e-ISSN 2795-3272
p-ISSN 2795-3264

10.5281/zenodo.10899177 Vol. 07 Issue 03 March - 2024 Manuscript ID: #01295

FACTORS INFLUENCING THE USE OF PHYPHOX SOFTWARE IN PHYSICS TEACHING AT HIGH SCHOOLS IN VIETNAM

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Abstract

In the context of contemporary digital education, the use of Phyphox software to turn smartphones into physics experiment equipment opens new opportunities for physics education in Vietnam, yet there are many challenges and opportunities to be explored. This study aims to evaluate the factors influencing the integration of this technology into teaching through a survey of 48 physics teachers nationwide using an online questionnaire with a 5-point Likert scale. Results show that teachers are confident and willing to adopt new technology, recognizing the positive impact of the software on educational quality and student engagement. However, they face difficulties integrating the software into lessons and lack support from resources and school leadership. The study emphasizes the importance of integrating technology into education and provides a basis for developing more effective teacher support strategies. This research contributes to the theoretical foundation on software use in education and aids policy makers, educational managers, and software developers in shaping strategies to optimize technology use in education, enhancing educational quality and preparing students with the necessary skills for the digital era.

Keywords

Educational Technology; Physics Teaching; Phyphox Application; Smartphone Experiments; Teacher Training.

Introduction

In today's digital age, integrating technology into education has become a mandatory trend rather than just a passing phase, especially in teaching natural science subjects such as Physics. Phyphox software, with its ability to transform smartphones into powerful physics experiment devices, has opened new opportunities for physics teaching and learning in general education environments. However, effectively utilizing this technology in education in Vietnam is still in its initial stages and requires further exploration.

This context has driven us to conduct research aimed at evaluating the factors affecting the use of Phyphox software in physics teaching at high schools in Vietnam. The goal of the study is not only to identify challenges and opportunities related to integrating this technology into the curriculum but also to propose solutions to enhance its effective use, contributing to improving the quality of physics education in the digital era.

Educational technology has been proven to enhance student interaction and engagement, as well as improve learning outcomes through providing flexible and personalized learning experiences. In the context of the recent COVID-19 pandemic, the demand for digital education has become clearer than ever, marking a turning point in the acceptance and application of technology in education. Therefore, this study contributes to this growing field by providing insights into the use of Phyphox as an educational tool from the perspective of teachers, who play a critical role in designing and implementing educational technology.

Through this study, we hope to not only shed light on the factors affecting the use of Phyphox in physics education in Vietnam but also provide a database for educators, policymakers, and software developers to improve and expand the use of technology in education.

Literature review

Research on the application of technology in education, especially the use of Phyphox software in teaching Physics, has garnered widespread interest from the educational and research community. Staacks et al. (2018) describe Phyphox as an advanced tool that allows the execution of physics experiments using smartphones, transforming them into a set of mobile experimental apparatus. Their work laid the groundwork for further exploration of this application in the educational setting. Alexandros et al. (2020) and Imtinan & Kuswanto (2023) explored the technical challenges teachers may face when integrating mobile phone sensors into physics laboratories and proposed solutions to overcome these challenges.

Carroll & Lincoln (2020), as well as Pierratos & Polatoglou (2020), demonstrated that using Phyphox in physics classes could significantly enhance students' understanding and interest by measuring kinematic variables with smartphones. Staacks et al. (2022) further extended the capabilities of Phyphox by facilitating collaborative experiments with large numbers of participants, proposing a new form of interactive and collaborative learning.

Coramik & İnanç (2023) showed how a physical pendulum experiment could be conducted using Phyphox in combination with Lego and the Tracker software, highlighting the flexibility and creativity in physics education. Other studies, such as those by Bin Ibne Walid & bin Umar (2022) and Putri Iswanto & Marpaung (2021), explored the development of smartphone-based physics

experiments like free-fall and sound interference experiments, demonstrating the convenience and effectiveness of using technology in education.
The contributions of Fatmawati & Sulisworo (2021), Yasaroh et al. (2021), and other authors like Pebralia & Amri (2021) and Pusch et al. (2021) have illuminated the potential of Phyphox not only in supporting traditional experiments but also in facilitating real-time data collection and experiments in real-world situations, opening new opportunities for physics education.
Additionally, studies by Fatmala et al. (2020), Sahlan Ishafit & Fayanto (2019), and Hikmatiar Ishafit & Wahyuni (2019) provided evidence of Phyphox's ability to enhance creative thinking and understanding of physics concepts, from determining the coefficient of restitution in partially elastic collisions to studying centripetal acceleration. The diversity in the application of Phyphox shows significant potential in improving the quality of physics education through the use of mobile technology.

Research in Vietnam also aligns with this global trend. Nguyen Thi Huyen Trang and Dinh Van Nam (2023) designed STEM education themes using Crocodile Physics software, while Truong Hoang Han (2023) explored the application of Classin software for testing and assessing students, indicating interest in integrating technology into education in Vietnam. Nguyen Quy Vinh (2023) provided insights into using the Thunkable application software to support hearing-impaired students, extending the potential use of technology in physics education to include students with special needs.

Combined with findings from previous studies like Bura Jufriansah & Donuata (2022), we observe that applications like Phyphox can significantly improve learning outcomes when considered from various aspects, including preliminary knowledge and student reactions. This indicates a positive trend in the acceptance and effectiveness of mobile technology in physics education, highlighting the potential of using these tools to create richer and more diverse learning experiences.
Thus, through these studies, it is evident that the use of Phyphox software and mobile technology in physics education has brought numerous educational benefits, from improving understanding and interest among students to facilitating new and creative teaching methods. However, there are challenges to be addressed, including issues related to infrastructure equipment and teacher training, to maximize the potential of this technology in education.

Research Method

Research Objectives

The goal of this study is to identify and analyze factors affecting the use of Phyphox software in teaching Physics at high schools in Vietnam. Specifically, the research aims to:
(1). Assess the level of readiness and confidence among teachers in utilizing new technology like Phyphox in teaching.
(2). Identify the challenges and opportunities related to integrating this software into the teaching program.
(3). Propose strategies to support teachers and improve the effectiveness of using educational technology in the learning environment.

Subjects and Study Sample

The study subjects include Physics teachers at high schools nationwide. A random sample of 48 Physics teachers was selected through communication channels such as email and Zalo from February 12th to February 19th, 2024. To ensure representativeness, the sample was chosen from a diverse range of provinces, including both urban and rural areas, as well as from both public and private

schools. The research team received 48 responses from the surveyed individuals. All these responses were complete and could be included in the analysis.

Table 1. Subjects participating in the survey

Survey Sample	Gender		Teaching Seniority			Educational Level		Type of School Participating in Teaching	
	Male	Female	Under 5 years	From 5-10 years	Over 10 years	Bachelor's Degree	Master's Degree	Public	Private
Quantity (Teachers)	22	26	7	3	38	41	7	37	11
Ratio (%)	45.8	54.2	14.6	6.3	79.2	85.4	14.6	77.1	22.9

Data Collection and Analysis

Data was collected through an online questionnaire consisting of questions designed on a 5-point Likert scale to evaluate the views and experiences of teachers regarding the use of Phyphox software in teaching Physics. Besides questions about the demographics of the participating teachers, the questions were divided into three groups.

Descriptive statistical analyses were performed to provide basic information about the characteristics of the study sample, including age distribution, gender, teaching experience, and the type of school where the teachers worked. Cronbach's Alpha reliability analysis was also applied to evaluate the stability and reliability of the scales in the questionnaire. This ensured that the questions in the questionnaire were appropriate and could be reused for future related research. During the analysis, other statistical methods such as frequency analysis, percentage distribution, and graphs were used to visualize the data, making the interpretation of results more straightforward and direct. This not only helped researchers better understand the teachers' perspectives but also provided a solid foundation for proposing improvement solutions.

The results from the data analysis will be discussed in the context of existing research and educational practice to identify practical recommendations for the development of Physics education programs in Vietnam. In this way, the research not only contributes to improving the theoretical foundation regarding the use of software in education but also supports stakeholders in leveraging technology to enhance education quality.

Table 2. Content of survey questions

Group 1: Experience and Perspectives on Using Technology in Teaching
- Q1. I feel confident using technology in teaching.
- Q2. I think using software like Phyphox can improve the quality of physics teaching.
- Q3. I regularly seek out and experiment with new technological tools in teaching.
- Q4. I am willing to participate in courses or workshops on using technology in teaching.
Group 2: Experience Using Phyphox Software
- Q5. I often use Phyphox software in physics teaching.
- Q6. I find it easy to learn how to use Phyphox software.
- Q7. Phyphox software helps enhance student interaction and interest in learning physics.
- Q8. I encounter difficulties in integrating Phyphox software into physics lessons.
Group 3: Awareness and Support for Teachers

- Q9. I believe there are enough resources (such as guides, technical support materials) to use Phyphox software effectively.
- Q10. I feel encouraged by the school administration to use technology like Phyphox in teaching.
- Q11. I am aware of the benefits of using Phyphox software for teaching and learning physics.
- Q12. I think the school's facilities (such as computer labs, mobile devices) are sufficient to support the use of Phyphox software in teaching.

Results research

General Evaluation

The analysis using SPSS 20.0 software indicated that the Cronbach's Alpha coefficient is 0.891 > 0.8, meaning the data collected is "good" in terms of reliability. The survey results are presented in Table 3.

Table 3. Analysis results of Reliability Statistics, Item Statistics and Item-Total Statistics

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.891	.894	12

Item Statistics

	Mean	Std. Deviation	N
Q1	4.0208	1.13905	48
Q2	3.8333	1.11724	48
Q3	3.7917	.98841	48
Q4	3.9792	1.04147	48
Q5	4.0000	1.03142	48
Q6	3.7292	1.08647	48
Q7	3.5625	1.14680	48
Q8	4.2292	.85650	48
Q9	3.5625	1.23609	48
Q10	3.8542	1.09135	48
Q11	4.1042	.92804	48
Q12	4.1667	.99645	48

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1	42.8125	60.794	.640	.885	.880
Q2	43.0000	60.426	.679	.888	.877
Q3	43.0417	61.147	.733	.890	.875
Q4	42.8542	60.680	.721	.878	.875
Q5	42.8333	62.099	.633	.907	.880
Q6	43.1042	62.223	.587	.555	.883
Q7	43.2708	63.946	.447	.680	.891
Q8	42.6042	65.563	.516	.545	.886
Q9	43.2708	63.053	.452	.736	.892
Q10	42.9792	61.468	.631	.746	.880
Q11	42.7292	63.691	.601	.768	.882
Q12	42.6667	62.993	.599	.758	.882

Evaluation of the group on experience and views on using technology in teaching
The surveyed teachers showed a high level of confidence in using technology for teaching, with an average score for Q1 indicating a certain level of confidence among teachers. The perception of the positive impact of software like Phyphox on the quality of Physics teaching is reflected through the average score for Q2. Questions Q3 and Q4 also showed the proactive and willing attitude of teachers in exploring and applying new technological tools in their teaching process.

Evaluation of experience using Phyphox software

The average scores for Q5 and Q6 indicate that Phyphox software is widely used in Physics teaching and that teachers feel relatively at ease learning how to use it. However, the average score for Q7 signals that student interaction and interest in learning Physics could be improved. Notably, the average score for Q8 indicates that some teachers still find it challenging to integrate Phyphox into Physics lessons, suggesting the need for further support and training.

Evaluation of Teachers' Awareness and Support

Results from this group show diversity in the awareness and support that teachers receive. The average scores for Q9 and Q10 reflect a lack of support resources and encouragement from school leadership regarding the use of technology like Phyphox. However, high scores for Q11 and Q12 indicate that teachers are well aware of the benefits of using this software and believe that the school's infrastructure is sufficient to support the use of this technology in teaching.

Overall, the survey results indicate positive awareness among teachers regarding the use of technology, particularly Phyphox software, in Physics teaching. Teachers have shown confidence and initiative in learning and applying new technological tools to improve teaching quality. However, although Phyphox software is highly regarded for its ability to enhance interaction and learning interest, some teachers still face challenges in integrating it into Physics lessons, highlighting the need for additional support and training from educational management bodies and schools.
Additionally, the results reflect a challenge related to resources and support from school leadership, despite teachers recognizing the value and benefits of using Phyphox. This suggests a need for increased investment in facilities and teacher training programs to encourage and support effective technology use in education.

Discussion

The results of this study have provided a deep insight into the use of Phyphox software in physics teaching at high schools in Vietnam. Compared to previous studies, it is evident that integrating technology into education, especially in teaching natural sciences like physics, has become an unavoidable trend in the digital era.
As Staacks et al. (2018) pointed out, the Phyphox software transforms smartphones into a powerful physics experiment toolkit, opening new opportunities for teaching and learning physics. Our results show teachers' confidence and willingness to apply new technologies in teaching, similar to the findings of Carroll and Lincoln (2020), suggesting that using Phyphox can significantly improve students' understanding and interest.

However, a major challenge faced by teachers, according to our survey results, is integrating Phyphox software into physics lessons. This reflects similar difficulties highlighted by Alexandros et al. (2020) and Imtinan & Kuswanto (2023). They explored technical issues that teachers might encounter when

integrating mobile phone sensors into physics labs and proposed solutions to overcome these challenges.
Another significant finding from our study is the lack of awareness and support from school management. This contrasts with the results of Staacks et al. (2022) about facilitating collaborative experiments with large participants using Phyphox, showing a new form of interactive and collaborative learning. This resource and support deficiency could demotivate teachers from adopting new technologies in teaching.

Compared to previous studies, our results also emphasize the importance of training and supporting teachers. Coramik and İnanç (2023) demonstrated how a physical pendulum experiment could be conducted using Phyphox combined with Lego, highlighting flexibility and creativity in physics education. This indicates the necessity of providing adequate resources and technical support to fully exploit the potential of technology in education.
Our study reaffirms the value of using technology in education, particularly the application of Phyphox software in physics teaching, but also highlights the challenges regarding resources and training that need to be addressed. This requires close collaboration among schools, teachers, and stakeholders to facilitate the effective adoption of technology.

In today's educational context, using software like Phyphox not only enhances interaction and interest in learning but also extends access to creative and effective educational methods. This implies that schools and educational management bodies need to recognize the importance of investing in technology and teacher training as an integral part of high-quality education development strategies.
Our study offers a fresh perspective on the status and prospects of using technology in physics education in Vietnam, contributing to the theoretical foundation of technology application in education and supporting policy makers, educational managers, and software developers in shaping strategies to optimize technology use in education.

Finally, researching and implementing technology in education requires careful consideration of benefits and challenges. Success depends not only on technology but also on investment in time, resources, and commitment from all parties involved. Looking ahead, focusing on developing training programs for teachers and improving infrastructure will be key to unlocking new opportunities while addressing the challenges of integrating technology into education, especially in physics teaching.

Conclusion

This research has identified and analyzed the factors that influence the use of Phyphox software in teaching physics at high schools in Vietnam. Through the survey and data analysis process, the study concluded that: Teachers who participated in the survey show confidence and readiness to adopt new technologies like Phyphox in teaching, recognizing its positive impact on the quality of education and student learning enthusiasm. However, they also face challenges including difficulties in integrating the software into their lessons and a lack of support from resources and school leadership.
The study highlights the importance of integrating technology into education, specifically in teaching physics, to enhance interaction and learning enthusiasm. It also clarifies the challenges faced by teachers when adopting new technologies, thus providing a basis for the development of more effective teacher support strategies.

Moreover, the study suggests that for schools and the Ministry of Education: There needs to be increased investment in infrastructure and the development of teacher training programs to support them in effectively using technology in teaching. This includes providing courses or workshops on educational technology and how to integrate new tools into teaching. For software developers: It is necessary to design more educational software like Phyphox. The software should be designed to easily integrate into teaching programs, with detailed usage instructions to help teachers easily adopt it. For teachers: It is crucial to actively share experiences and collaborate among teachers both domestically and internationally through forums and conferences on educational technology to explore and overcome challenges in adopting new technologies.

This research opens a new direction for the study and development of technology applications in physics education, contributing to improving the quality of education and preparing students with the necessary skills to succeed in the digital age.

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