay attention to the design and give full play to the role of the situational teaching method by combining the students' characteristics, the important and difficult points of the teaching materials, and the classroom and school environment in order to improve the students' learning interest and performance.

Keywords: Situational Teaching Method, Mathematics Achievement, Interest in Learning

Introduction

The Programme for International Student Assessment (PISA) proposes to examine students' mathematical abilities in four domains: mathematical skills, mathematical concepts, mathematical curriculum factors, and mathematical situation (Almarashdi & Jarrah, 2022; OECD, 2000). One of these domains is the ability to use mathematical knowledge to deal with mathematical problems in a variety of life situations. Therefore, through mathematics teaching and learning, students can learn to solve problems independently, learn to cooperate and communicate, so that they can continuously improve themselves is the urgent need of the times. The Curriculum Standards for Compulsory Education in Mathematics (2022 Edition) released by the Ministry of Education in China states that, in order to meet the needs of the times for talent training, the mathematics curriculum should pay special attention to the cultivation of students' innovative spirit and practical skills. At the same time, teachers are required to create mathematical situations based on students' existing life experiences.Close to the students' life reality, in line with the students' cognitive level, closely around the content of the teaching materials. Guide students to think independently, explore actively and communicate cooperatively in mathematical situations, so that they can master mathematical knowledge firmly on the basis of understanding (Huang, 2021).

Problem Statement

The mathematics content students learn is closely related to real life, and teachers need to teach on the basis of students' existing knowledge and experience in order to stimulate students' interest (McTighe & Brown, 2005). As a teaching method, it takes more time and effort to implement situational teaching. Although situational teaching has made progress at the theoretical level, there are many drawbacks in the practice processes (Fan & Zhao, 2020). Some teachers ignore the core feature that students are the objects of all educational activities, just let students listen to lectures, do not know their dominant position, classroom discipline is chaotic and scattered, and the overall classroom teaching efficiency is not high; some teachers create teaching situations limited to the form, do not focus on things that interest students (Zuo, 2020), do not carry out real emotional communication with students between the heart and the mind (Li, 2015), the created situations are hard, obscure and difficult to understand, and the situations created are hard, obscure, and detached from real life, so that students cannot connect the teaching situations with their lives (Hakim et al., 2020) .

Moreover, in actual teaching, some teachers still prefer the traditional open-ended teaching, in which new knowledge is imparted to students in the form of indoctrination, and then students are asked to do a lot of exercises to consolidate it (Wu, 2020). This way of teaching can help students consolidate their knowledge, but students' thinking skills are not developed, and they cannot find and solve mathematical problems through independent thinking (Yolanda, 2019).

As an important part of China's compulsory education mathematics curriculum, graphics and geometry can help students enhance their spatial concepts and application awareness, help them understand the characteristics of translation, rotation and axisymmetry, experience the changes and changes of shapes before and after movement, feel the beauty of mathematics, and gradually form spatial concepts and geometric intuition. The introduction of situational teaching method into elementary school mathematics graphics and geometry curriculum can reflect the living, situational and practical nature of teaching, and at the same time can reflect the process of teaching and the subjectivity of students (Gainsburg, 2008). Therefore, it is worth studying to introduce situations into the graphing and geometry classroom to help students form spatial concepts and awareness.

Literature Review

Concepts related to Situational Teaching Method

In China, situational teaching began with Li Jilin's practice of teaching Chinese in situation in 1978. According to Jilin Li, situational teaching is a teaching method that combines emotional activities with cognitive activities, aims to attract students' attention and sustained focus, and creates situations related to helping students develop their cognitive abilities so as to stimulate their feelings (Brown et al., 1989; Li, 2018; Wang, 2004). It has been widely used in the fields of medicine, programming, and multimedia (Guo et al., 2022). Lee summarized the four core elements of situational learning: truth, beauty, feeling and thinking, emphasizing that situationalization is created by connecting the classroom to the real-life environment. The theory is regarded as an educational theory with local Chinese cultural characteristics. However, some Chinese psychologists translate it as "affective teaching" because it is more concerned with the emotional experience of the situation (Guo et al., 2022).

The situational approach can produce significantly better results. Modern brain science research shows that children in affluent environments have higher IQs, and situationalized approaches can meet the developmental needs of students as they move from novice learners to self-directed learners (Cobb & Bowers, 1999). Situational learning helps students stay interested in the classroom, feel happy, and increases their motivation. Realistic situations create deep-rooted and interconnected knowledge, promote active construction of knowledge by learners through interaction with the environment, and enhance students' problem-solving skills. Situational instruction also improves abstract logical thinking by creating purposeful situations with logical procedures and ideas that develop children's aesthetic sensibilities and abilities and correct their values (Yang & Ni, 2020).

Situational teaching is not only applicable to the teaching of primary mathematics, but also to other subjects and to primary education as a whole (Li, 1996). It is a teaching model created by teachers to stimulate students' motivation and interest in learning in response to the complexity of children's learning knowledge, the uncertainty of the learning process, the openness of the learning system, and the difficulty of learning to catalyze children's potential.

There is no major difference in the conceptual description of the situational teaching method among scholars, and the conceptual understanding of the situational teaching method basically revolves around the creation of context, students' emotional experience, and integration with real life (Chang, 2017). In this study, the impact of situational pedagogy on student achievement in lower elementary mathematics classrooms was investigated through a quasi-experimental design based on the content of graphs and geometry.

Concepts Related to Graphing and Geometry

The content of graphics and geometry accounts for a large proportion of the mathematics curriculum in compulsory education. It requires teachers to create contexts that are closely related to students' real life, that are spatially imaginative, that can help students imagine and abstract the actual objects described based on geometric figures, and that can express the spatial orientation of objects and their position relationships with each other through the contexts created by teachers. The content is chosen to be close to students' real life and their cognitive psychology, aiming to enable students to develop the key abilities and core literacies needed by future society. The main contents include: the recognition of shapes, the measurement of shapes, and the position and motion of shapes (Fang, 2019).

In the part of recognition of shapes, it is based on the common shapes in the real world that students are familiar with, respecting children's cognitive starting point, starting from three-dimensional shapes in the real world, then learning the corresponding flat shapes through abstraction, from three-dimensional to two-dimensional, and then re-learning three-dimensional shapes from the perspective of metrics.

The measurement part of graphs is highly valued because it is particularly close to productive life. The importance of measurement in the mathematics curriculum can be seen worldwide. "Sense of measurement" is also receiving more and more attention as an important key competency.

The content of position and motion of graphs, which is not very extensive, is becoming one of the main contents of elementary school mathematics in compulsory education, broadening the students' perspective on mathematics. On the one hand, they learn to use numbers to describe the position of points and accumulate experience for subsequent learning of coordinates; on the other hand, they introduce translation, rotation and axisymmetry of shapes and explore the characteristics of discovering the motion of shapes.

Research Design

Quasi-experimental Design

Before the experiment, 60 students from two classes in the second grade were selected as the experimental class by random sampling, using the class learning atmosphere and students' mathematical level as the selection criteria. Among them, 30 were in the control group and 30 were in the experimental group. In this study, the second grade students of elementary school in a city were selected as the subjects. The reason for choosing the second grade students as the subjects is that they are at the primary stage of learning graphing and geometry, and they are basically at the same level, so the intervention experiment can better identify the differences in their learning abilities and better analyze the effect of situational teaching method on the learning performance of graphing and geometry.

In order to verify the research questions proposed in this study, firstly, the research subjects were selected rationally by investigating the analysis of the final exam results of the previous semester, i.e., analyzing the differences between classes and the consistency of students' mathematical levels to ensure the homogeneity of the experimental and control groups. Secondly, there was a quasi-experimental session, in which the control group adopted the traditional teaching method and the experimental group adopted the situational teaching method, followed by an analysis of whether the use of different teaching methods produced certain differences in the learning performance of the control and experimental groups. The specific stages are shown in Fig.

Teaching Design

In the design of teaching activities, both groups were taught by the same teacher, using the same textbook and at the same teaching pace. The topic of study was the chapter of "Graphs and Geometry" on understanding translations and rotations.

Research Instruments

The instruments used in the study were an interest dimension assessment tool and an examination paper. The instrument was designed to assess interest in mathematics learning. The scale was divided into four dimensions: teacher, student, curriculum, and environment, and each dimension was divided into five rating levels (1-5). Its specific distribution of questions is shown in Table 1. The mathematics test questions were developed using a standardized and rigorous procedure based on the curriculum objectives and content of the "Compulsory Education Mathematics Curriculum Standards" published by the Chinese

Ministry of Education, and the classical measurement theory (CTT) and item response theory (IRT) were used to calculate the index parameters of the test papers (including the test questions) with the aim of testing students' graphical and geometric abilities(Du et al., 2020; Liang, 2016). The results showed that the mathematics questionnaire had good internal consistency (Cronbach's α = 0.823).

Table 1
Questionnaire item distribution

Teacher	Student	Curriculum	Environment
1	5	6	2
4	8	15	3
9	12	16	7
11	13	17	18
19	14		
	20		

Data Processing
This study mainly used SPSS26.0 statistical software for statistical analysis of the data, and independent sample t-test and paired sample t-test analysis were used for data processing, where group1 represents the control group and group2 represents the experimental group.

Data Analysis
Analysis 1: Is there any difference between the graphical and geometric scores of the two groups on the pre-test?

Before conducting the experiment, the graph and geometry scores of the two classes were tested, and the differences were analyzed by independent sample t-test. The results are shown in Table 2, t=-.102, P=0.919>0.05, indicating that there is no significant difference between the pre-test graph and geometry scores of the experimental and control classes, indicating that the pre-test scores of the two classes are at a comparable level.

Table 2
Pre-test scores of the two groups

	group	N	Mean	Std. Deviation	t	Sig.
pre-test	1	30	60.27	14.083	-.102	0.919
	2	30	60.63	13.870		

Analysis 2: Is the score in the post-test scores of the two groups had improved?

After conducting the experiment, the math scores of the two groups were tested, and the differences were analyzed by independent samples t-test, and the results are shown in Table 3, t=-5.324, p<0.001, indicating that there is a significant and significant difference between the posttest math scores of the experimental and control groups, indicating that the posttest math scores of the experimental group group were significantly better than the posttest math scores of the control group.

Table 3
Post-test scores of the two groups

	group	N	Mean	Std. Deviation	t	Sig.(2-tailed)
post-test	1	30	67.67	10.397	-5.324	.000
	2	30	81.10	9.106		

Analysis 3: What is the differences in the experimental group's scores on the two pre- and post-tests, and did the scores improve significantly after teaching the situational approach?
The pre-test and post-test graphing and geometry math scores of the experimental group were tested, and the differences were analyzed by paired t-test. The results are shown in Table 4, t=-8.635, p<0.001, indicating that there is a significant and significant difference between the pre-test and post-test graphing and geometry scores of the experimental group, indicating that the post-test scores of the experimental group are significantly better than the pre-test.

Table 4
Pre- and post-test scores of the experimental group

	Mean	N	Std. Deviation	t	Sig.(2-tailed)
Pair 1	pre-test	60.63	30	-8.635	.000
	post-test	81.10	30		

Analysis 4: What is the difference in learning interest in graphing and geometry between the control and experimental groups in the pretest?
Before the experiment, the learning interest of the two groups was tested, the test was conducted from the four dimensions of the questionnaire and the differences were analyzed by independent samples t-test, the results are shown in Table 5, on the teacher factor, t=-.752, p=.4550.890>0.05, on the student factor, t=-.527, p=0.570>0.05, on the curriculum factor, t=.094 p=.925>0.05, and on environmental factors, t=-.470, p=.640>0.05,The above results indicate that there is no significant difference between the experimental and control groups in all four dimensions of the pretest, indicating that the pretest learning interests of the two groups are comparable.

Table 5
Differences in learning interest between the two groups on the pretest

	Group	N	Mean	Std. Deviation	t	Sig.(2-tailed)
Teacher Factor 1	1	30	2.9889	1.11841	-.752	.455
	2		3.2056	1.11476		
Student Factor 1	1		2.1278	.79351	-.527	.570
	2		2.2556	.93129		
Curriculum Factor 1	1		2.3500	.90877	.094	.925
	2		2.3250	1.13364		
Environmental Factor 1	1		2.4750	.85185	-.470	.640
	2		2.5833	.93157		

Analysis 5: Is there a difference between the pretest and posttest mathematics learning interest of the experimental group group?

The pretest and posttest mathematics learning interests of the experimental group group were tested and the differences were analyzed by paired t-test, where teacher factor 1 implies the pretest of the experimental group group teacher factor dimension, teacher factor 2 indicates the posttest of the experimental group teacher factor dimension, and so on for the remaining three dimensions. The results are shown in Table 6, in teacher factor, t=-2.65, p=.013>0.05, in student factor, t=-4.68, p=<0.05, in curriculum factor, t=-3.92, p<0.05, in environment factor, t=-3.66, p<0.05,The above results indicate that there are significant experimental group in student, curriculum and environment factors The above results indicate that there are significant differences between the experimental groups on the student, curriculum and environmental factors, while the differences on the teacher factors are not significant.

Table 6
Motivation analysis of the experimental group on pre-test and post-test

		Mean	N	Std. Deviation	t	Sig. (2 tailed)
Pair 1	Teacher Factor 1	3.2056	30	1.11476	-2.65	.013
	Teacher Factor 2	3.9500		.91722		
Pair 2	Student Factor 1	2.2556		.93129	-4.68	.000
	Student Factor 2	3.5833		1.08167		
Pair 3	Curriculum Factor 1	2.3250		1.13364	-3.92	.000
	Curriculum Factor 2	3.4750		1.00291		
Pair 4	Environmental Factor 1	2.5833		.93157	-3.66	.001
	Environmental Factor 2	3.3583		.94842		

Findings and Implications

The quasi-experimental study found that the use of situational teaching methods can help students improve their performance in mathematics and stimulate their interest in learning. The results of the pre- and post-tests in the experimental group showed that the situational approach relied more on students' own factors, course content, and environmental factors, and less on teachers' requirements and reliance in enhancing students' interest in learning, which indicates that teachers' use of the situational approach is reasonable and welcomed by students.

There are still many teachers who use only traditional lecture methods to help students learn mathematics. However, the abstract and complex nature of mathematical knowledge, as well as the standards of the compulsory mathematics curriculum, require that students should have the ability to think creatively and critically independently, to apply what they have learned in the classroom to real-life situations, and to identify and solve problems in real-life situations. Therefore, the use of situational teaching methods undoubtedly meets this characteristic and requirement. Therefore, to enhance students' learning interest and performance, designing interesting teaching situations that meet the characteristics is a direct way.

The following recommendations are made through the previous analysis
Teachers need to put more attention on students, listen to them, understand them, take into account each student's cognitive ability, thinking level, personality traits, learning interests, etc., and understand students' needs at each stage. Only by understanding students' needs well enough and creating situations by using things that students enjoy, the classroom atmosphere and teaching effect will be better and the communication between teachers and students will be smoother (Zuo, 2020). For example, teachers can choose to play games and role-play when creating situations according to students' playful and active characteristics, so that students can experience and feel the mystery and fun of mathematical knowledge in the process of creating situations by themselves, which not only makes students' needs and characteristics satisfied, but also greatly enhances their desire and interest to explore, achieving twice the effect with half the effort.

Secondly, teachers can collate the teaching design, courseware and teaching reflections of previous classes, combine their own teaching experience and textbook content, and summarize the situational teaching resources they have applied, and classify which situational teaching resources are more effective for different lesson types, students of different ages, and different textbook content respectively. Combining the characteristics of these resources and the new lesson content, in-depth analysis of the key points and difficulties of the teaching materials can stimulate students' interest in learning and students are more receptive. to form instructional management goals for student behavior improvement, habit formation, competency enhancement, and sustained growth.

Finally, school administrators can provide a resource sharing platform for teachers to unify and manage some props, pictures, teaching aids, books, and multimedia materials that may be used in the situational teaching method, providing teachers with multifaceted resources that are easy to use multiple times and save teachers' time and costs in preparing and designing instruction. Also can start from the campus environment where students learn and live every day, and provide students with rich situational resources by enriching campus culture, increasing vegetation in the campus, and changing the layout and pattern of classrooms. For example, you can display student drawings, stories of great celebrities, and profiles of world-renowned schools in the school hallways, hang colorful, fun, and cute student artwork from the ceiling of each floor, and plant colorful, shaped trees and plants on the campus. In addition, classrooms can be equipped with a book corner where students can check out a variety of books, and the walls outside the classroom can display students' handwritten books on a different theme each month. These are important resources that can help teachers use the surrounding environment to create a situation for students to enter the situation and understand the knowledge (Zuo, 2020).

Significance of the Study and Future Prospects
By analyzing the characteristics, use value and application effect of the situational teaching method, this study explores the aspects of the situational teaching method applied to the lower elementary mathematics classroom and the means of creating contexts, which can help front-line mathematics teachers to improve their teaching concepts, pay attention to the use

value of situational teaching and get rid of the boring and dull mathematics teaching mode. It seeks to carry out situational teaching in a form that is enjoyable to students in actual teaching, and ultimately achieve considerable educational goals. Secondly, this study helps teachers to use situational teaching method efficiently, enliven the classroom atmosphere, make students think independently in a relaxed and pleasant environment, motivation and so on can be mobilized effectively, which is conducive to strengthening the interaction between teachers and students and promoting the harmonious construction of teacher-student relationship. Finally, the situational teaching method is closely connected with students' real life, and students acquire new knowledge in familiar scenes to enhance their sense of learning achievement and learning interest.

Future researchers can take the following directions for further research. First, this study is to explore the effects of situational pedagogy on learning achievement and interest in the application of mathematical graphics and geometry in the second grade of elementary school, so that the study can be extended to other stages of elementary school or even middle and high school, and can cover the four aspects of the compulsory education curriculum standards that encourage students to explore, satisfy their curiosity, and enhance their motivation and learning achievement.

The second aspect is to consider the design of situational pedagogy. According to the findings of this study, teachers should focus on student, curriculum, and environmental factors when using situational pedagogy. Then, in future classrooms, students' characteristics and preferences can be fully considered by using multimedia technology, VR, and other modern information technologies that are pleasing and curious to students. In Mayer's (2002) words, many students prefer to learn through visuals. Therefore, attractive features such as colorful videos and interesting animations can save classroom time and can be used to stimulate students' interest in learning with their intuitive, convenient and time-space-breaking features.

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