

The Application of Online Micro-lessons in High School Geography Education

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Abstract: This paper focuses on the application of online micro-lessons in high school geography education, examining their effectiveness in Shenzhen's high school geography classrooms. It is recommended to establish a micro-lesson resource pool, combine flipped classrooms to increase interaction, and design micro-lessons to build a complete knowledge system. Experimental data indicate significant improvements in students' grades, interest, and efficiency when using micro-lessons. Survey results also confirm students' high approval of micro-lessons. Recommendations include strengthening policy support, enhancing teachers' information literacy, focusing on resource construction, exploring diverse application scenarios, and using artificial intelligence technology to promote the intelligent development of micro-lessons.

Keywords: Online Micro-Lessons, High School Geography Education, Educational Informatization

1. Introduction

Currently, China is on a new journey to build a comprehensively modern socialist country. Education, as a crucial cornerstone of national development, carries the significant mission of cultivating well-rounded socialist builders and successors with moral, intellectual, physical, aesthetic, and labor education. Against this backdrop, the Ministry of Education is driving educational reforms, targeting the Educational Informatization 2.0 action plan, and constructing a new "Internet + Education" ecosystem as a vital direction for educational reform[1]. Shenzhen, China, as a pioneer of reform and opening-up and a leader in educational informatization, is actively exploring the deep integration of information technology with education and teaching, committed to creating a new paradigm of "smart education."

High school geography education, as an essential part of basic education, bears the critical task of fostering students' geographical literacy, spatial thinking, and a harmonious human-earth perspective[2]. However, traditional geography classroom teaching often suffers from dull content, monotonous teaching methods, and low student engagement, making it challenging to effectively stimulate students' interest and enthusiasm for inquiry.

Online micro-lessons, as a new form of education, are characterized by their brevity, clarity of theme, and flexibility in form. They can break through time and space constraints, meet individualized learning needs, and provide new ideas and methods for high school geography teaching reform[3]. Integrating online micro-lessons into high school geography teaching can effectively enrich teaching content, innovate teaching methods, enhance students' learning interest and efficiency, promote the transformation of geography classroom teaching models, support the implementation of Shenzhen's Educational Informatization 2.0 action plan, and contribute to the cultivation of future talents with international perspectives and innovative capabilities[4].

This study aims to explore the application effects of online micro-lessons in high school geography teaching in Shenzhen, analyze their advantages and shortcomings, and propose suggestions for improvement, providing references for enhancing the quality of geography teaching and promoting the development of educational informatization.

2. Definition and Characteristics of Micro-lessons

Online micro-lessons refer to short, concise educational videos that use short videos as the primary knowledge carrier, focusing on a specific knowledge point or teaching segment, recording the teacher's explanation or demonstration process[5]. Their main features include:

Brevity and Easy Dissemination: Micro-lessons typically last about 5-10 minutes, concentrating on explaining a single knowledge point or skill, avoiding lengthy explanations, and improving learning efficiency.

Clear Theme: Micro-lessons revolve around specific teaching objectives, with focused content, typically lasting 25-180 seconds, highlighting key knowledge points and avoiding the dispersion and generalization of knowledge.

Strong Targeting: Courses can be divided into multiple micro-lessons, which can be individually designed according to different students' learning needs and progress, targeting and solving students' learning problems.

2.1. Advantages of Online Micro-lessons in High School Geography Teaching

Breaking Time and Space Constraints: Students can watch micro-lesson videos anytime and anywhere through online platforms, free from time and space limitations, facilitating independent learning and review. For example, students can use their spare time to watch micro-lessons for previewing or reviewing classroom content; they can also selectively watch relevant micro-lessons according to their learning progress, filling gaps and consolidating knowledge[6].

Rich and Diverse Content: Micro-lesson content can cover various geographical knowledge and skills, such as the analysis of the causes of geographical phenomena, the exploration of geographical problems, and the application of geographical information technology, meeting the diverse learning needs of students[7]. For instance, students with a good foundation can choose more advanced micro-lessons for in-depth knowledge learning, while those with a weaker foundation can opt for basic micro-lessons to strengthen and enhance their knowledge[8].

Lively and Engaging Format: Micro-lessons can use animations, videos, pictures, and other forms to visualize and enliven abstract geographical knowledge. For example, using animation to demonstrate the Earth's rotation and revolution, videos to showcase the natural scenery and cultural landscapes of different regions, and pictures to present the trends of geographical data can effectively increase students' interest and participation in learning[9].

Facilitating Teacher Reflection and Improvement: Teachers can watch their micro-lesson videos to reflect on shortcomings in the teaching process and make improvements. For example, adjusting teaching content, optimizing teaching methods, and improving teaching language can enhance teaching quality[10]. Additionally, teachers can use feedback from students after watching micro-lessons to understand their learning situations and adjust teaching strategies promptly, promoting effective student learning.

2.2. Shortcomings of Online Micro-lessons in High School Geography Teaching

High Production Costs: Creating high-quality micro-lessons requires a significant investment of time and effort, including instructional design, video recording, and post-production editing, making the production cost high for teachers[11].

Lack of Interactivity: Micro-lesson videos are generally a one-way knowledge output from the teacher, lacking interaction between teachers and students, which can lead to a sense of monotony and is not conducive to active participation and in-depth learning by students[12].

Fragmentation Risk: The brevity of micro-lessons can lead to fragmented knowledge points, hindering students from building a complete knowledge system.

To address these shortcomings, the researchers in this study suggest the following improvements for integrating micro-lessons into the classroom:

(1) **Establish a Micro-lesson Resource Library:** Schools can create a micro-lesson resource library to encourage teachers to share high-quality micro-lesson resources, reducing production costs.

(2) **Combine with Teaching Models like Flipped Classrooms:** Integrating micro-lessons with teaching models such as flipped classrooms and blended learning can increase interactive elements, promoting active participation and in-depth learning by students.

(3) **Build a Knowledge System:** When designing micro-lessons, teachers should pay attention to the connection and integration of knowledge points to help students build a complete knowledge system.

In summary, as a new type of educational resource, online micro-lessons have unique advantages in high school geography teaching, effectively enhancing students' learning interest and efficiency. However, they also have some shortcomings that require continuous exploration and improvement by teachers to better serve high school geography teaching.

3. Application Strategies of Online Micro-lessons in High School Geography Classroom Teaching

3.1. Pre-class Preparation

Knowledge Point Explanation: Teachers can create micro-lessons to briefly explain new knowledge that will be learned, helping students establish a preliminary knowledge framework and prepare for classroom learning. For example, before studying the chapter "The Movement of the Earth," teachers can create a micro-lesson explaining the basic concepts and laws of the Earth's rotation and revolution, aiding students in understanding the principles of the Earth's movement.

Case Analysis: Teachers can select cases related to new knowledge, create micro-lessons for analysis and explanation, and help students understand abstract geographical concepts and principles. For instance, before studying the chapter "Climate Types," teachers can create a micro-lesson analyzing the climate characteristics and their causes in different regions, assisting students in understanding the classification standards and formation mechanisms of climate types.

Key and Difficult Points: Teachers can create micro-lessons to highlight the key and difficult points of new knowledge, helping students clarify learning objectives and focus, thus improving learning efficiency. For example, before studying the chapter "Population Migration," teachers can create a micro-lesson pointing out the influencing factors, types, and outcomes of population migration, helping students grasp the key learning points.

3.2. Classroom Teaching

Topic Situation Introduction: Teachers can use micro-lessons to create real and vivid geographical situations, stimulating students' interest in learning and desire to explore. For example, when studying the chapter "Natural Disasters," teachers can play a micro-lesson video of an earthquake or volcanic eruption, allowing students to feel the destructive power of natural disasters and sparking their attention and thoughts on the subject.

Knowledge Explanation: For key and difficult knowledge points, teachers can use micro-lessons for in-depth explanations, aiding students in understanding and mastering the content. For instance, when studying "Plate Tectonics," teachers can use micro-lessons to demonstrate the movement of plates, helping students comprehend the relationship between plate movement and geological phenomena such as earthquakes and volcanoes.

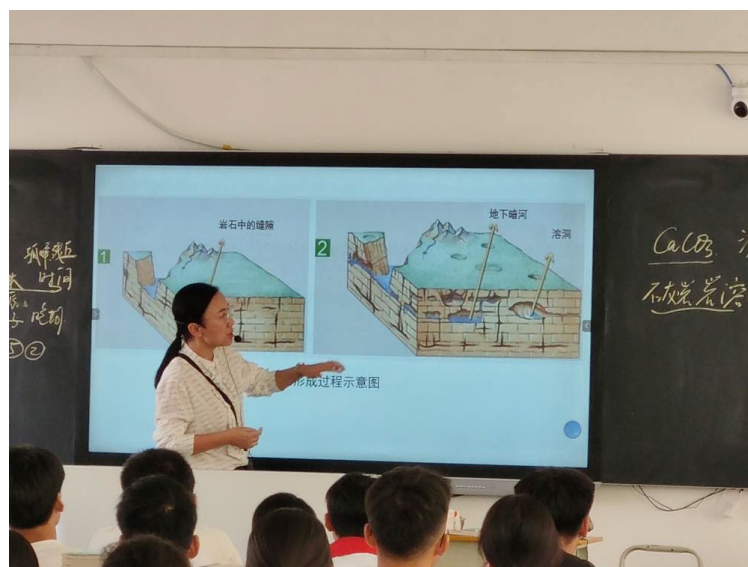


Figure 1: High school teachers using micro-lessons to introduce knowledge points

Case Analysis: Teachers can use micro-lessons to present real cases (as shown in Figure 1), helping students combine theoretical knowledge with practical issues, deepening their understanding and application of knowledge. For example, when studying "Urbanization," teachers can play a micro-lesson video on the development of Shenzhen city, allowing students to observe the process and impact of urbanization and engage in discussion and analysis.

Classroom Practice: Teachers can use micro-lessons for in-class exercises to consolidate students' learning outcomes and promptly discover and solve problems in their learning. For example, after studying the chapter "Maps," teachers can play a micro-lesson video on map interpretation, allowing students to practice and providing commentary and explanations.

3.3. Post-class Review

Knowledge Review: Students can use micro-lessons to review knowledge learned in class, deepening impressions and reinforcing memory.

Focus Consolidation: Students can selectively watch related micro-lessons based on their learning situations to consolidate key and difficult knowledge points.

Extension and Expansion: Students can use micro-lessons to extend learning content, such as watching documentaries and popular science videos related to geography, broadening their horizons and cultivating geographical thinking.

3.4. Homework Design

Diversified Homework Based on Micro-lessons: Teachers can design various forms of homework based on micro-lesson content, such as writing reflections after watching micro-lessons, creating mind maps, designing surveys, and conducting case analyses, enhancing students' learning outcomes. Teachers can use online platforms for homework submission and grading: Teachers can use online platforms to assign and grade homework. For example, after studying the chapter "Environmental Protection," teachers can assign students to watch a micro-lesson video on environmental pollution and write a proposal on environmental protection, submitting the assignment through an online platform for online grading and feedback.

3.5. Extracurricular Learning

Teachers can recommend high-quality micro-lesson resources and encourage students to use their spare time for independent learning, such as watching geographical science videos and learning geographic information technology.

Teachers can organize students to explore geographical issues using micro-lessons, such as investigating the urban development model of Shenzhen city and analyzing its ecological environment problems, fostering students' inquiry abilities and innovative thinking.

4. Research Design and Data Analysis

4.1. Research Subjects

This study selected two high school classes with comparable teaching levels, one as the experimental group (using online micro-lessons) and the other as the control group (traditional teaching).

4.2. Research Methods

Micro-lesson Experimental Group: The micro-lesson adopts a blended teaching model of "traditional teaching + online micro-lessons." Before class, teachers will push relevant micro-lesson videos for students to preview; during class, teachers will combine micro-lessons for explaining key and difficult points and case analysis, and engage in interactive discussions; after class, students can use micro-lessons for review and extended learning.

Regular Control Group: The micro-lesson uses a traditional teaching model, mainly relying on teacher classroom instruction and textbook learning.

Micro-lesson Teaching Content and Progress: The micro-lesson remains consistent to ensure the validity of the experiment.

4.3. Data Collection

Micro-lesson Pre-test and Post-test: Micro-lessons are tested before and after the experiment to assess students' learning outcomes, including mastery of geographical knowledge, application of geographical skills, and level of geographical thinking.

Micro-lesson Questionnaire Survey: Micro-lessons survey students' acceptance of online micro-lessons, learning experience, and evaluation of learning outcomes.

Micro-lesson Interviews: Micro-lessons conduct interviews with some students to gain a deeper understanding of their views and suggestions on online micro-lessons.

4.4. Data Analysis

Micro-lesson Descriptive Statistics: Micro-lessons analyze differences between the experimental and control groups in test scores and survey results.

Micro-lesson t-test: Micro-lessons test whether the differences in learning outcomes between the experimental and control groups are statistically significant.

4.5. Data Analysis Predictions

Based on the understanding of the advantages of online micro-lessons and the practical experience of blended learning models, we predict that students in the experimental group (using online micro-lessons) will have positive effects in the following aspects:

Improved Learning Scores: Micro-lessons can help students better understand and master knowledge points, improve learning efficiency, and thus enhance learning outcomes. It is predicted that the test scores of the experimental group will be significantly higher than those of the control group.

Increased Learning Interest: The lively and diverse format of micro-lessons can stimulate students' interest in learning, enhancing their initiative and enthusiasm. It is predicted that students in the experimental group will have a stronger interest in learning geography.

Enhanced Learning Efficiency: Micro-lessons can assist students in independent and personalized learning, saving study time and improving learning efficiency. It is predicted that students in the experimental group will complete learning tasks more efficiently.

Improved Learning Abilities: Micro-lessons can cultivate students' abilities in independent learning, information technology application, problem-solving, etc., enhancing their overall quality.

4.6. Research Limitations

Limited Sample Size: This study only selected two classes as research subjects, which may not fully represent the situation of all high school students.

Short Experiment Duration: The limited duration of the experiment in this study may not fully reflect the long-term impact of online micro-lessons.

Future research can expand the sample size, extend the experiment duration, and explore the application effects of online micro-lessons in different educational stages and subjects.

5. Research Results and Analysis

5.1. Learning Achievement Data Simulation and Analysis

To analyze the impact of online micro-lessons on student learning outcomes more comprehensively, we added simulated data and compared groups of students at different levels.

5.2. Overall Scores

Table 1 shows the overall scores comparison between the experimental group and the control group.

Table 1: Data Comparison between the Experimental Group and the Control Group

Group	Pre-test Average Score	Post-test Average Score	Average Score Increase	Overall Improvement Ratio
Experimental Group (Micro-lessons)	76.6	85.8	9.2	12%
Control Group (Traditional teaching)	74.6	82.1	7.5	10%

5.3. Grouping by Student Level

To further analyze the differentiated impact of online micro-lessons on students of different learning levels, we divided the students into three groups: excellent, average, and basic, as shown in Table 2.

Table 2: Data Comparison between Different Levels of the Experimental Group and the Control Group

Group	Level Group	Pre-test Average Score	Post-test Average Score	Average Score Increase	Increase Ratio	Average Increase Ratio
Experimental Group (Micro-lessons)	Excellent	85	94.5	9.5	11.10%	12.30%
	Average	78	85	7	8.90%	
	Basic	66.8	78	11.2	16.70%	
Control Group (Traditional teaching)	Excellent	83.5	91.5	8	9.50%	10.20%
	Average	75.8	82.5	6.7	8.80%	
	Basic	64.5	72.5	8	12.40%	

5.4. Analysis of Results

To conduct a more comprehensive analysis of the impact of online micro-lessons on student learning outcomes, we incorporated control data and compared groups of students at different proficiency levels (as shown in Table 1 and Table 2). Overall, the experimental group showed a greater improvement in scores than the control group, indicating that online micro-lessons have a positive effect on student academic performance. To further analyze the differentiated impact of online micro-lessons on students with varying levels of learning, we categorized students into three proficiency groups: excellent, average, and basic.

For the excellent students, both the experimental and control groups showed improved scores, but the increase was more significant in the experimental group. This suggests that online micro-lessons have a notable facilitative effect on the learning outcomes of excellent students. A possible reason is that excellent students generally have a solid academic foundation and strong learning abilities, with a higher degree of knowledge mastery, thus the enhancement space provided by online micro-lessons is relatively smaller. For the average students, the score improvement in the experimental group was significantly greater than that in the control group, indicating that online micro-lessons significantly boost the learning outcomes of average students. This may be due to the fact that average students have a relatively good academic foundation but still have areas where knowledge is not firmly grasped or deeply understood. Online micro-lessons can help them address these deficiencies and improve learning efficiency. For the basic-level students, the score improvement in the experimental group was much larger than that in the control group, demonstrating that online micro-lessons have a very significant promotive effect on the learning outcomes of basic-level students, helping them better understand and master knowledge, and narrowing the gap with other students.

5.5. Survey Results

Table 3: Students' Evaluation of the Effectiveness of Micro-lesson Empowered Teaching Activities

Survey Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I think online micro-lessons help me understand and master geographical knowledge.	60.00%	30.00%	8.00%	2.00%	0.00%
I think online micro-lessons have increased my interest in learning geography.	55.00%	35.00%	7.80%	2.00%	0.00%
I hope teachers use online micro-lessons more in classroom teaching.	50.00%	40.00%	6.50%	2.50%	0.00%
I think the content of online micro-lessons is lively and interesting, and the learning method is flexible and convenient.	57.00%	32.00%	8.00%	3.00%	0.00%
I think online micro-lessons can help me engage in independent and personalized learning.	55.00%	35.00%	8.00%	2.00%	0.00%
I think online micro-lessons help improve my learning efficiency.	52.00%	38.00%	7.00%	2.00%	1.00%

From the survey results (as shown in Table 3), most students have a high acceptance and approval of online micro-lessons, mainly reflected in the following aspects:

(1) Aids in understanding and mastering knowledge: 60% of students strongly agree, and 30% agree that online micro-lessons help them understand and master geographical knowledge. This indicates that online micro-lessons effectively assist students in learning geographical knowledge, resolving confusions, and improving learning outcomes.

(2) Increases learning interest: 55% of students strongly agree, and 35% agree that online micro-lessons have increased their interest in learning geography. This suggests that the format and content of online micro-lessons can attract students' attention, stimulate their interest in learning, and make the learning process more lively and interesting.

(3) Flexible and convenient learning method: 57% of students strongly agree, and 32% agree that the content of online micro-lessons is lively and interesting, and the learning method is flexible and convenient. This shows that online micro-lessons break the time and space constraints of traditional classroom teaching, allowing students to learn at their own time and pace, which is more in line with the learning habits of modern students.

(4) Promotes independent and personalized learning: 55% of students strongly agree, and 35% agree that online micro-lessons can help them engage in independent and personalized learning. This indicates that online micro-lessons provide students with more opportunities to independently choose learning content and methods, meeting the learning needs of different students and promoting personalized development.

(5) Improves learning efficiency: 52% of students strongly agree, and 38% agree that online micro-lessons help improve their learning efficiency. This suggests that online micro-lessons can help students make better use of time, improve learning efficiency, and achieve better learning outcomes.

In summary, most students have a positive attitude towards online micro-lessons, believe they are helpful for their learning, and hope that teachers will use online micro-lessons more. The average score statistics and survey results are consistent, further confirming the positive evaluation and positive effects of online micro-lessons by students. Students generally have a high recognition of online micro-lessons, considering their content lively and interesting, and the learning method flexible and convenient, which helps them engage in independent and personalized learning, increasing learning interest and efficiency. However, a few students remain skeptical or doubtful, possibly due to insufficient understanding of online micro-lessons or concerns about their lack of interactivity, which may not solve problems in learning. Students hope that teachers will use online micro-lessons more in classroom teaching and suggest developing more micro-lessons of different types and difficulties to meet personalized learning

needs.

To better leverage the role of online micro-lessons in high school geography teaching, this study suggests strengthening promotion to let more students understand their advantages and features, and encouraging teachers to actively explore and develop more high-quality micro-lesson resources and effectively integrate them into classroom teaching. Teachers should design micro-lessons of different types and difficulties according to students' learning needs and styles to meet personalized learning needs, and add interactive elements to micro-lessons to enhance student participation and learning outcomes. By continuously improving and perfecting the application strategies of online micro-lessons, it is believed that they will become an effective tool to enhance students' learning interest and efficiency, helping students develop comprehensively.

6. Conclusion and Recommendations

6.1. Research Conclusion

The results of this study show that online micro-lessons, as a new type of educational resource, have significant application value in high school geography classroom teaching. Online micro-lessons can effectively enhance students' learning interest and efficiency, promote understanding and mastery of knowledge, narrow the gap between students of different learning levels, and promote the development of personalized and in-depth learning. This aligns with the goals of the national Educational Informatization 2.0 action plan and fits the new ecological development trend of "Internet + Education."

6.2. Research Recommendations

This study suggests that the educational authorities strengthen policy guidance and support for online micro-lessons, encourage schools and teachers to actively explore the development and application of micro-lessons, establish a sound micro-lesson resource sharing mechanism, and promote the co-construction and sharing of high-quality micro-lesson resources.

Teachers should strengthen training on information technology application skills, master micro-lesson production techniques, enhance instructional design capabilities, effectively integrate online micro-lessons into classroom teaching, and promote the deep integration of information technology with education and teaching.

This study encourages teachers to combine practical teaching, create micro-lessons with clear themes, refined content, and lively forms, and develop micro-lessons of different types and difficulties based on student learning needs and situation analysis, meeting personalized learning needs.

Teachers should combine online micro-lessons with teaching models such as flipped classrooms and blended learning, explore the application of micro-lessons in pre-class preparation, classroom teaching, post-class review, homework design, and extracurricular learning, construct diversified teaching scenarios, and enhance teaching effectiveness.

Teachers should actively explore the application of artificial intelligence technology in micro-lesson production, resource distribution, and learning situation analysis, promote the intelligent development of online micro-lessons, and provide students with more accurate and personalized learning services.

Looking to the future, as information technology continues to develop and new productive forces emerge, online micro-lessons will play an increasingly important role in high school geography teaching. The future development trend of micro-lessons will focus more on intelligence, personalization, and interactivity, and integrate with virtual reality, augmented reality, and other technologies to create a more immersive and experiential learning environment for students, promote the innovative development of geography education, and contribute to the cultivation of future talents with international vision and innovation capabilities.

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