Development of Video With Microlearning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science and Engineering

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Abstract
The objectives of this study were to: 1) develop video with microlearning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering, 2) compare the learning achievement of students between pre-test and post-test scores after using video with microlearning on soil research, and 3) study the satisfaction of students using video with microlearning on soil research. The sample of this study was 30 students majoring in environmental engineering at Sichuan University of Science and Engineering in China, in the academic year 2024. They were selected by using purposive sampling. The research instruments consisted of 1) video with microlearning on soil research, 2) questionnaire of content and media quality, 3) questionnaire of learning achievement, and 4) questionnaire of students' satisfaction. The research results revealed the following: 1) An evaluation of the video content quality on soil research by the experts showed the appropriateness at the excellent level (=4.83, *SD*=0.23) and an evaluation of media quality by the experts also showed the appropriateness at the excellent level (=4.50, *SD*=0.58). 2) The post-test scores of learning achievement were higher than the pre-test scores with statistically significant difference at the .05 level. 3) The student's satisfaction on using video with microlearning on soil research was at the satisfied very good level (=4.64, *SD*=0.54) as well.

Keywords: Video, Microlearning, Soil Research, Learning Achievement

Introduction

In recent years, the rapid development of information technology has greatly improved all kinds of education mediated by video. In particular, the emergence of online education has made online courses with instructional videos as the carrier of knowledge dissemination highly favored by the public (Means B, et al., 2009). As an important part of online courses, teaching video has become the multimedia learning resource with the highest frequency and the largest scale of use in the context of education informatization with its powerful audio-visual multi-channel dynamic presentation of learning content (Marta et al., 2023) and has become the focus of the national construction and development of high-quality educational resources. The Ministry of Education has pointed out in the policy document "Education Informatization 2.0 Action Plan" that it is necessary to improve the quality of digital educational resources, bring together universities, enterprises, the government and other parties to provide high-quality large- scale online courses to strengthen the construction and sharing of high-quality digital educational resources. During the new crown epidemic, all kinds of schools around the country made full use of these online video courses to carry out the "no class, no school" teaching activities, providing students with a variety of free teaching video resources to ensure the normal development of education and teaching work. It can be seen that teaching video occupies a very important position in the construction of national digital educational resources and is an important teaching and learning resource in educational teaching activities. And the research on the development of teaching videos to improve college students' academic performance is of great significance in promoting the construction and development of high-quality educational resources (Gumisirizah et al., 2024).

Learning outcomes, usually refers to the outcomes of knowledge and comprehension, attitudes and values, skills and behaviors that students acquire after undergoing a learning experience (Rohmawati et al., 2023). The evaluation of college students' learning outcomes is a key factor in the quality assurance of higher education talent cultivation and an important way for colleges and universities to respond to social accountability and improve the quality of education within the school. Under the influence of "student-centered" education concept, learning outcome evaluation, which focuses on the value-added of students' learning and emphasizes the effectiveness of students' education, has gradually become an important benchmark for measuring the quality of talent cultivation in colleges and universities (Tang et al., 2023). At present, the evaluation system of applied undergraduate colleges and universities is generally subject to the shackles of "five only", without highlighting the orientation of application, and the talent cultivation has always existed the tendency of focusing on academics but not on application, theory but not on practice, which does not reflect the fundamental demand of applied talents of "learning to use". Therefore, it can be said that the learning outcomes of students in applied undergraduate colleges and universities should not only have the general learning outcomes in line with the social development of the new era, but also have the learning outcomes in the field of applied talents.

The need for students to learn about soil research is evident in several ways. First, as the foundation of agricultural production, soil is critical to healthy crop growth (Li et al., 2023). Through in-depth study of soil research, students are able to master key factors such as nutrients and microorganisms in the soil, providing scientific support for the training of future professionals in the field of agriculture. Secondly, as an integral part of the ecosystem, soil, together with water and air, forms the foundation of life on earth (Chakraborty et al., 2018). Through the study of soil research, students can understand the impact of human activities on

soil and actively participate in the protection and sustainable use of the ecological environment. In addition, the study of soil involves the management and sustainable development of land resources. By understanding the nature, fertility and conservation of soil, students are able to plan and manage land resources in a more scientific manner, and to promote the society in the direction of sustainable development (Zheng et al., 2020).

Micro learning videos are short, focused, and highly targeted learning resources designed to deliver specific learning objectives in a concise and engaging manner. Typically ranging from a few seconds to a few minutes in duration, these videos leverage multimedia elements such as visuals, animations, and narration to convey information effectively. Unlike traditional lengthy lectures or tutorials, microlearning videos aim to capture learners' attention and deliver key concepts swiftly, catering to their limited attention spans and on-the-go learning preferences (Naser, 2024). Thus, this study focuses on the integration of the video with micro learning and soil research content to enhance learning achievement of students at Sichuan University of Science and Engineering. With this approach, the students could develop their learning system in terms of learning behaviors, learning achievement and motivation.

Research of Objectives

1. To develop video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering.
2. To compare the learning achievement of students between pre-test and post- test scores after using video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering.
3. To study the satisfaction of students who using video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering.

Literature Review

Video of Learning

With the rapid development of information technology, video has become an indispensable medium in the learning process. Video can not only convey complex knowledge information but also improve learners' participation and interest through visual and auditory stimuli. Research has shown that Video of Learning can effectively promote knowledge understanding and memory, especially in online education and blended learning environments, which is becoming increasingly important (Noetel et al., 2021). At the same time, with the popularity of social media, the rapid spread of short videos and teaching videos also provide learners with more learning resources and flexible learning methods. Therefore, in-depth research on the application and influence of video in learning has important practical significance for improving the quality of education and learning effect.

Micro Learning

Micro Learning, as a new way of learning, has been widely concerned in the field of education because of its flexibility and efficiency. The core idea of micro-learning is to fragment knowledge and provide short and easily digestible learning content to adapt to the shrinking attention spans and fast-paced lifestyles of contemporary learners. Research shows that micro-learning can not only improve learners' learning motivation, but also significantly

improve knowledge retention rate and application ability (Samala et al., 2023). With the popularity of mobile devices, the forms and application scenarios of micro-learning are constantly enriched. From online courses to corporate training, micro-learning is gradually becoming an effective tool to improve learning results.

Soil Research

The importance of soil research in environmental protection and sustainable agricultural development cannot be ignored. Research has shown that the physical, chemical, and biological properties of soils have a direct impact on ecosystem health and agricultural production (Cardoso et al., 2013). With global climate change and population growth, the problem of soil degradation and nutrient loss is becoming more and more serious, which makes research on soil management and improvement particularly urgent (Gomiero, 2016). In this context, it is essential to carry out extensive research on soil properties and management strategies in universities to address local ecological challenges and improve agricultural productivity. By applying micro-learning videos to soil research courses, students can be helped to master complex soil science knowledge more effectively, thereby improving learning achievement.

3P Production

The 3P production model, i.e. pre-production, production and post-production, is a key step in the development of video content. Each stage of the process helps to ensure the quality and effectiveness of the final product. Pre-production involves scripting, planning, and design, and is the stage where a solid foundation is laid for the content (Paulaharju, 2021). The production phase focuses on actual shooting and recording and improves the quality and attractiveness of the material through technical means (Cunha et al., 2019). Post-production optimizes video effects through editing, special effects and audio processing to improve learners' experience and comprehension (Bolibok, 2022). Studies have shown that a systematic 3P production process can significantly improve the teaching effect of educational videos and students' learning outcomes (Johnson et al., 2014). Therefore, the application of 3P production mode in the development of teaching video can effectively support the realization of curriculum objectives and learners' knowledge mastery.

Learning Achievement

Learning Achievement is a core concept in educational research, which refers to the acquisition and performance of knowledge, skills and attitudes in a specific learning environment. In recent years, researchers have paid more and more attention to the influence of different teaching strategies and tools on learning achievement. For example, data support for problem-based Learning (PBL) and Blended Learning can significantly enhance student learning achievement by increasing engagement and providing diverse learning resources (Prince, 2004; Means et al., 2013). In addition, research has shown that interactive digital media, such as educational videos and online assessment tools, also have a significant positive impact on learning achievement, enhancing students' comprehension and memory by providing immediate feedback and multi-sensory stimulation (Zhang et al., 2006).

Research of Methodology

The research methods used in this paper include literature analysis, observations, interviews, questionnaires, and field studies. Based on the article analysis and practical teaching experience, this paper discusses about the development of video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering.

Population

The population of this study is 98 students at Sichuan University of Science and Engineering from College of Chemical and Environmental Engineering, year 2024, China. The sample of this study was 30 students majoring in environmental engineering at Sichuan University of Science and Engineering year 2024, College of Chemical and Environmental Engineering, China. They were selected by using purposive sampling that their major is closely related to soil research, which is conducive to improving their professional knowledge and broadening the scope of knowledge in different directions.

Research Instruments

The research instruments consisted of (1) video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering (2) content and media quality questionnaire for video with micro learning on soil research to enhance learning achievement of students (3) learning achievement of students between pre-test and post-test scores using video with micro learning on soil research to enhance learning achievement of students and (4) satisfaction questionnaires to assess students' satisfaction level for video with micro learning on soil research to enhance learning achievement of students.

Data Analysis

The data were analyzed using Mean, Standard Deviation and t-test. Data amassment, the researcher experimented with an experiment was one group pretest and post-test test scores design; the population selected by purposive sampling. The measure and statistics and assessment are video with micro learning on soil research to enhance learning achievement of students, questionnaire of satisfying data was mean, standard definition, t-tests the dependent sample statistics. Amassment statistics data after the experiment and calculate (O1) and (O2) for mean and compared, arrangement for the experimental model by video with micro learning on soil research to enhance learning achievement of students.

Variables

1. Independent variable is video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering.
2. Dependent variables are (1) the students' learning achievement after using video with micro learning on soil research to enhance learning achievement of students and (2) the students' satisfaction with video with micro learning on soil research to enhance learning achievement of students.

Conclusion

Study the Quality of Video With Micro Learning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science and Engineering

The results of the content quality assessment of the video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering evaluated by three content experts. The overall quality was excellent level (=4.83, *SD*=0.23). When considering each item, it was found that the content of the video accurately reflects the scientific principles and methods of saline-alkali soil improvement, the video comprehensively introduces the causes, characteristics and hazards of saline-alkali soil, the video describes in detail the various methods (e.g. physical, chemical and biological methods) of saline-alkali soil improvement, the video describes in detail the effects of saline-alkali soil on crop growth, the pictures, animations and diagrams in the videos are clear and intuitive and help in understanding the concept of saline-alkali soil improvement were excellent level (=5.00, *SD*=0.00), respectively.

The results of the media quality assessment of the video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering evaluated by three media experts. The overall quality was excellent level (=4.50, *SD*=0.58). In the evaluation of each project, it was found that the pace and rhythm of the video is good, the structure of the video content is clear, the images and animations in the video are vivid and educational, there are enough visual changes and transitions in the video to keep the viewer's interest and attention, Clear and concise details (=4.67, *SD*=0.58).

Compare the Learning Achievement of Students Between Pre-test and Post-test Scores Using the Video With Micro Learning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science and Engineering

Table 1: Compare of Average Score Before and After of the Students Using the Video With Micro Learning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science And Engineering

Items	**n**		***SD***	**df**	**t-test**	**Sig. (2-tailed)**
Pre-test	30	7.80	2.79	29	31.04	0.00*
Post-test	30	15.00	4.55			

*p＜.05

Table 1 presented the video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering. The mean score of pre-tests was 7.80, and the score of standard deviation (*SD*) was 2.79. The result after using the video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering constituted a substantial improvement in students which translated into a high post-test 15.00 and standard deviation (*SD*) 4.55 and t-test analysis before and after the treatment 31.04 which demonstrated a considerable difference was statistically significant at the .05 level.

Study the Satisfaction of Students Who Using the Video With Micro Learning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science and Engineering

The results of evaluation of students' satisfaction with the video with micro learning on soil research to enhance learning achievement of students at Sichuan University of Science and Engineering by 30 students. The overall students' satisfaction was very good level (=4.64, *SD* =0.54). When considering each item, it was found that the video provides successful cases and case studies to increase the practicality and credibility of the learning was very good level (=4.80, *SD*=0.48). The video content is accurate and detailed, clearly explaining the causes and hazards of saline-alkali soil, and the video employs a wealth of visual changes and switches to help keep the viewer's interest was very good level (=4.73, *SD*=0.45, =4.73, *SD*=0.52), respectively.

Discussion

Study the Quality of Video With Micro Learning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science and Engineering

The results of this study show that soil research videos based on micro-learning are excellent in improving the learning achievement of students in Sichuan Institute of Technology. Evaluations by content experts show that video content reaches a level of excellence in accurately reflecting scientific principles and methods (=4.83, *SD*=0.23). The video demonstrates in detail the multiple methods of saline-alkali soil improvement and their impact on crop growth, combined with clear and intuitive pictures and animations, greatly promoting students' understanding of complex topics (Mayer, 2002). In addition, the evaluation of media experts also shows that the media quality of video is also at an excellent level (=4.50, *SD*=.85). The rhythm, content structure and visual effects of the video were highly recognized, and sufficient visual changes and transition designs effectively maintained the interest and attention of the audience (Sweller et al., 2011). On the whole, this video based on micro-learning effectively combines content quality and media quality, which can significantly improve students' understanding and application ability of saline-alkali soil research. This is consistent with previous research showing that video learning can enhance learning through multi-sensory stimulation and interactivity (Zhang et al., 2006).

Compare the Learning Achievement of Students Between Pre-test and Post-test Scores Using the Video With Micro Learning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science and Engineering

This study has effectively improved the learning achievement of students in Sichuan University of Science and Engineering through video micro-learning. The results of the study showed that students scored an average of 7.80 (SD=2.79) on the test before watching the video and significantly improved to 15.00 (SD=4.55) after using the video. The T-test result was 31.04, indicating that the increase was statistically significant ($p<0.05$). This remarkable improvement indicates that video micro-learning, as a teaching tool, can effectively promote students' understanding and application of saline-alkali soil research. This is consistent with the findings of Zhang et al. (2006), which showed that multimedia instruction can improve student learning outcomes through rich visual and auditory stimuli. The advantage of video micro-learning is its ability to provide immediate feedback and multi-sensory stimulation, which facilitates students' understanding and memory of complex concepts (Mayer, 2002). In

addition, video micro-learning provides a flexible learning environment where students can learn according to their own learning pace, which improves their learning initiative and self-efficacy to a certain extent (Means et al., 2013). Therefore, this teaching method not only improves learning achievement, but may also play a positive role in students' long-term learning experience.

Study the Satisfaction of Students Who Using the Video With Micro Learning on Soil Research to Enhance Learning Achievement of Students at Sichuan University of Science and Engineering

To improve the soil research achievements of students in Sichuan University of Science and Engineering through video micro-learning. The results of the study showed that students' satisfaction with using video microlearning was very good level (=4.60, *SD*= 0.54). Specifically, students were most satisfied with the video provides successful cases and case studies to increase the practicality and credibility of the learning (=4.80, *SD*=0.48), indicating that these practical application cases significantly enhanced the practicality and credibility of learning. In addition, the accuracy and detail of the video content, especially in explaining the causes and hazards of saline-alkali soil, were highly appreciated by the students (=4.73, *SD*=0.45), and the rich visual transformation and switching design in the video also effectively maintained the interest of the audience (=4.73, *SD*=0.52). These results are consistent with the core principle of multimedia learning theory that learning can be significantly improved by integrating text, images, and multimedia elements (Mayer, 2002). Further research supports this view. Kizilcec et al. (2013) found that video learning can enhance students' learning effectiveness and satisfaction through multi-sensory stimulation and interactivity. In addition, Guo et al. (2014) showed that video length, visual effects and interactivity are key factors affecting the effectiveness of online learning. These findings suggest that video micro-learning can effectively improve student achievement and satisfaction, especially in complex subjects such as soil studies. In addition, this teaching method not only provides a flexible and adaptable learning environment, but also significantly enhances students' understanding and interest in practical application cases.

Recommendations

1. Integrate Interactive Elements: Incorporate interactive features like quizzes or discussion prompts within the micro-learning videos to actively engage students and reinforce their understanding of soil research concepts.
2. Implement Feedback Mechanisms: Establish a system for students to provide feedback on the videos, which will help refine content and delivery based on their experiences and needs.
3. Enhance Video Quality: Ensure high production values for the videos, including clear visuals, engaging graphics, and professional narration, to improve student comprehension and retention.

Suggestions for Further Research

1. Enhance Assessment Tools: Develop comprehensive assessment tools beyond pre- and post-tests, such as formative quizzes or reflective activities, to continuously gauge student understanding and provide immediate feedback throughout the learning process.
2. Pilot and Refine Content: Before fully implementing the micro-learning videos,

conduct a pilot study with a smaller group of students to gather detailed feedback. Use this feedback to refine video content and delivery methods to better meet the educational needs of the students.

3. Conduct Longitudinal Studies: Extend the research to evaluate the long-term impact of micro-learning videos on students' knowledge and application of soil research concepts beyond immediate test results.

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