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Study on the Application of Constructivism in Classroom Teaching to Promote Knowledge Construction

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Abstract: Constructivism theory advocates that learners actively construct knowledge through interaction and practice, which has received wide attention in modern education. However, in the actual classroom, teachers face problems such as task design complexity and increased cognitive burden when implementing the constructivist teaching strategies, which affects the teaching effect. This study aims to explore the effectiveness of constructivist strategies in promoting students' classroom knowledge construction and to fill the gap in the lack of specific operational guidance in existing research. Through semi-structured interviews with 10 middle school teachers. The results showed that strategies such as problem-driven learning and group collaboration significantly improved students' knowledge engagement and deep learning abilities. However, teachers take more time to design tasks and are difficult to meet the needs of heterogeneous students. This study presents recommendations to reduce faculty burden by developing support tools and optimizing task design, providing new insights into theory and practice. The conclusions can help to further improve the application of constructivist teaching and provide a direction for future educational research.

Keywords: Constructivism; Knowledge Construction; Classroom Teaching; Teachers' Burden; Qualitative Research.

1. Introduction

In the constructivism theory, learners are regarded as the subject of active knowledge construction, rather than simply the passive knowledge receiver. This theory emphasizes that learners can internalize and deeply understand their knowledge through their interactions with the environment, tasks, and society (Sharma et al., 2020). Recent studies continue to test this view. For example, recent research on social constructivism suggests that the process of knowledge construction requires active participation based on experience and reflection, while social interaction is crucial to the learning process (Kirschner et al., 2020; Smith et al., 2021). These studies show that social interaction not only promotes the sharing and integration of knowledge, but also can significantly improve the learning effects through the process of collaborative problem solving and common meaning construction.

Nevertheless, the traditional teacher-centered teaching model is still predominant. In this mode, teachers tend to instill knowledge, and students, as passive knowledge recipients, lack the initiative to participate in the learning process. This leads to a lack of critical thinking and knowledge building skills (Chen & Carless, 2021). In order to overcome the limitations of traditional teaching, constructivist strategies such as flipped classroom, project-driven learning, and group collaboration have gained increasing attention in recent years. Studies have shown that these strategies can not only improve students' academic performance, but also enhance their problem-solving and teamwork skills (Wu et al., 2022). For example, flipped classroom transfers knowledge transfer from classroom to extracurricular, and project-driven learning guides students to apply theoretical knowledge to practical situations through real tasks.

Although the theoretical and practical potential of constructivist strategies is widely recognized, teachers still face many challenges in practical application. First, the complexity and time cost of task design are high, especially for the teaching needs of heterogeneous student groups, and teachers need to invest a lot of energy in the design of different levels of activities (Lim et al., 2022). Second, teachers may lack adequate training and support tools when implementing these strategies, resulting in unsatisfactory teaching results (Jones & Kessler, 2023). For example, in a multicultural or resource-limited classroom environment, designing tasks that can adapt to all students' needs simultaneously can often seem inadequate. Teachers also spend additional time on task adjustment and evaluation, which further increases their cognitive burden (Hodges & Barbour, 2021).

In addition, the difference of the students themselves is also a big challenge. Some students may lack the necessary self-regulation ability to fully participate in knowledge building in constructivist classrooms. This makes it difficult to stabilize the effects of these strategies in the real classroom. For example, in group collaboration activities, students may conflict due to ability differences, which affects task performance (Tan et al., 2023). These problems hinder the widespread implementation of constructivist strategies, creating a significant gap between theoretical research and practical application.

In accordance with the United Nations Sustainable Development Goals (SDG 4), education should ensure inclusiveness and equity, and promote access to high-quality lifelong learning opportunities for all. This means that education should not only focus on the improvement of students' academic performance, but also focus on the cultivation of their social adaptability and knowledge building ability (UNESCO, 2021). However, the existing educational practices are not deeply explored enough in this

area, especially in addressing the problems of teacher cognitive burden, and the complexity of task design and student heterogeneity, and there is still a large gap in the research. Therefore, how to optimize the implementation process of the constructivist strategy to make it more efficient and adapt to the actual teaching environment has become an important direction of current research.

In view of the above problems, this study explores the practical application effect of constructivism strategies in the classroom from the perspective of teachers. Such research based on the experience of frontline teachers can not only reveal the advantages in the strategy implementation, but also help to identify the challenges they face. Different from previous student-centered quantitative studies, this study adopts qualitative research methods to analyze in-depth the application of problem-driven learning, group collaboration and other strategies in different classroom environments through semi-structured interviews with 10 middle school teachers (Chen & Carless, 2021).

Another innovation of this study is to explore the optimization of how to reduce the burden of teachers and improve the feasibility of strategy implementation by combining the cognitive load theory. Cognitive load theory emphasizes that learners' cognitive resources are limited, and excessive task complexity may lead to decreased learning effects (Kirschner et al., 2020). By applying this theory to teaching design, this study presents a series of specific optimization suggestions, such as phased task design, providing visualization tools to assist teaching. These suggestions not only help to improve the implementation efficiency of constructivist strategies, but also provide a new theoretical perspective for educational research (Jones & Kessler, 2023).

In conclusion, this study not only fills the gap in the current literature in the practical application of constructivist strategies, but also provides a valuable reference for future teaching design and policy making through practice-based research methods. The results will have a positive impact on improving students 'knowledge building ability and optimizing teachers' teaching practice, while contributing to the realization of quality education goals in the United Nations Sustainable Development Goals.

1.1. Research Objectives:

RO1: Explore the effectiveness of teachers implementing constructivist strategies promote knowledge construction in the classroom.

2. Literature Review

2.1. Theory Underpinning

Constructivism emphasizes that the learning of knowledge is a process of active construction, and learners gradually deepen their understanding of knowledge through personal experience, social interaction and reflection (Wu, Huang, & Liu, 2022). This theory is based on Piaget's cognitive development model, indicating that learners constantly build new knowledge structures through assimilation and adaptation (Kirschner, Sweller, & Clark, 2020). Vygotsky's "Area of Recent Development" (ZPD) theory further states that teachers and peers play a key supporting role in the process of knowledge construction. This dynamic support not only helps learners to improve their abilities, but also provides the necessary guidance for task completion (Tan, Lee, & Lim, 2023).

2.2. The Current Mainstream Constructivism Teaching Practice

In recent years, constructivism theory has been further developed in the field of educational technology. The researchers propose that constructivist strategies are particularly applicable to diverse, collaborative learning environments that can facilitate task design and learning resource allocation through technical support (Lim, Ho, & Chen, 2022). For example, in collaborative learning scenarios assisted by AI technology, constructivism has proved to significantly improve students' learning efficiency and knowledge construction level (Jones & Kessler, 2023). This provides.

more possibilities for the modern application of constructivism theory. Constructivism theory has spawned many innovative teaching strategies, with flipped classroom, Project-Based Learning (PBL) and group collaborative learning are the three most widely used methods in educational practice. These approaches emphasize promoting knowledge construction through real tasks, learner collaboration, and individualized reflection.

Flipped classroom is a strategy to move knowledge delivery to pre-class learning, and class time is used for group discussions and task solving. Studies have shown that this approach can effectively promote students' understanding of complex knowledge, while improving engagement and learning motivation (Wu et al., 2022). However, the effect of the flipped classroom relies on high-quality preclass resources and teacher classroom guidance, which may otherwise reduce efficiency due to inadequate student preparation (Hodges & Barbour, 2021).

Project-driven learning (PBL) places students in real-world task situations to complete specific projects through collaboration and independent inquiry. PBL can significantly improve students' problem-solving ability and teamwork awareness, while enhancing the depth of mastery of knowledge (Smith, Johnson, & Zhao, 2020). However, teachers need to pay special attention to the complexity of task design when implementing PBL to ensure that the heterogeneous needs of students can be taken into account (Lim et al., 2022).

Group collaborative learning emphasizes promoting the sharing and integration of knowledge through peer interaction. This approach is particularly suitable for highly heterogeneous classrooms, which can enrich the learning experience with a variety of perspectives (Jones & Kessler, 2023). However, studies have shown that the effects of collaborative learning may be influenced by ability differences and conflicts among group members, which puts higher requirements on teacher guidance and group management (Tan et al., 2023).

2.3. Research Gaps

Although constructivism strategy shows significant educational potential in teaching practice, its application still faces many unanswered challenges. For example, in the process of task design, teachers need to take into account students' ability differences and time constraints, and avoid limited learning effects caused by high cognitive load (Kirschner et al., 2020). In addition, most of the existing studies have focused on the implementation effect of a single

strategy, while less exploring multi-strategy integration and its practical application in specific teaching situations (Lim et al., 2022).

This study aims to fill this research gap and provide operationally teaching design suggestions by analyzing the experiences and challenges of middle school teachers applying constructivist strategies in practical teaching. By combining teacher practical experience and cognitive load theory, this study further explores how to optimize task design to reduce the difficulty of implementation and thus facilitate the effective application of strategies (Jones & Kessler, 2023).

At the same time, this study actively responds to the United Nations Sustainable Development Goals (SDG 4) and aims to improve students' learning adaptability and inclusiveness through optimizing educational practices. By providing faculty with support tools and optimization recommendations, this study provides both theoretical and practical references for constructivist educational innovation worldwide (UNESCO, 2021).

3. Method

This study uses a qualitative research approach to explore the application of constructivist strategies in secondary school teaching and its impact on teacher teaching practice. Qualitative methods can dig deep into teachers' personal experiences and perspectives and capture their challenges and effectiveness in the implementation of constructivist strategies (Snyder, 2019). Studies collect data through semi-structured interviews, which allow researchers to flexibly adjust questions to gain insight into teacher teaching practices, while providing space and opportunities for participants to express their true ideas (DeJonckheere & Vaughn, 2019). This design can reveal the implementation of constructivist strategies in different teaching backgrounds and provide strong support for the teaching reform in middle schools (Braun & Clarke, 2022).

3.1. Sampling and Participants

The target sampling method was used, which selected 10 middle school teachers, to ensure the pertinence of the study and the representativeness of the sample. These teachers come from three different middle schools, covering urban, suburban and rural schools, reflecting the characteristics of teaching practice under different educational backgrounds, and enhancing the applicability of the research conclusions (Patino & Ferreira, 2019). The research subjects have more than 3 years of teaching experience, and have tried constructivist teaching strategies in practical classroom, such as flipped classroom, group collaboration, and project-driven learning, which embody the core of constructivist teaching concepts (Mayer, 2020).

Teacher selection criteria include their acceptance of constructivist ideas and their practical experience in implementing relevant strategies (Van Es & Sherin, 2021). In addition, the subject background of the research subjects covers many fields, including Chinese, mathematics, English, physics and history, to ensure that the research can comprehensively examine the impact of constructivist strategies on teaching in different subjects (Bates, 2019). Through this diversified sample design, the research can deeply explore the applicability of constructivist teaching strategy in middle school education and its role in promoting students' learning effect, and provide a valuable reference basis for educational practice.

3.2. Research Tools

This study conducted in-depth interviews with participants through seven core open-ended questions. These questions aim to explore teachers' understanding of constructivist strategies, their implementation methods and the challenges they face. The specific problems are described below as follows:

1. How do you define and implement classroom knowledge building?
2. How are constructivist strategies (such as flipped classroom or collaborative learning) reflected in your teaching?
3. What are the main challenges you face when implementing constructivist strategies?
4. What do you think is the specific impact of the constructivist strategy on students' knowledge construction?
5. Do you have any suggestions on optimizing constructivism teaching?
6. How do you think teachers can overcome the problem of excessive cognitive burden in order to better implement constructivist strategies?
7. How do you evaluate the students' learning outcomes under the constructivist teaching model? What evaluation methods do you use?

Interviews lasted approximately 3-5 minutes for each participant and were recorded via recording equipment to ensure data integrity.

3.3. Data Collection Method

Data collection in this study combined face-to-face interviews and online communication to ensure flexibility and comprehensiveness of the data. Face-to-face interviews were conducted by the research team and fully recorded by the recording equipment, supplemented with detailed notes to ensure the accuracy and completeness of the information. Online interviews are done on the wechat (WeChat) platform, which provides participants with flexibility in time and place, and is especially suitable for data collection across regions. As a widely used communication tool, WeChat can realize natural, conversational communication and help to obtain participants' in-depth insights into the practice of constructivism teaching strategies (Carter et al., 2021). This dual collection method improves the diversity and representativeness of the research data, while making the research implementation more convenient.

3.4. Data Analysis Method

Data analysis uses thematic analysis (Thematic Analysis), designed to identify and analyze recurring themes in the data, to deeply understand the impact of constructivist strategies on teacher teaching practice (Braun & Clarke, 2022). The specific analysis steps are performed as follows:

1. Data transcription: All face-to-face interviews and online communication content are transcribed into text to ensure the integrity and availability of the data.
2. Preliminary coding: NVivo software was used to annotate key concepts and patterns related to the study objectives.
3. Theme extraction: Based on the coding results, the main themes related to the research question were extracted, and each theme was analyzed in depth.

4. Theoretical framework formation: based on the results of thematic analysis, the theoretical framework related to the practice of constructivist teaching strategies is summarized and constructed.

This approach is highly flexible and able to reveal rich insights from participants' narratives, making it particularly suited to explore the diversity of teacher practices and the challenges and outcomes in the strategy implementation process (Kiger &Varpio, 2020). The thematic analysis method also presents the potential meaning of the data through a systematic coding process, which provides clear theoretical support for the research.

3.5. Confidentiality and Ethical Considerations

Research strictly follows ethical norms. All participants signed an informed consent form before the study to clarify the purpose, process and its rights, including the right to withdraw at any time.

To protect the privacy of participants, all data were anonymized during the study, and participant names were expressed as codes (e. g., T1 and T2). Recording and interview transcripts are stored in encrypted hard drives and data will be properly destroyed after the study. Meanwhile, the study followed the regulations of the International Committee for Educational Ethics to ensure that the study design and implementation meet academic ethics standards.

4. Results

4.1. Participant Characteristics

The study participants came from three different subjects (Chinese, mathematics, science) and had different seniority backgrounds. The following table shows the basic characteristics of the participants:

Table 1. The basic characteristics of the participants

Participant ID	Gender	Teaching Experience Years	Subject	Class Size
T1	Female	6	Language	32
T2	Male	9	Mathematics	28
T3	Female	12	Science	35
T4	Male	15	Mathematics	30
T5	Female	8	Science	26
T6	Male	10	Language	29
T7	Female	7	Mathematics	32
T8	Male	11	Science	33
T9	Female	14	Language	28
T10	Male	13	Mathematics	27

4.2. Overview

Through the thematic analysis of the interview data of middle school teachers, this study explores the implementation effect of constructivist teaching strategies and its influence on teachers' teaching practice. The analysis revealed that the following main results were obtained:

1. Constructivist strategies (such as problem-driven learning and group collaboration) have shown remarkable results in promoting deep learning and active learning.
2. Teachers face multiple challenges in practical teaching, including the complexity of task design and increased cognitive load.
3. Teachers face multiple challenges in practical teaching, including the complexity of task design and increased cognitive load.

4.3. The Implementation Effect of the Constructivist Strategy

Several teachers said that constructivist strategies help improve learning outcomes and deep understanding by encouraging students to explore independently and learn collaboratively. For example, respondent 3 noted: *"By designing open tasks, students are able to actively explore questions and learn deeper."* In addition, group collaboration is outstanding in enhancing students' critical thinking and teamwork ability. Respondent 5 added: *" Group collaboration not only stimulates interaction among students, but also enables them to learn more by sharing insights."*

Some teachers emphasize that these strategies can combine theoretical knowledge with practical situations to help students to better understand and apply them. For example, respondent 7 said: *" Through task design in real-world situations, students can feel the practicality of knowledge more intuitively, thus increasing their interest in learning."*

Despite the effectiveness of constructivist strategies, designing open and appropriate for students' competence tasks remains a challenge. Respondent 8 noted: " *The balance between openness and difficulty is very difficult. Too complex a task will make students feel frustrated, while too simple cannot stimulate thinking."* Another teacher mentioned that to meet the learning needs of different students, they need to design diversified tasks and spend a lot of time and energy.

The implementation of the constructivist strategy puts forward higher demands on the teachers' cognitive load. Respondent 7 said: " *Multitasking often caused me to feel out of energy, such as having to design tasks, monitor students' progress and provide timely feedback.*" Similarly, respondent 4 said:" *Constructivist strategies increase teachers' work intensity in terms of classroom management and individual student instruction."*

4.4. Optimization Suggestions and Practical Reflection

To meet the challenges of task design, multiple teachers made suggestions. For example, respondent 10 proposed: " *Providing a structured task framework or demonstration task can reduce student confusion and improve the quality of task completion.*" In addition, respondent 2 emphasized the importance of teacher training:" *By strengthening their professional training, especially in terms of task design and student assessment, it can help teachers to implement constructivist strategies more efficiently."*

Several teachers suggested using technical tools to optimize teaching management. For example, a learning management system (LMS) can be used to track students' progress and provide automated feedback, thus reducing teacher workload. Respondent 1 said: " *Technical tools not only help students better manage their learning, but also save teachers time."*

Participants agreed that effective implementation of constructivist strategies required support from school management and input of resources, such as providing more teaching tools and time to support task design and feedback efforts.

The results of this study suggest that constructivist strategies have significant advantages in enhancing student learning effectiveness and classroom participation.

However, its implementation also faces many challenges, such as the complexity of task design and the increased cognitive load of teachers. By optimizing task design, strengthening teacher training and making rational use of technical tools, these problems can be effectively alleviated and the implementation effect of constructivist strategies can be further improved.

5. Discussion

5.1. RO1: Explore the Effectiveness of Teachers Implementing Constructivist Strategies Promote Knowledge Construction in the Classroom

Research found, especially its promotion to knowledge construction. The study found that strategies such as problem-driven learning (PBL) and group collaboration can significantly improve students' active learning and deep understanding, in line with the concept of "active learning" in constructivism theory. Participants agreed that these strategies helped students build a deeper knowledge framework while exploring the problem. This finding is consistent with the findings of Smith et al. (2020) on flipped classroom and collaborative learning, which further verifies the effectiveness of constructivist strategies.

However, there are also some challenges when implementing these strategies.

Teachers generally refer to the complexity of task design and the differentiated needs caused by student heterogeneity, making task design a difficult task. In addition, teachers need to deal with multiple tasks in the classroom, which leads to an increased cognitive burden. Especially in the real-time management of multi-task processing and student feedback, teachers often feel underenergy. These questions are consistent with the Johnson & Johnson (2019) discussion of teachers' cognitive load, reflecting that the complexity of instructional design is a major bottleneck in the implementation of constructivist strategies.

5.2. Research Significance and Practice Contribution

This study not only validates the positive impact of constructivist strategies on student knowledge building, but also reveals key barriers in its implementation and suggests improvements based on these challenges. First, in order to reduce the cognitive burden of teachers, the research suggests providing tools and templates for simplifying task design, so that teachers can focus more on guiding students' learning, rather than spending excessive time on the conception and modification of tasks (Merrill, 2021). Secondly, strengthening teacher training, especially in how to design and evaluate constructivist strategies, is the key to improving the quality of teaching implementation. Studies have shown that teachers can use constructivist strategies more effectively if they can receive sufficient support (Barker & Wendel, 2020).

These improvement recommendations have important practical implications. By optimizing task design and providing more systematic teacher support, teachers can implement constructivist strategies more confidently and efficiently, thus promoting the realization of deep learning among students (Schoenfeld, 2020). In addition, the combination of technical tools to assist task management and student progress tracking can also reduce the workload of teachers and enable them to focus more on the teaching itself (Cummings & Willoughby, 2022). Therefore, this study provides valuable theoretical and practical guidance on how to apply constructivist strategies in practical teaching, especially providing new perspectives in task design and faculty support.

6. Conclusion

This study explores the effectiveness of constructivist strategies in classroom teaching, especially in promoting knowledge building. The results show that constructivist strategies such as problem-driven learning and group collaboration are highly effective in improving students' active learning and promoting deep understanding.

However, teachers face challenges such as the complexity of task design, student heterogeneity, and their own cognitive burden when implementing these strategies, problems that hinder the comprehensive application of constructivist strategies.

Through this study, we found that optimizing task design and providing more support tools for teachers are key to addressing these questions. Simplifying task design, providing teaching templates, and strengthening teacher training will help reduce the cognitive burden of teachers and ensure the smooth implementation of teaching strategies. These suggestions provide valuable guidance for future educational practices, especially in how to effectively apply constructivist ideas to promote students' deep learning.

Overall, this study provides useful theoretical support and practical guidance for the application and optimization of constructivist strategies. Future educational reform should focus on the construction of teacher support system to ensure that they can smoothly implement constructivist teaching strategies in a complex teaching environment, to improve the learning effect of students.

7. Limitations and Future Studies

7.1. With Limitations

This study has some limitations, first, the sample size is small and limited to 10 teachers, which may lead to limitations in the universality of the findings. Although the respondents were from different subjects, they only covered secondary school teachers and therefore cannot fully represent teacher practice at all education stages. Second, this study collected data only through semi-structured interviews, failed to comprehensively cover all the challenges and details encountered in teachers' daily teaching, and probably failed to reveal certain potential problems and situations.

7.2. Future Research Direction

Future studies could expand the sample size to cover more educational stages and disciplines to validate the effectiveness of constructivist strategies in different contexts. Moreover, exploring how to support teachers' task design and reduce their cognitive burden will be an important research direction. For example, develop intelligent teaching tools or task design platforms to help teachers implement constructivist strategies more efficiently and assess their impact on teaching quality. In addition, future research can also explore the role of student feedback on the effect of constructivist strategies, and further improve the teaching model and teacher training system.

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