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The Current Status of the use of Gizmos Interactive Simulations in Teaching Science and Social Studies - 3rd Grade: A Case Study in Selected Primary Schools in Vietnam

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ABSTRACT: Information technology is playing an increasingly important role in education, particularly in subjects that require visual representation, such as Science and Social Studies at the elementary level. This study evaluates the current application of Gizmos interactive simulations in teaching science and social studies - 3rd grade at selected elementary schools in Vietnam. Through a survey of 57 primary school teachers, the study analyzes the extent of usage, benefits, challenges, and potential solutions to enhance the effectiveness of this tool.The findings reveal that while most teachers are inclined to integrate technology into their teaching, the use of interactive simulations remains limited. The primary challenges include language barriers, a lack of detailed instructional guidance, and insufficient infrastructure. Nevertheless, the majority of teachers recognize the potential of Gizmos interactive simulations to enhance teaching effectiveness through their interactive and visually engaging nature. Based on these findings, the study proposes several strategies to promote the adoption of Gizmos interactive simulations in elementary education, contributing to the overall improvement of teaching quality in the context of comprehensive educational reform. These insights not only provide an overview of the current use of interactive simulations in elementary instruction but also offer practical solutions to optimize their implementation, helping teachers more easily access modern educational technology.

KEYWORDS: teaching, interactive simulations, Gizmos, science and social studies, grade 3.

1. INTRODUCTION

Simulated experiments/ interactive simulations in teaching serve as instructional tools that replicate real-world phenomena, processes, or experiments within a virtual environment through specialized software. These simulations allow students to observe and explore properties and relationships between objects in a visually engaging, interactive, and effective manner. Moreover, simulations can be reused multiple times without incurring significant maintenance or replacement costs, creating a sustainable and cost-efficient learning environment. In modern education, the integration of information technology in teaching has become increasingly common, particularly in primary education. Numerous studies [1], [2], [3], [4], [5], [6], [7] highlight that one of the most notable innovations in teaching methodology is the use of simulated experiments/ interactive simulations to reconstruct scientific phenomena. This approach helps students comprehend abstract concepts more effectively through visual and interactive experiences.

According to Hoang Thi My Linh (2017), simulated experiments/ interactive simulations are constructed using virtual tools and objects based on real-world counterparts. When performing these simulations, results align with natural scientific laws, just as they would in real-life experiments. Engaging with simulated experiments/ interactive simulations enables students to discover properties and relationships between objects [1]. Erlam, G. D., Smythe, L., and Wright-St Clair, V. (2017) emphasize that simulation itself is not a pedagogy but rather an immersive teaching/learning platform that represents a functioning system or process [8]. Simulated experiments/ interactive simulations create an interactive and intuitive learning environment where students can directly observe phenomena and engage with simulation tools. This hands-on interaction fosters independent exploration and personalized learning [2]. In addition to knowledge acquisition, simulated experiments/ interactive simulations play a crucial role in enhancing teaching effectiveness, significantly improving both knowledge transmission and retention. By replicating complex phenomena and processes, simulations stimulate curiosity and creative thinking among students. Engaging with these simulations allows learners to access information directly while encouraging exploration and experiential learning. This approach promotes creativity, problem-solving skills, and independent inquiry [3], [4], [9]. The study "The Influence of Gizmos Digital Simulation on the Perceptions of

Grade 9" by Jaymar S. Dela Cruz and John Patrick Carl R. Hermosura highlights the benefits of integrating Gizmos digital simulations in science education. Their research underscores how digital simulations enhance students' learning experiences and comprehension of scientific concepts. Additionally, they stress the need for targeted methodologies to address gender-related variations in technology adoption and attitudes, ensuring equitable learning benefits [6].

Furthermore, instead of preparing physical materials and equipment for real-world experiments, simulated experiments/ interactive simulations allow for the recreation of scientific phenomena in a visually intuitive manner, eliminating the need for significant resource expenditures. This advantage is particularly critical for schools or educational institutions with limited budgets, as acquiring, maintaining, and replacing laboratory equipment—such as chemicals, measuring instruments, and specialized experiment kits—can be costly.

Recognizing the substantial benefits of simulated experiments/ interactive simulations in teaching, especially in science education, several international and bilingual schools in Vietnam, such as Vinschool, Wellspring, and the Vietnam Australia International School (VAS), have pioneered the integration of advanced technology into their curricula. These institutions use simulation software to illustrate complex scientific phenomena. Additionally, some public primary schools in major cities—such as Le Van Tam Primary School (Hanoi) and Nguyen Binh Khiem Primary School (Ho Chi Minh City)—have begun incorporating simulated experiments/ interactive simulations into STEM education programs. Private schools like Doan Thi Diem Primary School and Star Hanoi Primary School invest not only in modern facilities but also in software tools such as PhET and Crocodile Physics to support teaching.

However, in Vietnam, research on the application of interactive simulations /digital simutations in primary education remains limited, particularly concerning the subject Science and Social Studies in third grade. Most studies focus on integrating technology into STEM subjects or higher education levels, while primary education—especially interdisciplinary subjects like Science and Social Studies—has not been thoroughly examined. Additionally, no research has systematically evaluated the current use of Gizmos interactive simulations/ interactive simulations in primary education at public schools in Vietnam. The challenges that teachers face when adopting and implementing this tool have yet to be systematically analyzed. This gap highlights the urgent need for further investigation.

Therefore, this study aims to assess the current status of using Gizmos interactive simulations in teaching Science and Social Studies in third grade at selected public primary schools in Vietnam. Based on the findings, the research proposes appropriate solutions to enhance the effective application of this tool in teaching. This study not only provides empirical data on the use of simulated experiments/ interactive simulations in primary education but also offers strategic recommendations to help teachers maximize the benefits of technology in improving instructional quality.

2. MATERIALS AND METHODS

2.1. Participants

To assess the current state of teaching Science and Social Studies in third grade at primary schools and to develop a teaching process for selected lessons within this subject, we designed a survey questionnaire regarding the use of simulated experiments/ interactive simulations in teaching Science and Social Studies in third grade.

The survey consisted of 12 questions, focusing on the extent of technology integration in teaching, particularly the use of simulated experiments/ interactive simulations in general education and Gizmos interactive simulations in teaching Science and Social Studies in third grade. The survey was conducted from December 19, 2024, to December 31, 2024, involving 57 primary school teachers from four different primary schools: Gia Thanh Primary School and Gia Van Primary School (Gia Vien District, Ninh Bình Province); Dong Cao Primary School (Pho Yen City, Thai Nguyen Province); Thong Nhat Primary School (Thai Nguyen City, Thai Nguyen Province).

The survey aimed to collect detailed information to serve as a basis for analyzing and proposing effective teaching solutions for Science and Social Studies in third grade.

Table 1. Demographic Information of Survey Participants

	Gender			Teaching experience				Education level		
	Male	Female	Other	Less than 5 years	5 to under 10 years	10 to under 15 years	Over 15 years	College	University Degree	Master's Degree
Number of Teachers	4	53	0	10	13	13	21	6	50	1
Percentage (%)	7	93	0	17,5	22,8	22,8	36,9	10,5	87,7	1,8
Total	57(100%)			57(100%)				57(100%)		

2.2. Methods

To conduct this study, we developed a meticulously designed online survey questionnaire using Google Forms. The questionnaire was structured clearly and included a variety of question types to comprehensively gather teachers' perspectives on the use of simulated experiments/ interactive simulations in teaching Science and Social Studies in third grade.

We opted for a 100% online survey format because some questions required teachers to access external links and watch embedded videos illustrating specific simulations. After finalizing the questionnaire on Google Forms, we distributed the survey link to teachers via Zalo—a widely used, convenient, and secure social networking platform in Vietnam. This distribution method ensured ease of access, quick response times, and high participation rates. By leveraging Zalo, we maximized teacher engagement, ensuring rich, diverse, and reliable data collection.

The survey was designed to collect detailed information on key aspects such as:

- The extent to which simulated experiments/ interactive simulations are used in teaching,
- The perceived effectiveness of simulations in lesson delivery,
- The challenges teachers face when adopting simulated experiments/ interactive simulations, particularly those from the Gizmos simulation library.

The collected data was processed using descriptive statistical analysis to determine:

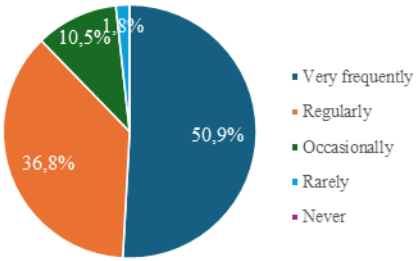
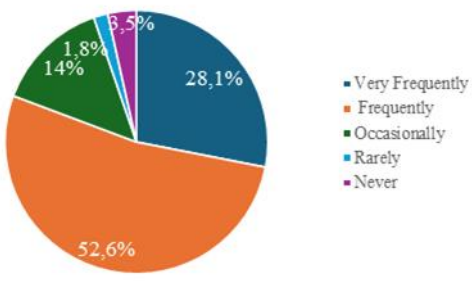
- The frequency of simulated experiment use,
- The teachers' familiarity with Gizmos,
- The barriers encountered, and
- The level of support teachers require to integrate these tools effectively.

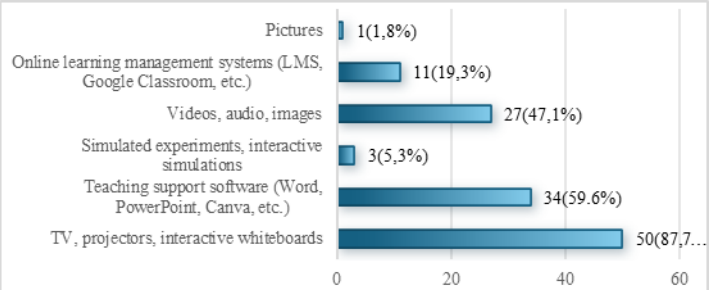
For statistical analysis, we used SPSS 26 to calculate frequencies, percentages, and key trends in teachers' responses, providing a clear, data-driven overview of the current application of simulated experiments/ interactive simulations in primary education.

3. RESULTS AND DISCUSSION

Based on the research objectives and survey design principles, we developed and refined the questionnaire content. The next steps involved designing an online survey using Google Forms, generating a survey link, distributing it to teachers at the selected primary schools, and analyzing the collected responses. The key findings from the survey are as follows:

Group 1: *Assessment of Information Technology (IT) Application in Teaching, Particularly in Science and Social Studies for Third Grade*

Survey questions and Results	Result analysis
Q1.1: Frequency of IT use in teaching  **Figure 1: The chart illustrates the frequency of IT use in teaching.**	The survey results indicate that 87.7% of teachers use IT regularly or very frequently, younger teachers tend to adopt technology more readily, while teachers with longer experience are less inclined to integrate IT due to traditional teaching habits. This trend aligns with the research of Ertmer & Ottenbreit-Leftwich (2010), which suggests that younger teachers are more open to adopting new technologies [10].
Q1.2: Frequency of IT use in teaching Science and Social Studies  **Figure 2: The chart illustrates the frequency of IT use in teaching Science and Social Studies.**	80.7% of teachers use IT frequently in this subject, which is slightly lower than the general IT application rate. Some teachers limit their IT use due to the subject's nature, which requires hands-on activities and real-world experiments. This finding is consistent with Hew & Brush (2007), who identified barriers such as lack of skills, resources, and infrastructure when integrating technology into teaching [11].

Q1.3: Common IT tools used by teachers  **Figure 3: The chart illustrates the common IT tools used by teachers in teaching.**	Among the IT tools used in teaching, 87.7% of teachers use projectors and interactive boards, 59.6% use presentation software, while only 5.3% use simulated experiments/ interactive simulations. Teachers prefer user-friendly tools over simulated experiments/ interactive simulations, which require higher technical expertise. This finding is in line with the study by Nguyen Thi Hao (2014), which highlighted that a lack of resources and training is the main barrier to adopting simulation-based teaching [12].

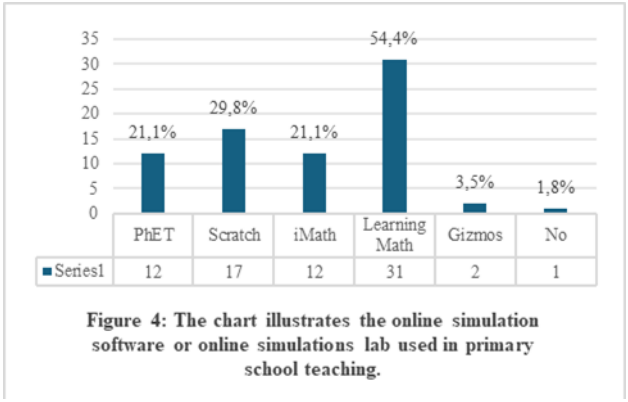
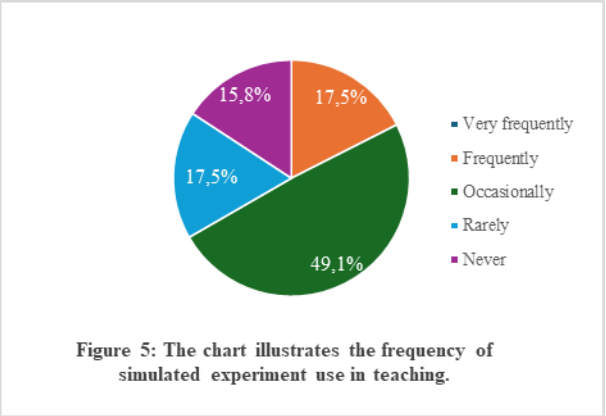
General evaluation of group 1 results

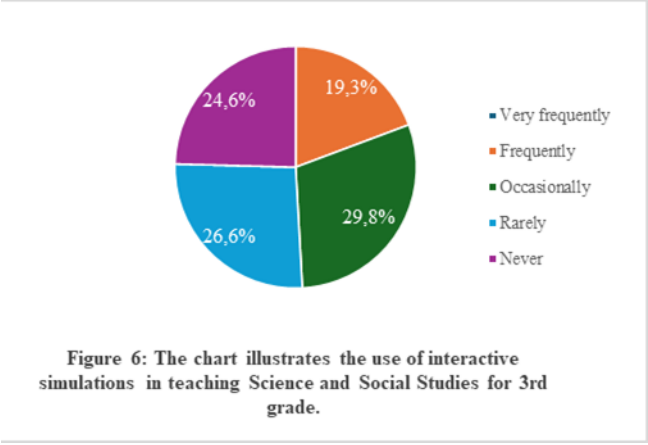
The survey results show that IT integration in teaching has been widely adopted by primary school teachers, especially in Science and Social Studies. A large proportion of teachers (87.7%) frequently or very frequently use IT in their teaching, confirming its crucial role in improving instructional quality.

For Science and Social Studies, given its emphasis on real-world applications and visual learning, 80.7% of teachers use IT, which enhances the subject's engagement and effectiveness.

However, modern tools like virtual experiments or interactive simulations remain underutilized (only 5.3%), indicating the need for further training and support to integrate advanced educational technologies effectively.

Group 2: *Evaluation of Simulated Experiment Applications in Teaching, Particularly in Science and Social Studies for Third Grade*

Survey questions and Results	**Result Analysis**
Q2.1: Online simulation software or online simulations lab used in primary school teaching  **Figure 4: The chart illustrates the online simulation software or online simulations lab used in primary school teaching.**	Learning Math (54.4%) and Scratch (29.8%) are the most commonly used; Gizmos (3.5%) and PhET (21.1%) have very low adoption rates. This reflects a tendency among primary school teachers to favor user-friendly, visually supportive tools over specialized simulation software that requires deeper expertise. This aligns with Nguyen Thi Hao's (2024) research, which found that despite the benefits of simulated experiments/ interactive simulations, language barriers, lack of guidance, and limited resources discourage teachers from adopting these tools [12].
Q2.2: Frequency of simulated experiment use in teaching  **Figure 5: The chart illustrates the frequency of simulated experiment use in teaching.**	The data from Figure 5 reflects the extent of simulated experiment use in primary school teaching. The results show that the use of simulated experiments/ interactive simulations by teachers is still limited, with the majority of teachers using them only occasionally (49.1%) or rarely (17.5%), while only 35% of teachers use them regularly or very frequently. In this survey, it is evident that many teachers still use simulated experiments/ interactive simulations in a limited manner, and they have not yet become an integral part of teaching. The main reasons for this may stem from insufficient infrastructure, lack of teaching resources, and limited teacher proficiency in using simulation software.

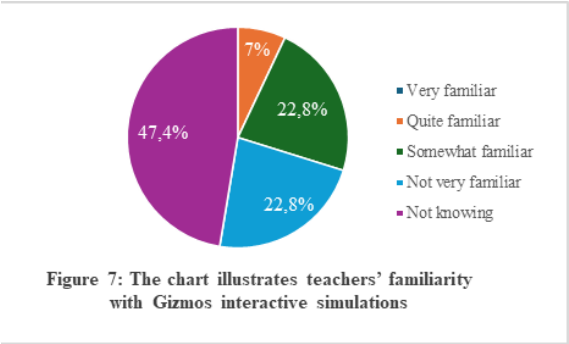
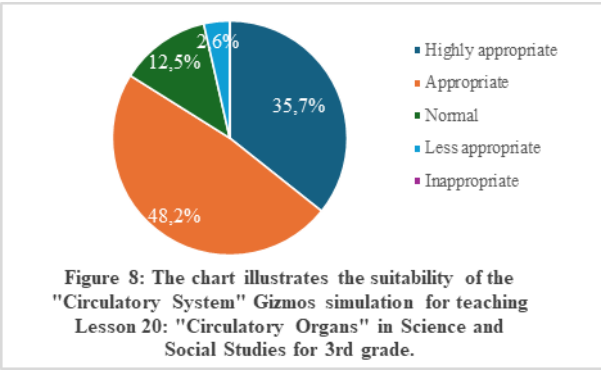
Q2.3: Use of interactive simulations in teaching Science and Social Studies for 3rd grade  **Figure 6: The chart illustrates the use of interactive simulations in teaching Science and Social Studies for 3rd grade.**	The survey data presented in Figure 6 indicates that the use of simulated experiments/ interactive simulations in Science and Social Studies for third grade remains low, with nearly 50.9% of teachers using them at a minimal level or not at all. This may be due to limited resources, insufficient proficiency in using simulation software, and the specific nature of the subject. To address this issue, it is essential to implement policies that support teachers, enhance training programs, and invest in teaching resources, ensuring that simulated experiments/ interactive simulations become an integral part of teaching Science and Social Studies for 3rd grade.

General evaluation of group 2 results

Despite growing awareness of the benefits of simulated experiments/ interactive simulations, their adoption remains limited in primary education. Most teachers still prioritize traditional teaching tools such as projectors and presentation software, rather than interactive simulations.

For Science and Social Studies in third grade, nearly 50% of teachers rarely or never use simulated experiments/ interactive simulations, highlighting a lack of resources and specialized training. This aligns with previous studies [12] that identified key barriers to technology integration in education.

Group 3: *Evaluation of the Applicability of Gizmos interactive simulations*

Survey questions and Results	**Result Analysis**
Q3.1: Teachers' familiarity with Gizmos interactive simulations (https://gizmos.explorelearning.com/)  **Figure 7: The chart illustrates teachers' familiarity with Gizmos interactive simulations**	The survey results from Figure 7 reflect primary school teachers' familiarity with interactive simulations in the Gizmos library. The findings indicate that most teachers are either unaware of Gizmos or have very limited knowledge of it, with 47.4% of teachers not knowing about this tool at all and 22.8% stating they are "not very familiar" with it. This suggests that the recognition of Gizmos within the teaching community remains very low, despite its strong potential as a powerful educational tool for enhancing instruction.
Q3.2: Suitability of the "Circulatory System" Gizmos simulation for teaching Lesson 20: "Circulatory Organs"- Science and Social Studies for 3rd grade  **Figure 8: The chart illustrates the suitability of the "Circulatory System" Gizmos simulation for teaching Lesson 20: "Circulatory Organs" in Science and Social Studies for 3rd grade.**	The analysis of the results shows that over 80% of teachers recognize the suitability of Gizmos interactive simulations for teaching the circulatory system, affirming that this tool has great potential in supporting instruction. However, despite the high awareness of the benefits of simulations, their actual usage remains low due to limited resources, insufficient training, and teachers' lack of technological proficiency. Therefore, to fully leverage the potential of Gizmos, it is necessary to implement supportive policies, invest in teacher training, and expand experimental research to optimize the application of simulated experiments/ interactive simulations in teaching Science and Social Studies.

Q3.3: Suitability of the "Pollination Process" Gizmos simulation for teaching Lesson 13: "Plant Parts" - Science and Social Studies for 3rd grade

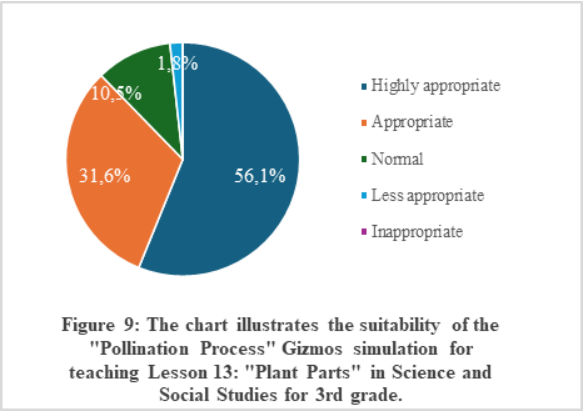


Figure 9: The chart illustrates the suitability of the "Pollination Process" Gizmos simulation for teaching Lesson 13: "Plant Parts" in Science and Social Studies for 3rd grade.

The survey results indicate that over 87% of teachers consider the Gizmos simulated experiment "Pollination Process" to be appropriate or highly appropriate for teaching Lesson 13 in Science and Social Studies for third grade. This confirms that simulation technology has great potential in supporting the teaching of natural phenomena, allowing students to observe and better understand the pollination process.

However, compared to the findings from Question 3.1 (Figure 7), where 70.2% of teachers were unfamiliar or completely unaware of Gizmos, these results suggest that while teachers acknowledge the usefulness of simulated experiments/ interactive simulations, their actual implementation remains limited. This aligns with the study by Ertmer & Ottenbreit-Leftwich (2010), which emphasizes that despite teachers' positive perceptions of technology, its practical application depends on multiple factors such as training, resources, and technical support. [10]

Q3.4: Overall usefulness of Gizmos in teaching Science and Social Studies for third grade

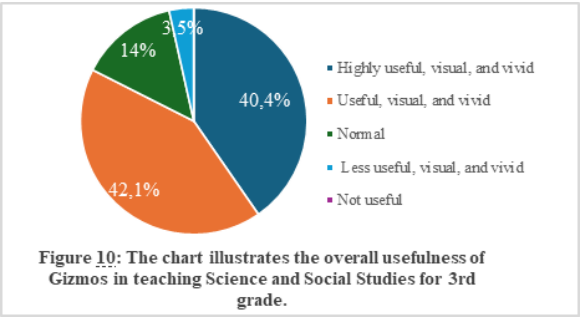


Figure 10: The chart illustrates the overall usefulness of Gizmos in teaching Science and Social Studies for 3rd grade.

The survey results indicate that 82.5% of teachers consider Gizmos interactive simulations to be useful, visually engaging, and interactive, reaffirming that simulation technology has significant potential in teaching Science and Social Studies for third grade. However, despite the highly positive perception, actual implementation remains limited, possibly due to a lack of training, resources, or instructional guidance.

Q3.5: Challenges in using Gizmos simulations

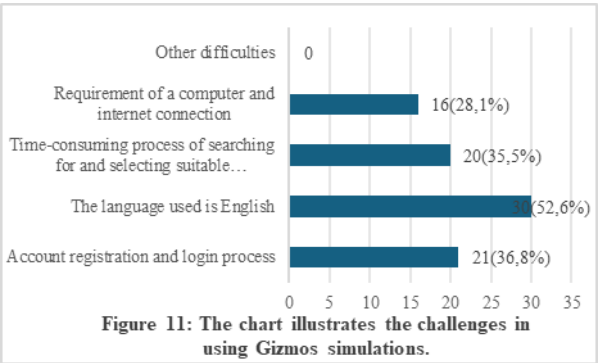


Figure 11: The chart illustrates the challenges in using Gizmos simulations.

Regarding the challenges teachers face when accessing Gizmos interactive simulations, the survey results indicate that the biggest barrier is the language issue (52.6%), followed by account registration difficulties (36.8%) and finding relevant content (35.5%). Additionally, device requirements and internet connectivity are also limitations for some teachers (28.1%). These challenges align with barriers identified in previous studies, particularly the lack of native language support, suboptimal user experience, and inconsistent infrastructure conditions.

Q3.6: Teachers' willingness to use Gizmos simulations in teaching

Among the 57 surveyed teachers, 55 teachers (96.5%) expressed willingness to use interactive simulations from the Gizmos library to support the teaching of Science and Social Studies 3rd grade. Only 2 teachers (3.5%) were not yet ready to adopt this tool.

Reasons why teachers are willing to use Gizmos

Despite variations in wording, the majority of teachers agreed that simulated experiments/ interactive simulations offer numerous practical benefits for teaching, including:

- Enhanced visual representation and engagement: Images and simulations help illustrate complex concepts, making knowledge transmission more effective than traditional teaching methods.
- Facilitating easier knowledge acquisition for students: Students can directly observe scientific processes, improving their comprehension, especially for abstract topics.

- Encouraging learning interest and proactive exploration: Simulated experiments/ interactive simulations make lessons more engaging, stimulating inquisitive thinking and promoting student autonomy and self-learning.
- Improving teaching quality: With animated visual support and high interactivity, simulated experiments/ interactive simulations make lessons more dynamic and enhance students' knowledge retention.
- Alignment with the new general education curriculum: The experiments in Gizmos are designed with technology integration, keeping pace with modern educational innovations.
- Helping teachers adopt and familiarize themselves with modern technology: Some teachers believe that using software like Gizmos not only enhances their technological skills but also aligns with the trend of innovative teaching methods in the digital era.

Reasons why some teachers are not yet ready to use Gizmos

Although most teachers support the adoption of Gizmos, 2 teachers (3.5%) were not yet willing to use the tool, citing the following reasons:

- Gizmos has not been widely implemented in the official curriculum, so teachers have not had the opportunity to explore it or do not yet see its necessity.
- Lack of familiarity with technology and insufficient training, leading to hesitancy in integrating simulated experiments/ interactive simulations into teaching.

General evaluation of group 3 results

The findings highlight a positive perception of Gizmos simulations but a significant gap between awareness and actual use.

- Limited awareness: 70.2% of teachers are unfamiliar with Gizmos, showing its low penetration in primary education.
- High perceived effectiveness: Over 80% of teachers recognize the value of Gizmos, particularly in making lessons more engaging and interactive.
- Main barriers: Language constraints (52.6%), complex registration (36.8%), and difficulty finding content (35.1%) hinder wider adoption.
- High willingness to adopt: 96.5% of teachers are ready to use Gizmos, provided they receive adequate training and support.

Proposed solutions to overcome challenges in using Gizmos interactive simulations

Addressing language barriers

- Develop Vietnamese instructional materials, including steps for accessing, using, and integrating simulations into lessons.
- Translate key content of simulated experiments/ interactive simulations to help teachers effectively utilize the tool.

Facilitating registration and access

- Simplify the account registration process and provide trial accounts or online training sessions.
- Create detailed instructional guides in the form of documents and video tutorials to help teachers easily navigate the platform.

Enhancing teachers' competence in using simulated experiments/ interactive simulations

- Organize short-term training courses on the application of Gizmos in teaching.
- Develop a system of model lesson plans integrating simulated experiments/ interactive simulations for teachers to reference and apply.

Overcoming infrastructure limitations

- Encourage the use of available devices such as smartphones and tablets to access simulated experiments/ interactive simulations.
- Provide suitable infrastructure support for schools with limited technological resources.

Raising awareness of the benefits of simulated experiments/ interactive simulations

- Organize workshops and experience-sharing sessions on the effectiveness of Gizmos in teaching.
- Combine traditional teaching methods with technology to facilitate seamless adoption and flexible application for teachers.

Supporting teachers in selecting appropriate simulations

- Develop a catalog of simulations categorized by topics in the third-grade Science and Social Studies curriculum.
- Create a repository of sample lesson plans incorporating simulated experiments/ interactive simulations, helping teachers save time in searching for and selecting suitable experiments.

4. CONCLUSIONS

This study assessed the current status of using Gizmos interactive simulations in teaching Science and Social Studies for third grade at selected public primary schools in Vietnam. The survey results indicate that while most teachers have integrated technology into their teaching, the actual use of simulated experiments/ interactive simulations remains limited. The main challenges include a lack of instructional guidance, language barriers, difficulties in accessing the platform, and insufficient infrastructure.

However, the majority of teachers recognize the significant potential of Gizmos interactive simulations in enhancing teaching quality due to their interactive and visually engaging nature.

This research contributes to a better understanding of the current state and potential of using simulated experiments/ interactive simulations in primary education. Additionally, it proposes practical recommendations to help teachers effectively integrate technology into their teaching, ultimately improving educational quality in the context of modern teaching reforms.

To address the challenges associated with using simulated experiments/ interactive simulations in general, and Gizmos interactive simulations in particular, this study proposes several solutions: (1) Develop Vietnamese-language instructional materials, including step-by-step guides for accessing and using the platform; (2) Simplify registration and access to Gizmos, providing trial accounts and user-friendly onboarding processes; (3) Organize training programs to enhance teachers' skills in utilizing simulated experiments/ interactive simulations; (4) Improve school infrastructure to facilitate the effective use of educational technology; (5) Increase teachers' awareness of the benefits of simulation technology in education; (6) Develop a digital repository with categorized simulations and sample lesson plans for easy access and implementation.

However, this study has some limitations. Firstly, it focuses only on surveying teachers without evaluating the actual impact of Gizmos interactive simulations on student learning outcomes. Additionally, the survey was conducted within a limited number of primary schools, meaning the findings may not be fully representative of the broader adoption of technology in teaching Science and Social Studies at the primary level.

Future research should include experimental studies to assess the direct impact of simulated experiments/ interactive simulations on students' learning performance using quantitative measurement methods. Furthermore, expanding the study to a wider range of schools across different regions would provide a more comprehensive understanding of the adoption and effectiveness of simulated experiments/ interactive simulations in primary education.

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