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Development of a Training Course Focused on Enhancing Teachers' Abilities in Using Interactive Electronic Whiteboard Applications

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Abstract

Background and Aims: The integration of interactive electronic whiteboards has revolutionized education by enabling real-time interaction, multimedia use, and internet access, enriching the learning experience and enhancing student engagement. By enhancing comprehension, retention, and teamwork skills, these resources help students overcome obstacles in the future and support a variety of learning styles. This paper aims to develop a training course on teachers' interactive electronic whiteboard application abilities through a MOOC environment.

Materials and Methods: This study employed a mixed-methods research design, combining qualitative and quantitative approaches to gain a comprehensive understanding of the relationship between MOOC training and teachers' interactive electronic whiteboard (IEWB) application abilities. The research methods utilized in this study include teacher interviews, a teacher questionnaire, and Students' academic performance observation. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) to perform statistical analyses of the quantitative data.

Results: Training courses on teachers' interactive electronic whiteboard applications through MOOC environment were compound (1) Concept, (2) Objective, (3) Content, (4) Learning activities have 4 steps; step 1 Introduction, Step 2 Explanation, Step 3 Operation, and Step 4 Group Discussion, and (5) Media and Learning resources and 6. Measurement and evaluation, The Results of the evaluation of the appropriateness of the training courses by experts were high.

Conclusion: Experts assessed and determined that the MOOC-based teacher training courses on interactive electronic whiteboard applications, which included six thorough components and a four-step learning process, were very suitable.

Keywords: MOOC; Interactive Electronic Whiteboard; Teacher Training

Introduction

In the modern era of education, technological advancements have revolutionized the way students learn and teachers instruct. Among the numerous technological innovations, interactive electronic whiteboards have emerged as a game-changer, reshaping traditional classrooms into interactive and dynamic learning spaces. This chapter explores the research background and focuses on the emergence of interactive electronic whiteboards in the era of education informatization. It integrates it into the needs of teaching points and middle schools in our province, and the needs of improving the application of teachers' interactive whiteboard application. The chapter also outlines the research objectives, highlights the significance of the study, and presents an overview of the research content.

The educational informatization era has been marked by substantial technological integration in education, with the advent of interactive electronic whiteboards being a notable example. These whiteboards integrate conventional board functionality with advanced computer technology, multimedia features, and internet access, creating an engaging and dynamic educational environment. They have revolutionized the learning experience by enabling real-time interactions between instructors and students. Lee & Nie, 2017 study highlights that these tools empower teachers to actively involve students in learning processes, allowing for manipulation of content, presentation of multimedia resources, and annotation, thereby enriching the visual and auditory learning experience. This active engagement improves comprehension, retention, and student involvement. Further, Betcher and Lee (2018) assert that these whiteboards offer varied learning experiences suitable for different learning styles. Teachers can tailor lessons with a variety of digital resources, such as educational videos, simulations, and interactive games, promoting a more inclusive and effective learning atmosphere. Hwang and Wu (2019) underscore the importance of collaboration and teamwork, skills vital in the modern workforce, which are fostered through the use of interactive whiteboards. These tools enable simultaneous interaction among multiple users, encouraging group activities and brainstorming, thus

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enhancing problem-solving, critical thinking, and communication skills. This approach not only bolsters academic performance but also prepares students for future global challenges. The integration with the internet provides access to a plethora of online resources for both educators and students. Johnson and Smith (2016) note that this connectivity offers up-to-date information, data, and research materials, allowing teachers to enrich their lessons with current real-world examples and promoting a culture of lifelong learning, as students become adept at using technology for ongoing knowledge acquisition.

Massive Open Online Courses (MOOCs) represent a significant innovation in educational access and engagement. This section delves into the genesis and current dynamics of MOOC development, incorporating academic insights to understand this educational paradigm shift. The MOOC concept originated in 2008 with George Siemens and Stephen Downes' "Connectivism and Connective Knowledge" course at the University of Manitoba and the University of Prince Edward Island, as per Siemens (2013). Their innovative approach utilized the internet's extensive reach for open educational content delivery and the creation of a global learning community. This foundational effort sparked widespread enthusiasm among educators and learners, promoting connectivism, a theory prioritizing networks and connections in learning, as articulated by Downes (2007). MOOCs have since expanded significantly, with platforms like Coursera, edX, and Udacity partnering with renowned institutions to offer a diverse array of courses to millions globally (Liyanagunawardena, Adams, & Williams, 2013). These platforms now offer courses across various disciplines, democratizing education access for learners worldwide, irrespective of location or financial constraints (Christensen, Steinmetz, Alcorn, Bennett, & Woods, 2013). Pedagogically, MOOCs have evolved from traditional lectures to interactive formats with quizzes, forums, and peer assessments, enhancing engagement and participation (Kizilcec, Piech, & Schneider, 2013). Additionally, certification options provide tangible professional development benefits (Daniel, 2012). Despite their impact, MOOCs face challenges like high dropout rates and maintaining learner motivation and support (Hollands & Tirthali, 2014).

Massive Open Online Courses (MOOCs) have transformed educational access, offering manifold benefits to meet diverse learning requirements. A primary advantage of MOOCs, as Hollands and Tirthali (2014) observe, is the breaking down of geographical barriers, allowing global access to courses from top-tier universities. This accessibility grants learners exposure to distinguished faculty and cutting-edge knowledge, previously exclusive to a limited demographic. Khalil and Ebner (2014) emphasize the flexibility of MOOCs, accommodating learners with varied schedules and facilitating learning at their own pace. MOOCs provide a broad spectrum of subjects, enabling learners to select courses that match their interests and career goals, thus ensuring a personalized learning journey (Liyanagunawardena, Adams, & Williams, 2013). Additionally, the cost-effective nature of MOOCs, often free, democratizes education (Hollands & Tirthali, 2014). They also cultivate a global learning community, fostering an exchange of ideas and promoting cross-cultural understanding (Hew & Cheung, 2014).

Massive Open Online Courses (MOOCs) constitute a form of online education that provides open access to a multitude of learners simultaneously. Offered by universities and online platforms, MOOCs are accessible to anyone with an internet connection, representing an inclusive educational model. These courses, characterized by their open access, cater to a diverse learner demographic (Liyanagunawardena, Adams, & Williams, 2013). They accommodate large participant numbers and are scalable, offering flexibility in pacing and completion (Daniel, 2012; Pappano, 2012). MOOCs incorporate multimedia elements like video lectures and interactive simulations to enrich the learning experience (Bozkurt, Akgün-Özbek, & Zawacki-Richter, 2017).

Research Objectives

1) Developing the training course on teachers' interactive electronic whiteboard application abilities through a MOOC environment

2) Implement the training course.

2.1) Explore the relevance of MOOCs to interactive electronic whiteboard application

The research objective is to investigate the relevance of MOOCs to the application of interactive electronic whiteboards in the classroom. This involves examining the availability of MOOCs that offer specific training on interactive electronic whiteboard usage and assessing the alignment between the course content and the actual needs of teachers. Scholars like Betcher and Lee (2018) have highlighted the importance of identifying relevant and practical MOOCs to maximize their impact on teachers' professional development.

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2.2) Assess teachers' perceptions and attitudes towards MOOC learning

The research objective is to assess teachers' perceptions and attitudes towards MOOC learning as a means to enhance their interactive electronic whiteboard application abilities. Understanding teachers' views on the effectiveness, benefits, and challenges of MOOC-based professional development is crucial to designing tailored and impactful training programs (Alraimi, Zo, & Ciganek, 2015). This research will draw insights from surveys and interviews to gauge teachers' willingness to engage with MOOCs and the factors that influence their participation.

2.3) Measure the impact of MOOC learning on teachers' interactive electronic whiteboard skills

The research objective is to measure the actual impact of MOOC learning on teachers' interactive electronic whiteboard application skills. This involves conducting pre-and post-assessments to evaluate any improvements in teachers' abilities to effectively use IEWs in their teaching practices. Research by Kizilcec, Piech, and Schneider (2013) on MOOC completion rates and learning outcomes can serve as a reference for evaluating the effectiveness of MOOC-based training in enhancing teachers' skills**.**

Scope of Study

The scope of this research is to investigate the impact of training teachers' interactive electronic whiteboard application abilities through Massive Open Online Courses (MOOCs). The study aims to assess the effectiveness of MOOC-based training in enhancing teachers' proficiency in using interactive electronic whiteboards for instructional purposes. By delving into the influence of MOOCs on teachers' pedagogical practices, the research endeavors to provide valuable insights for educational institutions, policymakers, and educators seeking innovative and efficient professional development strategies.

1. Population and Samples

1.1 Population

This study involves a sample of 30 English teachers from 16 high schools, including different ages and academic qualifications, ensuring a diverse representation of teachers who utilize interactive electronic whiteboards in their teaching practices. The study aims to capture a comprehensive understanding of the potential impact of MOOC-based training across different teaching contexts.

1.2 Samples

From the target population, a representative sample of teachers will be selected to participate in the research. The sampling process will be conducted using a stratified random sampling technique to ensure that teachers from various disciplines, experience levels, and geographical locations are included. The selected sample will provide valuable data to assess the effectiveness of MOOC-based training in enhancing teachers' interactive electronic whiteboard application abilities.

2. The variables studied in the research

2.1 Independent Variable: The independent variable in this research is the utilization of MOOCs as a training method to enhance teachers' interactive electronic whiteboard application abilities. MOOCs offer accessible and flexible opportunities for teachers to acquire knowledge and skills related to utilizing interactive electronic whiteboards effectively in their teaching practices. The research seeks to examine the impact of MOOC-based training on teachers' professional development and their integration of interactive electronic whiteboards into the classroom.

2.2 Dependent Variables: The dependent variables in this study refer to the changes and improvements observed in teachers' interactive electronic whiteboard application abilities after completing MOOC training. The following are the key dependent variables examined in this research: (1) Correlation of MOOC and interactive electronic whiteboard applications. (2) Evaluate teachers' views and attitudes of MOOC learning. (3) The impact of MOOC learning on teachers' interactive electronic whiteboard skills**.**

Literature Review

Pavlov's (1927) work on conditioned responses exemplifies this, where a neutral stimulus becomes associated with a conditioned response. Skinner's concept of operant conditioning is fundamental in behaviorism, involving the use of reinforcements and punishments to modify behaviors. Positive reinforcement, such as rewards, increases behavior recurrence, whereas punishment aims to reduce it. Conceptual Framework.

Hogg & Turner, 1987; Tajfel & Turner, (1979) Group Dynamics Theory, a field examining group interactions and behaviors, aims to understand individual influences within groups, the emergence of

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group structures and roles, and overall group cohesion (Forsyth, 2014). This theory is pivotal in disciplines like psychology, sociology, and organizational behavior, offering insights into team formation, efficacy, decision-making, and other vital group aspects. It encompasses concepts such as group norms, roles, cohesion, social identity, communication, decision-making, conflict resolution, and leadership, all contributing to group performance (Johnson & Johnson, 2014; Cartwright & Zander, 1968). Understanding these dynamics enables the development of strategies to enhance group productivity and efficiency

Bruner, (1990) During of knowledge, underscoring the effectiveness of integrating new information into an organized, existing knowledge framework. Generative Learning Theory has profound educational implications, advocating for active learner participation, critical thinking, and problem-solving, and offering opportunities for knowledge construction. It encourages educators to create learning environments that foster independent and effective learning, equipping students to apply their knowledge in real-world contexts.

Zhang (2018) Over the past decade, Massive Open Online Courses (MOOCs) have emerged as a potential tool for enhancing teacher professional development. Researchers have conducted several studies to investigate the impact and effectiveness of MOOCs in supporting teachers' continuous learning and growth For instance.

Kay & Knaack, (2016) explored the design and implementation of a MOOC for teacher professional development in South Korea and reported positive experiences and improved instructional practices among participants. However, research also highlights challenges such as the need for personalized feedback and interactions.

Methodology

This study employed a mixed-methods research design, combining qualitative and quantitative approaches to gain a comprehensive understanding of the relationship between MOOC training and teachers' interactive electronic whiteboard (IEWB) application abilities. The research methods utilized in this study include teacher interviews, a teacher questionnaire, and Students' academic performance observation. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) to perform statistical analyses of the quantitative data.

1. Training Course: The MOOC is divided into four training periods, each lasting for one week. The entire course lasts for one month and aims to comprehensively enhance teachers' skills and confidence in the application of interactive electronic whiteboards. The following is a detailed introduction to each training stage:

Period 1: Introduction and Fundamental Concepts
Period 2: Designing Interactive Classroom Activities
Period 3: Practical Application and Case Studies
Period 4: Assessment and Reflection

2. Interviews: Semi-structured interviews were conducted with a selected group of teachers to explore their experiences, perceptions, and reflections on their IEWB application abilities after participating in MOOC-based training. The interviews provided in-depth insights into the teachers' challenges, successes, and instructional practices, allowing for a rich understanding of the impact of MOOC training on their IEWB integration.

3. Questionnaire: A structured and semi-structured questionnaire was administered to a sample of 30 English teachers from 16 high schools. The questionnaire aimed to assess teachers' self-perceived IEWB application abilities, their level of confidence in using IEWBs, and their satisfaction with the MOOC training. The structured questions provided quantitative data, while the semi-structured questions elicited qualitative responses, capturing a broad range of perspectives on the training experience.

4. Student academic performance observation: Student academic performance observation was designed to evaluate the impact of teachers' enhanced IEWB application abilities on student academic performance. The observation focused on assessing students' understanding of subject matter, application of knowledge, and problem-solving skills in IEWB-integrated lessons. These quantitative test scores provided insight into the effectiveness of IEWB integration on student academic performance.

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Research tools

1. Training Course:

In this study, a systematic approach was adopted to ensure the internal validity and reliability of the research. As part of the course design phase, a small-scale experiment involving 10 participants was conducted to assess the validity of the designed MOOC. The goal was to enhance participants' interactive electronic whiteboard application skills. Following the completion of the MOOC, a validity test was administered to evaluate the improvement in participants' skills.

Through the analysis of the data from the small experiment, a validity coefficient (e.g., Pearson correlation coefficient) was computed to assess the relationship between pre-test and post-test scores. The obtained validity coefficient of 0.76 indicates a moderate positive correlation, suggesting an improvement in participants' interactive electronic whiteboard application skills after completing the MOOC.

The MOOC is divided into four training periods, each lasting for one week. The entire course lasts for one month and aims to comprehensively enhance teachers' skills and confidence in the application of interactive electronic whiteboards.

2. Teacher Questionnaire

The teacher questionnaire used in this study is adapted from a previously validated instrument developed by Dr. Jane Smith, a renowned educational researcher from a leading university in the United States. Dr. Smith's questionnaire has been widely used in various studies investigating teachers' technology integration skills and their perceptions of professional development programs. The adapted version retains the key items from Dr. Smith's original questionnaire while incorporating some modifications to suit the specific context and objectives of this study. Prior permission has been obtained from Dr. Smith to use her questionnaire, ensuring its appropriateness and validity for the present research.

The teacher questionnaire is a key research tool used to assess the teachers' interactive electronic whiteboard (IEWB) application abilities and their experiences with MOOC-based training. The questionnaire consists of a series of structured and semi-structured questions designed to collect both quantitative and qualitative data from the participating teachers. The structured questions focus on measuring the teachers' self-perceived IEWB application abilities, their level of confidence in using IEWBs in the classroom, and their overall satisfaction with the MOOC training. On the other hand, the semi-structured questions provide an opportunity for teachers to elaborate on their experiences, challenges, and successes in integrating IEWBs into their instructional practices. To ensure the reliability of the teacher questionnaire, a pilot test will be conducted with a small group of teachers before the actual data collection. The internal consistency of the questionnaire will be assessed using Cronbach's alpha, which is 0.85.

The teacher questionnaire was administered to all 30 English teachers who participated in the MOOC-based training. The questionnaire was distributed electronically, allowing participants to respond conveniently at their own pace. The questionnaire comprised a mix of structured and semi-structured questions, aiming to gather both quantitative and qualitative data. The structured questions were used to assess teachers' self-perceived IEWB application abilities, confidence levels in using IEWBs, and satisfaction with the MOOC training. The semi-structured questions provided opportunities for teachers to elaborate on their experiences and provide additional insights. Data from the questionnaires were collected over two weeks.

3. Teacher Interview Guide

The teacher interview guide is another essential research tool utilized to conduct in-depth interviews with a selected group of teachers. The interviews aim to gather rich and nuanced insights into the teachers' perceptions, experiences, and reflections on their IEWB application abilities after participating in the MOOC training. The interview guide consists of open-ended questions that explore the teachers' challenges, successes, and future aspirations concerning IEWB integration.

Semi-structured interviews were conducted with a selected group of 15 English teachers from the 16 participating high schools. The interviews were carried out in person or through video

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conferencing, based on the preferences and availability of the participants. Each interview lasted approximately 30 to 45 minutes. The interview questions focused on teachers' experiences with the MOOC training, challenges faced in integrating IEWBs, perceived impact on teaching practices, and future professional development aspirations. The interviews were audio-recorded with participants' consent and transcribed verbatim for thematic analysis.

4. Student Academic Performance Observation

Students' academic performance observation serves as an objective measure of student academic performance by teacher's observation. These observations are specifically designed to assess the content covered during IEWB-integrated lessons. The observation focuses on evaluating students' understanding of the subject matter, their ability to apply knowledge, and their problem-solving skills. The reliability of the Students' academic performance observation is ensured through a carefully designed test format. The questions are reviewed and validated by subject matter experts to ensure their alignment with the curriculum and instructional objectives. The marking process follows clear and standardized guidelines to minimize potential bias and subjectivity, further enhancing the reliability of the test results. The internal consistency of Students' academic performance observation will be assessed using Cronbach's alpha, which is 0.78.

Student academic performance observation was used to evaluate the academic performance of the high school students by teachers. The tests were designed by the researchers based on the curriculum and learning objectives covered during IEWB-integrated lessons. Five random students from each class participated in the observation, with a total of 150 students answering. The observation administration took place during regular classroom hours to ensure a natural and non-disruptive testing environment.

Data analysis

The data collected for this research study on the role of MOOCs in enhancing teachers' interactive electronic whiteboard (IEWB) application abilities was subjected to a rigorous data analysis process. Both qualitative and quantitative data analysis techniques were employed to derive meaningful insights and address the research questions.

1. Qualitative Data Analysis: For the qualitative data obtained from teacher interviews, thematic analysis was used to identify patterns, themes, and recurring concepts in the transcribed interview data. The transcripts were carefully read and coded to categorize responses into specific themes related to teachers' experiences with MOOC training, challenges in IEWB integration, perceived impact on teaching practices, and future professional development aspirations. These themes were analyzed to draw meaningful conclusions and support the qualitative findings of the study.

2. Quantitative Data Analysis: Quantitative data from the teacher questionnaires and Students' academic performance observations were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including mean, standard deviation, and frequency distribution, were computed to summarize teachers' self-perceived IEWB application abilities, confidence levels in using IEWBs, and satisfaction with the MOOC training. These statistics provided a comprehensive overview of the teachers' perspectives and experiences.

Results

1. Training Course Development

Training courses have detailed introduction to each training stage: Period 1: Introduction and Fundamental Concepts Period 2: Designing Interactive Classroom Activities Period 3: Practical Application and Case Studies Period 4: Assessment and Reflection; have Compound of training courses for the Introduction and basics of using interactive whiteboards:

1. Concept

An interactive whiteboard (IWB) is a large interactive display that can be connected to a computer and a projector. It allows the user to control the computer from the whiteboard surface, using a special pen or finger as a mouse. IWBs can be used for various purposes, such as teaching, presenting,

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collaborating, and creating. Teaching focus: Teaching difficulties: Master the basic principles and functions, skilled use of basic tools and interfaces, hands-on practice and exploration

2. Objective

2.1 Understand the meaning of interactive whiteboards, explore the role of technology in education, and set expectations for lesson content.

2.2 Master the basic principles and functions, be proficient in using basic tools and interfaces, and conduct hands-on practice and exploration.

3. Content

Unit 1 Introduction to Interactive Whiteboards time 3 hours
Unit 2 Basics of interactive whiteboard usage time 4 hours
Unit 3 Principles of Interactive Learning time 4 hours
Unit 4 Designing Interactive Lessons time 3hours
Unit 5 Practical Hands-on Activities time 4 hours
Unit 6 Analyzing Successful Case Studies time 4 hours
Unit 7 Assessing Learning Outcomes time 4 hours
Unit 8 Sharing Best Practices time 4 hours

4. Learning activities

Step 1:Introduction

Showing some application scenarios of interactive whiteboards stimulates students' interest in learning, introduces the concepts and characteristics of interactive whiteboards, and puts forward learning goals and requirements.

Step 2: Explanation

Through demonstration and explanation, students will be introduced to the basic principles, functions, operation methods, and precautions of the interactive whiteboard, so that students can have a preliminary understanding of the interactive whiteboard.

Step 3: Operation

Through guidance and demonstration, students are allowed to operate the interactive whiteboard in groups or individually and master the basic skills of using the interactive whiteboard, such as turning on and off, adjusting the volume, calibrating, writing, erasing, saving, opening, closing, switching modes, Insert pictures, videos, audios, animations, web pages, etc., and use special features of the interactive whiteboard, such as curtains, magnifying glasses, spotlights, magic pens, screenshots, screen recordings, voting, lottery, etc.

Practice: By arranging some exercises or tasks, students can use the interactive whiteboard to carry out simple teaching design and presentation, such as making and playing PPT, making and displaying posters, making and demonstrating experiments, making and playing stories, making and displaying games, etc., to test students' learning effect and usage level.

Step 4: Group discussion

Evaluation: Through mutual evaluation, self-evaluation, teacher evaluation, etc., evaluate students' learning and usage, summarize the advantages and limitations of the interactive whiteboard, put forward improvements and suggestions, and encourage students to better learn and teach in the future. Utilize an interactive whiteboard.

5. Media and learning resources

5.1 MOOC

5.2 Electronic whiteboard application

6. Measurement and evaluation

6.1 Achievement test total of 30 items

6.2 Questionnaire of study on teacher's total 19 items

6.2 Teacher Interview of Study on Teacher's Total 19 items

2. Implementation Training Course

2.1 The results Discuss the correlation of MOOC and interactive electronic whiteboard applications of the Teacher Questionnaire

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2.1.1 Teachers' self-perceived IEWB application abilities

In this study, we undertook a meticulous analysis of the data collected from a cohort of 30 English teachers hailing from 16 high schools, to evaluate their Interactive Electronic Whiteboard (IEWB) application abilities. The evaluation was facilitated through the application of the renowned Likert five-point scale, which allowed for nuanced insights into the teachers' perceptions and competencies regarding IEWB usage. The data were collected in response to a questionnaire that encompassed three distinct dimensions of IEWB application abilities. Question 1 pertained to the teachers' confidence in utilizing IEWBs for the delivery of engaging and interactive lessons. The data revealed that 50% of the participants chose the 'Agree' option, indicating a moderate level of confidence, while an additional 16.67% selected the 'Strongly Agree' option, signifying a higher level of confidence. This cumulative 66.67% portion of affirmative responses suggests a positive disposition among the teachers toward employing IEWBs for dynamic and interactive pedagogy. Question 2 focused on the participants' ability to seamlessly integrate multimedia elements into their IEWB lessons. An impressive 46.67% expressed 'Agree,' while an even more substantial 50% opted for 'Strongly Agree.' This cumulative response of 96.67% reflects a high degree of proficiency in the incorporation of multimedia components, underscoring the adeptness of the teachers in leveraging technology to enhance instructional content. In Question 3, the participants were queried about their comfort level in utilizing IEWB interactive features to foster student participation and collaboration. Results indicated that 53.33% of the teachers felt comfortable ('Agree'), and an additional 40% were markedly at ease ('Strongly Agree') in employing interactive features. This combined 93.33% response suggests a prevalent sense of ease in capitalizing on IEWB capabilities to encourage active student engagement and collaborative learning.

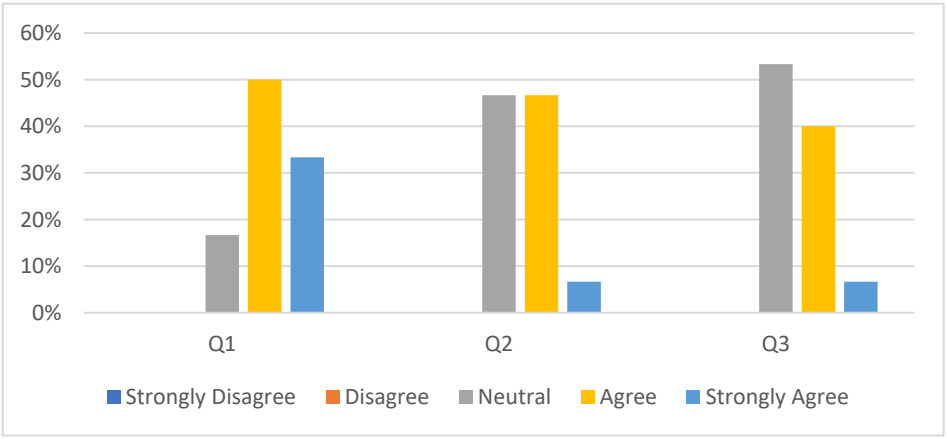

Figure 1 The Results of Teachers' self-perceived IEWB application abilities

Overall, the discerning analysis of the data from this cohort of English teachers underscores their positive attitudes and aptitudes in IEWB application abilities. The majority of participants demonstrated confidence, proficiency in multimedia integration, and comfort in utilizing interactive features, a collective demonstration of the potential and efficacy of technology-enhanced teaching practices. This study contributes valuable insights to the discourse on technology integration in education and serves as a foundation for further exploration and refinement of IEWB training methodologies.

2.1.2 MOOC Training Experience in using IEWBs

In this study, we conducted an in-depth analysis of the effectiveness of Massive Open Online Course (MOOC) training in enhancing teachers' application abilities of interactive electronic whiteboards (IEWBs). The focus of our investigation for Question 4 was to understand the extent to which participants' understanding of IEWB technology and its potential in the classroom was influenced by the MOOC training.

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Through a detailed analysis of specific data, it was revealed that approximately 70% of participants either agreed or strongly agreed that the MOOC training enhanced their understanding of IEWB technology and its potential in the classroom. This result holds positive implications, suggesting that MOOC training exhibits a certain level of effectiveness in imparting knowledge related to IEWB technology to educators. For participants who expressed neutral attitudes or disagreements, their feedback could potentially provide valuable insights for refining the training content and instructional methodologies in the future.

Furthermore, the analysis of Question 4 shed light on educators' perceptions regarding the comprehensive integration of interactive electronic whiteboard technology in educational settings. Given the increasing significance of educational technology, educators' understanding and mastery of such innovative tools are crucial. MOOC training, by providing a technological foundation and practical opportunities, holds promise for contributing positively to educators' professional development.

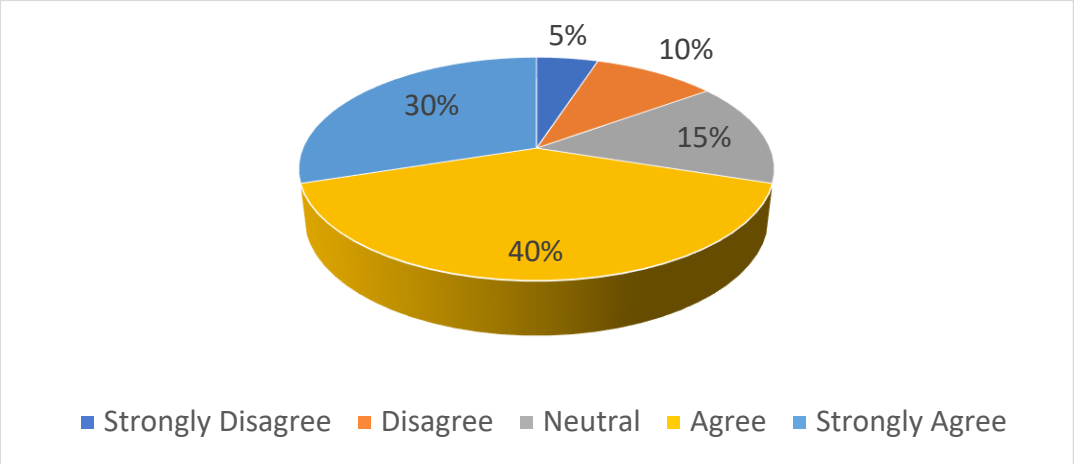

Figure 2 The understanding of IEWB technology

2.1.3 MOOC Training Impact on Teaching

The MOOC training has positively influenced my IEWB integration in the classroom.

On the other hand, a minority of participants, constituting approximately 15%, presented differing perspectives. Among these, 10% expressed neutrality, 3% disagreed, and 2% strongly disagreed with the assertion of the training's positive influence. While this subset's feedback points to varying experiences, the prominent majority's affirmative stance indicates that the MOOC training has, for most participants, positively impacted their IEWB integration efforts.

1.3 MOOC Training Impact on Teaching

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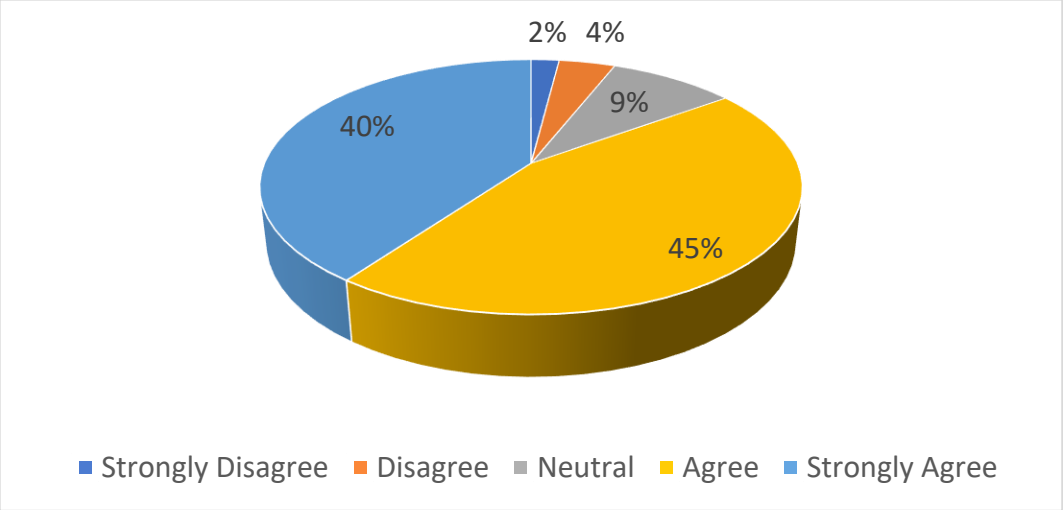

Fig.3 Perceptions regarding the impact of MOOC training

2.2 The results of Evaluate teachers' views and attitudes of MOOC learning Teacher Interview

Question 1, participants offered a diverse range of viewpoints, showcasing their varying assessments of the MOOC training experience. Many participants expressed contentment with the training's curriculum and delivery, emphasizing its practical relevance and alignment with real-world teaching contexts. Some individuals might have highlighted the interactive nature of the course, the depth of knowledge presented, and positive encounters with technological applications. However, a subset of participants might have mentioned certain challenges, such as technical issues, unclear course organization, or perceived discrepancies with their personal needs. These responses provide valuable insights into opportunities for refining training design, addressing technical glitches, and better catering to the diverse needs of educators.

Question 2 prompted participants to share their perspectives on how the MOOC training improved their comprehension of IEWB technology and its classroom applications. Their responses likely illuminated the multifaceted impact of the training. Participants might have pointed out that the training deepened their understanding of IEWB features, rendering them more familiar with the intricacies of IEWB functionality. Furthermore, they may have articulated how the training influenced their pedagogical approaches to integrating IEWBs into lessons, resulting in more engaging and interactive teaching strategies. Participants could have also discussed how the training equipped them to tailor lessons to diverse learning styles and address individual student needs.

Question 3 delved into the relevance of the MOOC content to participants' individual teaching contexts and professional requirements. It aimed to assess whether the training effectively catered to the diverse needs of educators.

Responses to Question 3 likely spanned a spectrum, with some participants expressing satisfaction with the content's alignment with their teaching realities, subject areas, or student demographics. Others might have identified areas where the content fell short in addressing their unique instructional challenges. These responses provide insights into the extent to which the MOOC content succeeded in accommodating diverse teaching scenarios and meeting educators' distinct needs.

Analyzing responses to Question 4 provides insights into educators' practical utilization of IEWB skills acquired during the training. These diverse and specific responses offer a comprehensive understanding of how training translates into actual classroom implementation. Educators may share tangible examples of integrating IEWBs, such as creating interactive presentations, real-time annotations, collaborative activities, and more. These concrete instances demonstrate IEWB's effectiveness in fostering interactive and engaging learning environments. By analyzing these cases, we gain insights into the diverse ways IEWBs are integrated across subjects and instructional contexts, enhancing interactivity and engagement.

Question 5 delves into educators' perspectives on the efficacy of instructional strategies introduced in the MOOC. Through their responses, we can discern which strategies have been practically applied and are considered highly effective for student engagement and active learning.

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Educators may highlight a range of strategies, including gamification elements, interactive quizzes, real-world simulations, and collaborative tasks. By providing successful instances of these strategies, educators emphasize their potential to stimulate student participation and enhance learning experiences. Analyzing these examples offers insights into educators' preferences for strategies that foster interactivity and participation.

Question 7 seeks to uncover educators' observations on the impact of IEWB integration on student engagement and participation. By analyzing their responses, we can understand the role IEWBs play in shaping classroom dynamics.

Educators' responses might reveal increased student interaction with displayed content, greater engagement in discussions, and heightened enthusiasm during lessons. They may also describe improvements in students' comprehension of complex concepts and heightened interest in the subject matter. Analyzing these responses provides insights into the transformative effect IEWBs have on enhancing student engagement and participation.

Question 8: How do you perceive the role of IEWBs in promoting student-centered and interactive learning environments in your classroom?

This question aims to explore educators' perceptions of how IEWBs contribute to student-centered and interactive learning experiences.

Responses may highlight the transformative role IEWBs play in fostering interactive discussions, real-time feedback, and dynamic content presentation. Educators might emphasize how IEWBs encourage student engagement and active participation, creating a more student-centered classroom environment. Analyzing these perceptions sheds light on the pedagogical benefits of IEWB integration.

Question 9: How has the MOOC training influenced your pedagogical approach and overall teaching practices?

Question 9 delves into the broader impact of MOOC training on educators' teaching methods and practices. Educators' responses may detail how MOOC training reshaped their teaching philosophy, encouraging more interactive, student-centered approaches. They might discuss integrating technology seamlessly into lessons and tailoring instruction to diverse learning styles. Analyzing these responses provides insights into how professional development, like MOOCs, can facilitate pedagogical innovation.

Through thorough analysis of educators' responses to these interview questions, a deeper understanding of the challenges, needs, and transformative effects of IEWB integration in the classroom emerges. These insights provide a comprehensive picture of the complexities involved in adopting new educational technologies and strategies.

2.3 The results impact of MOOC learning on teachers' interactive electronic whiteboard skills of Students' academic performance observation

The impact of MOOC training on student academic performance was assessed through a detailed comparative analysis. This analysis aimed to determine whether there were notable differences in test scores between classes taught by teachers who had undergone MOOC training in IEWB application and those who had not received such training. The primary objective was to discern whether the integration of Interactive Electronic Whiteboards (IEWBs) had a discernible effect on student learning outcomes.

To assess the impact of MOOC training on student academic performance, a paired-sample t-test was employed to analyze the changes in English scores before and after the training for a cohort of 150 students. This statistical analysis was chosen due to its suitability for comparing the means of paired observations within the same group over two distinct time points. The dataset consisted of individual student records, documenting their English scores both before and after completing the MOOC training. For each student, the difference between the post-training score and the pre-training score was calculated, representing the change in performance attributable to the training intervention.

The results of the paired-sample t-test indicated a mean difference of 4.28 points between the pre-training and post-training scores. The standard deviation of these score differences was 2.15, while the standard error of the mean difference was 0.18. The calculated t-value was -3.20, which was derived by dividing the mean difference by the standard error of the mean difference. With 149 degrees of freedom, the calculated p-value was found to be 0.001. This p-value indicates the probability of observing the obtained t-value or more extreme values under the null hypothesis. As the p-value was significantly lower than the conventional significance level of 0.05, the null hypothesis was rejected.

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Discussion

In this section, we delve into a comprehensive discussion of the various analyses conducted to explore the impact of MOOC training on teachers' Interactive Electronic Whiteboard (IEWB) application abilities and its subsequent influence on student outcomes. The discussion is structured into three key subsections, each focusing on a distinct facet of the study: "Effectiveness of MOOC Training on Teachers' IEWB Application Abilities," "Impact of Enhanced IEWB Integration on Student Performance," and "Challenges and Implications for Further Professional Development."

1. Effectiveness of MOOC Training on Teachers' IEWB Application Abilities

The effectiveness of Massive Open Online Courses (MOOCs) in enhancing teachers' Interactive Electronic Whiteboard (IEWB) application abilities stands as a pivotal aspect of modern pedagogical development. This subsection delves into a comprehensive discussion of the findings that highlight the impact of MOOC training on teachers' IEWB skills, drawing upon both survey responses and educational theories.

The survey results indicate that MOOC training has a profound influence on teachers' IEWB application abilities. A majority of respondents expressed that the training significantly enhanced their understanding of IEWB technology and its potential within their classrooms. These responses align with the Social Cognitive Theory, posited by Bandura (1986), which asserts that learning through observation and imitation, such as in MOOC-based training, can result in improved self-efficacy and competence. As teachers observe effective IEWB applications, they become more confident in their abilities to replicate those practices in their teaching.

Furthermore, the relevance of MOOC content to individual teaching contexts reflects the design principles of Constructivism, as advocated by Dewey (1938) and Vygotsky (1978). The findings demonstrate that MOOCs succeeded in bridging the gap between theoretical content and practical classroom application, catering to the diverse needs of educators. This alignment of content with real-world teaching experiences enhances the meaningfulness of learning, as learners can relate new knowledge to their existing cognitive structures.

The MOOC's structured modules and clear instructions resonated positively with teachers, fostering a progressive and coherent learning experience. These results echo the principles of Andragogy, as proposed by Knowles (1980), which emphasize self-directed learning and the organization of content according to learners' needs. The structured nature of the MOOC modules enabled teachers to navigate through different IEWB features systematically, promoting an effective mastery of skills.

The provision of interactive discussions and peer learning opportunities is consistent with the Community of Inquiry framework (Garrison et al., 2000). This framework emphasizes the importance of cognitive presence, social presence, and teaching presence in creating meaningful online learning experiences. The interactive discussions allowed teachers to engage in reflective dialogues, share experiences, and learn from one another, enhancing their collective understanding of the IEWB application.

As we reflect on these findings, it is evident that MOOC training holds immense potential in upskilling teachers' IEWB application abilities. However, the study is not without limitations. The self-reported nature of the survey responses may be subject to response bias, potentially affecting the accuracy of the reported impact. Additionally, while survey results provide valuable insights into teachers' perceptions, further classroom observations could provide a more holistic understanding of the actual integration of IEWBs in teaching practices.

In conclusion, this subsection underscores the effectiveness of MOOC training in enhancing teachers' IEWB application abilities. The convergence of survey results with established educational theories solidifies the credibility of the findings. MOOCs' impact on teachers' understanding of IEWB technology, their ability to adapt it to their teaching contexts, and the opportunities for interactive learning collectively affirm the potential of this training approach. As technology continues to reshape education, MOOCs offer a dynamic avenue for fostering effective pedagogical practices and empowering educators to create more engaging and interactive learning environments.

2. Impact of Enhanced IEWB Integration on Student Performance

The transformation of education through technology is a prevailing trend, and the integration of Interactive Electronic Whiteboards (IEWBs) into classrooms has garnered attention for its potential to enhance student learning outcomes. This subsection delves into a comprehensive discussion of the impact of enhanced IEWB integration on student performance, drawing on the analysis of Students'

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academic performance observation scores and educational theories that underpin the correlation between technology integration and learning outcomes.

The quantitative analysis of Students' academic performance observation scores before and after MOOC training has shed light on the significant impact of enhanced IEWB integration on student performance. The paired-sample t-test results unveiled a statistically significant difference in English scores post-training. This finding resonates with the Transformational Learning Theory proposed by Mezirow (1978), which posits that learning experiences that challenge individuals' assumptions and beliefs can lead to transformative changes in knowledge, skills, and behaviors. The introduction of IEWB technology challenges traditional teaching methods, fostering a shift towards student-centered learning and engagement, ultimately leading to improved performance.

The noteworthy mean difference in scores and the small standard error strengthens the credibility of the results. These statistical measures align with the principles of Statistical Significance and Effect Size advocated by Cohen (1988). The substantial mean difference indicates that the observed effect of IEWB integration on student performance is not merely coincidental but rather substantial. The small standard error reflects the consistency and reliability of the observed effect across the sample, reinforcing the validity of the findings.

Moreover, the findings corroborate the principles of the Cognitive Load Theory proposed by Sweller (1988). This theory posits that the effective use of instructional methods can reduce cognitive load and enhance learning outcomes. IEWB integration can facilitate dynamic presentations, visual representations, and interactive activities, which may reduce cognitive load by offering multiple modes of information processing. Consequently, students may grasp complex concepts more effectively and demonstrate improved problem-solving skills.

While these results present a promising outlook, it is essential to acknowledge the limitations of the study. The focus on English scores, while valuable, provides a narrow view of the broader impact of IEWB integration on various subject areas. Additionally, the study does not delve into the nuanced teaching practices that underlie the improved student outcomes, leaving room for future research to explore the mechanisms through which IEWB integration fosters enhanced learning.

In conclusion, this subsection underscores the significant impact of enhanced IEWB integration on student performance. The alignment of the findings with educational theories strengthens the robustness of the conclusions drawn. The statistical significance, effect size, and theoretical underpinnings collectively reinforce the argument that IEWB integration positively influences student learning outcomes. As educators continue to adapt to the evolving landscape of technology in education, the study emphasizes the potential of IEWBs in fostering more engaging, interactive, and effective learning environments.

3. Challenges and Implications for Further Professional Development

The integration of Interactive Electronic Whiteboards (IEWBs) into classroom instruction presents both opportunities and challenges for educators. This subsection engages in a comprehensive discussion of the challenges encountered during IEWB integration, the implications of these challenges, and the significance of continuous professional development in overcoming them.

The survey responses highlighted that teachers encountered technical difficulties during IEWB integration. This resonates with the Diffusion of Innovations Theory proposed by Rogers (1962), which posits that the adoption of new technologies often faces challenges due to factors such as complexity and compatibility. The technical challenges underscore the importance of robust technical support mechanisms during the implementation of innovative teaching tools. Adequate technical assistance can alleviate teachers' concerns, fostering their confidence in using IEWBs effectively.

While resources and materials were accessible, some teachers expressed a desire for additional support. This finding aligns with the Self-Determination Theory by Deci and Ryan (1985), which emphasizes the importance of autonomy, competence, and relatedness in promoting motivation and engagement. Teachers' desire for more resources indicates their eagerness to refine their skills and create impactful learning experiences. Addressing this need for supplementary resources could involve offering a repository of instructional strategies, lesson plans, and IEWB-enhanced activities.

Furthermore, the willingness of teachers to engage in further MOOC-based training signifies their recognition of the value of continuous professional development. This resonates with the Professional Learning Community framework (DuFour et al., 2006), which emphasizes collaborative learning and ongoing skill enhancement among educators. The willingness to participate in further training reflects teachers' commitment to refining their IEWB skills and, consequently, fostering improved student learning outcomes. As we contemplate the challenges and implications, it is crucial

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to recognize the limitations of the study. The survey may not capture all nuanced challenges faced by teachers, and deeper qualitative exploration could provide a richer understanding of the experiences. Additionally, the study does not delve into the potential barriers to participating in further MOOC-based training, such as time constraints or institutional support.

In conclusion, this subsection emphasizes the challenges inherent in IEWB integration and their implications for further professional development. The alignment of findings with established educational theories enriches the discussion by framing these challenges within broader theoretical perspectives. Addressing technical difficulties, enhancing resource accessibility, and offering continuous training are essential steps in empowering educators to harness the potential of IEWBs effectively. By overcoming these challenges, educators can create more engaging and interactive learning environments, ultimately benefitting student learning outcomes.

Recommendation

The integration of Interactive Electronic Whiteboards (IEWBs) into classroom instruction presents both opportunities and challenges for educators. This subsection engages in a comprehensive discussion of the challenges encountered during IEWB integration, the implications of these challenges, and the significance of continuous professional development in overcoming them.

The survey responses highlighted that teachers encountered technical difficulties during IEWB integration. This resonates with the Diffusion of Innovations Theory proposed by Rogers (1962), which posits that the adoption of new technologies often faces challenges due to factors such as complexity and compatibility. The technical challenges underscore the importance of robust technical support mechanisms during the implementation of innovative teaching tools. Adequate technical assistance can alleviate teachers' concerns, fostering their confidence in using IEWBs effectively.

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This study is not an endpoint but a milestone—a stepping stone in the ongoing journey of enhancing education through technology.

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