International Journal of Recent Innovations in Academic Research
E-ISSN: 2635-3040; P-ISSN: 2659-1561
Homepage: https://www.ijriar.com/
Volume-9, Issue-3, July-September-2025: 207-214

Research Article

Teaching Physical Sciences and Digital Tools: Analysis of Pedagogical Practices in the Pikine-Guediawaye Academy

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Received: July 30, 2025 **Accepted:** August 19, 2025 **Published:** August 25, 2025

Abstract
The teaching of physical sciences in the Pikine-Guédiawaye Academy faces pedagogical and structural challenges, but also opportunities offered by the progressive integration of digital tools. This study aims to analyze pedagogical practices related to the use of digital technology in order to assess their impact on the quality of teaching and learning. For our work, we have administered a questionnaire via a Google forms platform. The target is students and teachers of physical sciences at the Pikine-Guédiawaye Academy. Data collected from 38 teachers and 54 students shows a growing adoption of digital tools such as interactive simulations and experimental videos. These tools, although sometimes used occasionally, facilitate the understanding of abstract concepts. However, many obstacles limit the optimal use of digital technology, including a lack of teacher training, insufficient equipment (computers, video projectors, internet connection), and disparities in access between establishments. Some practices, such as the inverted classroom or online tutorials, are beginning to emerge but remain marginal.
Keywords: Pikine Guédiawaye Academy, Teaching Physical Sciences, Digital Technology, Teaching Practices.

Introduction

For several decades, science education, particularly that of physical sciences, has been aimed at an elite group of students. In the past, the teaching of physical sciences in secondary education was limited to laboratory experiments and blackboard demonstrations. Today, innovative technological tools exist that can facilitate the understanding of certain phenomena considered complex. The development of these technological tools, essential in the 21st century-digital technology-has impacted the field of education, particularly the teaching of physical sciences, experimental disciplines. The period of 2020 marked by COVID-19 is a perfect illustration of this [1]. It is in this respect that the President of the Republic of Senegal, aware of the usefulness of this tool, as part of the implementation of the public policy framework "Senegal 2050", launched the digital strategy published "New Technological Deal" on February 24, 2025 (MEN, 2025) n° 00001107). This same desire was noted at the level of the 7th strategic axis of education development, namely "promoting the teaching of English, digital science and technology and sustainable development. However, although digital technology has many advantages, its integration into the teaching of physical sciences also raises issues and challenges, particularly in terms of teacher training, access to infrastructure and teacher reluctance [2, 3].

It is therefore essential to examine the challenges and opportunities offered by these new technologies in order to improve the learning of physical sciences and prepare students for the challenges of the modern scientific world [4]. Numerous surveys conducted in certain establishments of the Pikine Guédiawaye Academy have shown that students experience difficulties in learning about mechanical signals and waves, and wave propagation [5, 6].

Materials and Methods

In this article, we have proposed to study the teaching of physical sciences and digital tools: Analysis of pedagogical practices in the Pikine-Guédiawaye Academy. For the research methodology, the target population concerns active physical science teachers working in schools (middle and secondary) with at least 5 years of seniority and students from the academy. The data collection strategy is mixed in nature,

combining quantitative and qualitative approaches for an in-depth understanding of the practices taught. To facilitate dissemination and analysis, we have administered our questionnaire via an online platform Google form.

Results and Discussion

The results obtained from 38 teachers and 54 students provide us with a holistic view of the practice of physical sciences using digital technology.

Results of the Questionnaire Conducted with Teachers at the Pikine Guédiawaye Academy

Question 1: How Many Years of Teaching Experience Do You Have? (38 Answers)

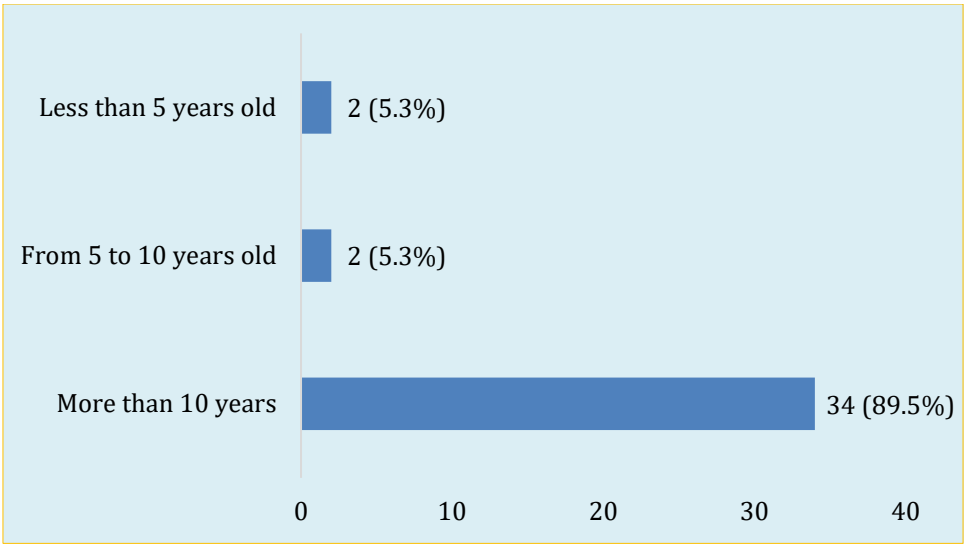

Figure 1. Distribution of teachers by teaching experience.

The results showed that of the 38 physics and chemistry teachers at the Pikine-Guédiawaye Academy surveyed, 5.3% have less than 5 years of teaching experience, and the same percentage for those with between 5 and 10 years; 89.5% have more than 10 years. These results show that 10.6% of active teachers, and a few of the 89.5%, have found the use of digital technology effective.

Question 2: Do You Use Digital Tools Frequently in Your Physical Sciences Classes? (38 Answers)

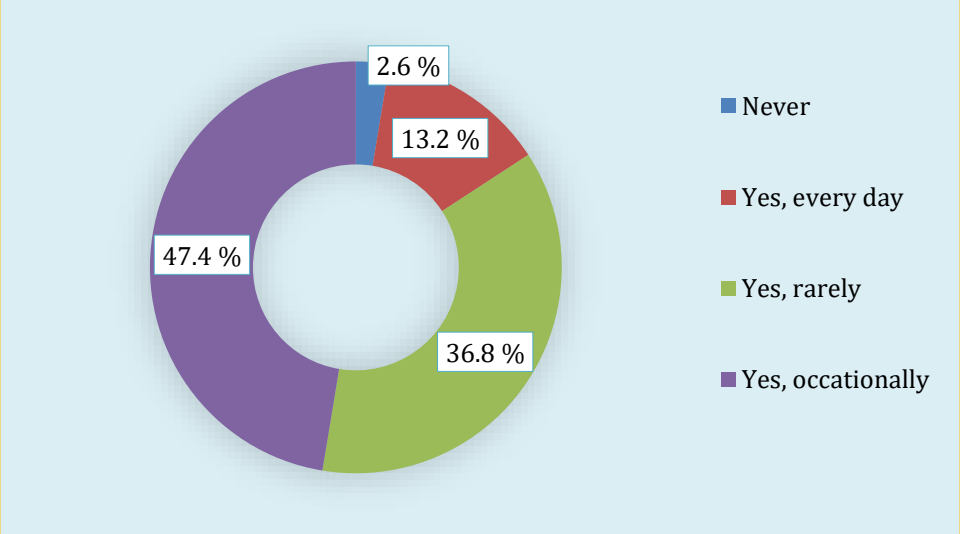

Figure 2. Frequency of use of digital tools in physical science courses.

Out of a total of 38 teachers surveyed, 2.6% of teachers have never used digital tools in their teaching, and 13.2% of teachers use digital tools in their classes every day. However, it should be noted that 36.8% of teachers rarely use digital tools in their teaching practices. Nevertheless, we found that 47.4% of teachers

occasionally use digital tools in their teaching and learning. It should be noted that almost all teachers are digitally savvy.

Question 3: At What Point in the Teaching Process Do You Use Digital Tools? (38 Answers)

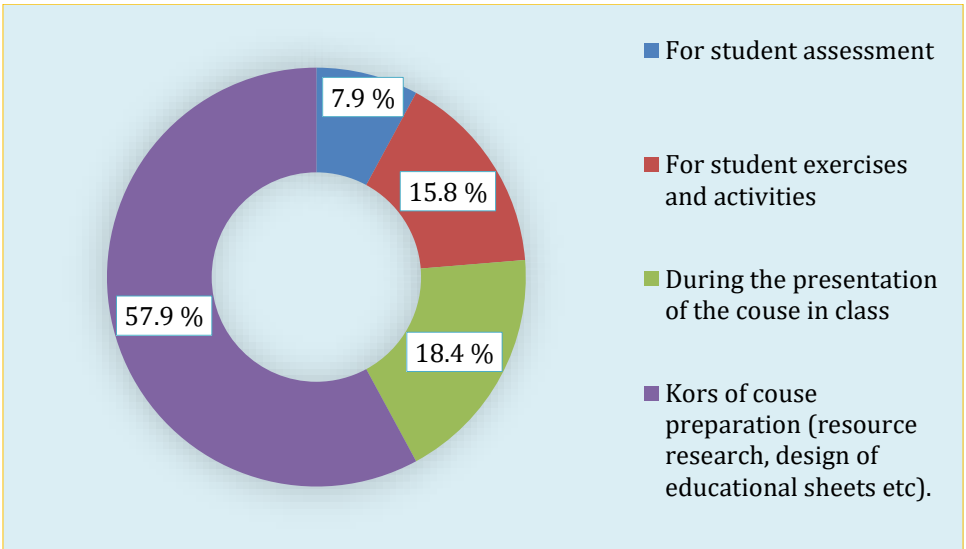

Figure 3. Use of digital tools.

Of the 38 respondents, 57.9% of teachers use digital tools when preparing lessons (searching for resources, designing teaching aids), which proves that more than half of teachers have the opportunity to run simulations on certain, sometimes complex, concepts. 18.4% of teachers use digital tools during lesson presentations in class. However, 15.8% of teachers use digital tools during student exercises and activities. However, 7.9% use digital tools for student assessment. This shows that even if the frequencies of use vary, adaptation to innovations remains convincing.

Question 4: Do You Think That the Use of Digital Technology Improves Students Understanding? (38 Answers)

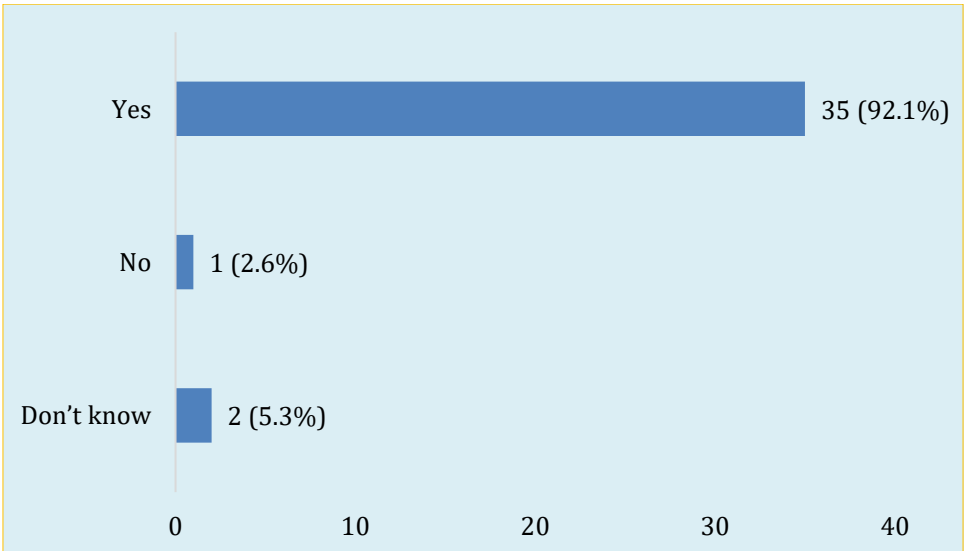

Figure 4. Teachers' distribution regarding improving students' understanding of digital use.

Of the 38 teachers surveyed, 92.1% use digital technology to improve students' understanding of theoretical and experimental lessons. This shows that half of the teachers use digital tools to improve teaching and learning. However, only 2.6% of teachers believe that using digital technology is inappropriate to improve teaching. Similarly, 5.3% do not know how to position themselves to understand how digital tools can improve teaching.

Question 5: What Digital Tools Do You Use Frequently? (38 Answers)

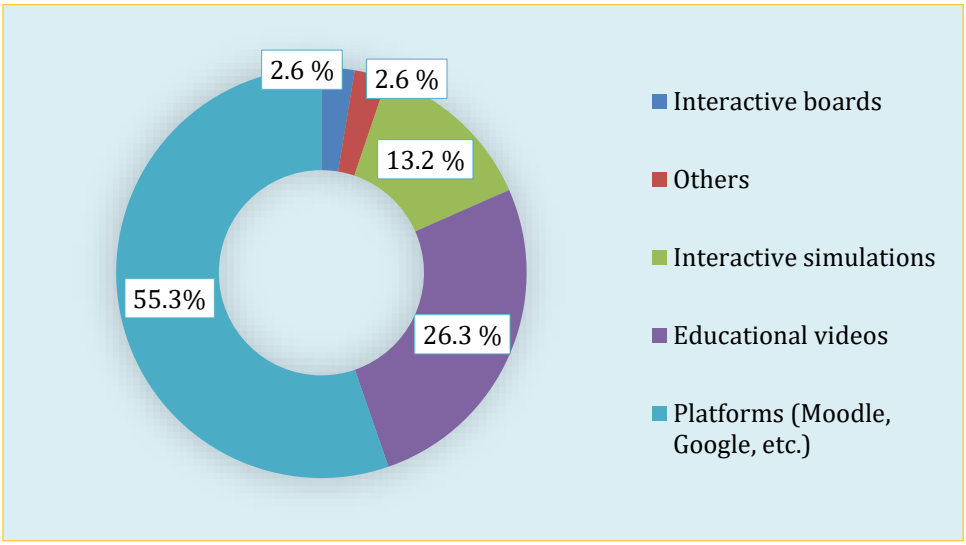

Figure 5. Frequency of use of digital tools.

The results show that out of the 38 respondents, 55.3% of teachers frequently use certain digital tools such as platforms (Moodle, Google, etc.). Of the total number surveyed, 26.3% of teachers use educational videos in their teaching and learning. However, 13.2% of teachers use digital tools for interactive simulation.

However, few of the teachers surveyed chose to frequently use interactive whiteboards in their teaching and learning. However, others did not make a choice or did not specify their method for transmitting knowledge. This is a positive perception of the influence of digital technology.

Question 6: In Your Opinion, What Are the Advantages of Digital Technology in Teaching Physical Sciences? (38 Answers)

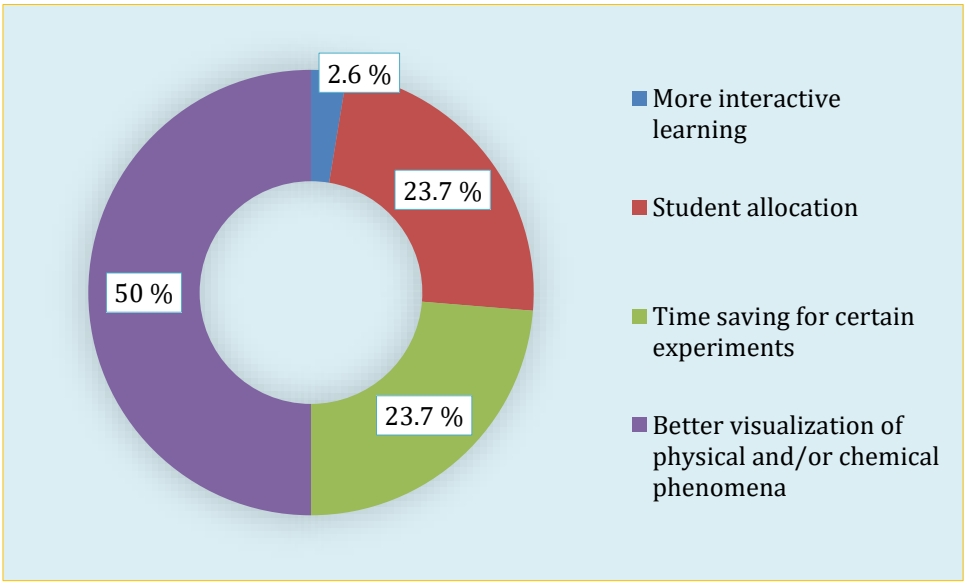

Figure 6. Distribution of digital benefits.

Of the 38 respondents, 50% of teachers, or half, say that one of the advantages of digital technology in teaching physical sciences is better visualization of physical and/or chemical phenomena. 23.7% of teachers believe that saving time for certain experiments and increasing student motivation are advantages of digital technology in teaching physical sciences. However, 2.6% of teachers believe that digital technology in teaching physical sciences makes learning more interactive.

Question 7: Have You Encountered Any Difficulties in Using Digital Technology? (38 Answers)

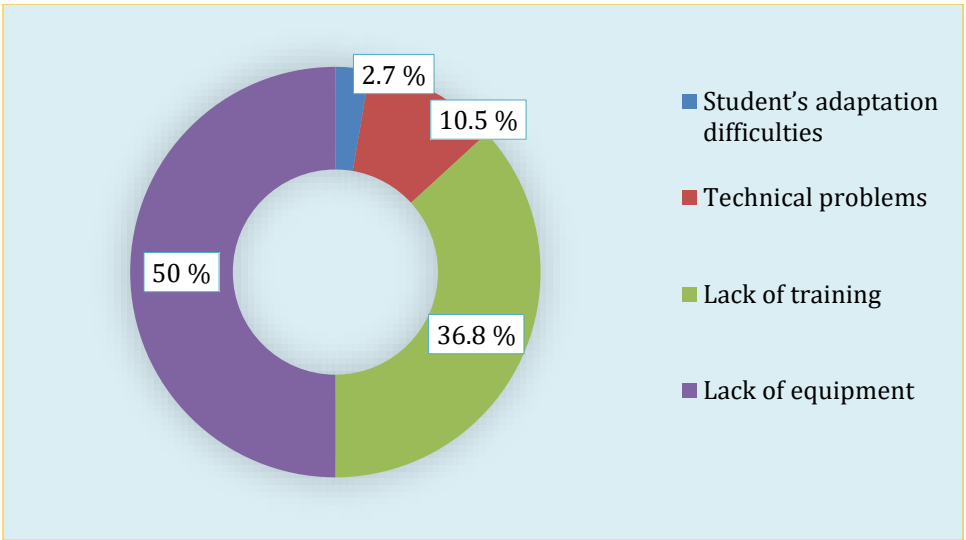

Figure 7. Difficulties encountered in using digital technology.

Out of a total of 38 teachers surveyed, 50% encountered difficulties using digital technology due to a lack of equipment. However, 36.8% of teachers said their main difficulty using digital technology in teaching was related to a lack of training. However, 10.5% of teachers highlighted technical issues related to the use of this innovative tool. However, 2.7% of teachers mentioned difficulties in students adapting to the use of digital technology.

Partial Conclusion

These results from the questionnaires confirm the lack of infrastructure available to teachers. We also note a lack of teacher training, which leads to the complete lack of use of digital tools. However, their use can improve teaching practices and save time.

Results of the Questionnaire Conducted Among Students of the Pikine Guédiawaye Academy

Question 8: Does Your Teacher Use Digital Tools in Class? (54 Answers)

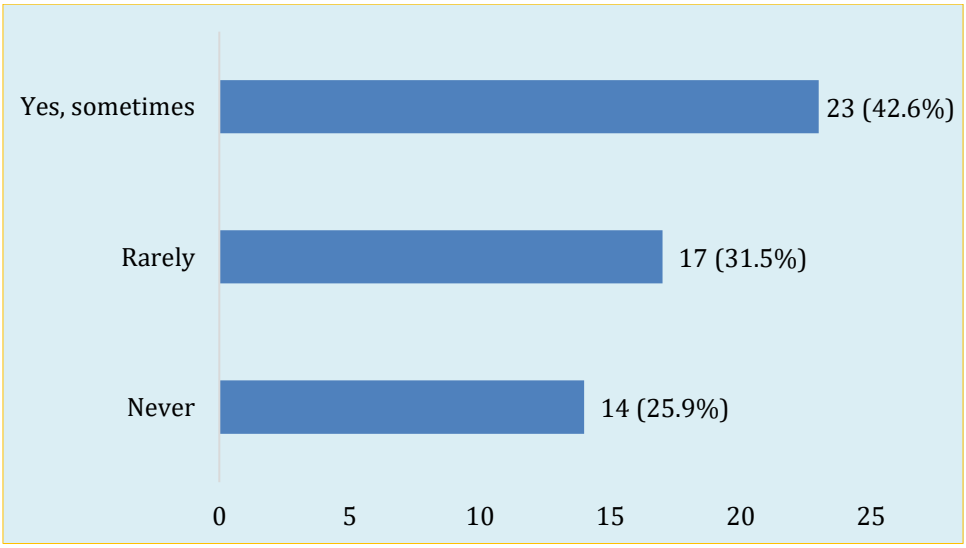

Figure 8. Distribution of digital tool use in the classroom.

Of the 54 student respondents, 42.6% said their teacher sometimes uses digital tools in the classroom. This indicates that teachers are in the digital age, which will allow even flipped classrooms to lead to autonomy. 31.5% of teachers rarely use them. It was found that 25.9% of teachers have never used digital tools in the classroom, according to students. This confirmed that some teachers who have built up their seniority are reluctant to use this technological tool.

Question 9: Do You Use Digital Tools in Physical Sciences Classes? (54 Answers)

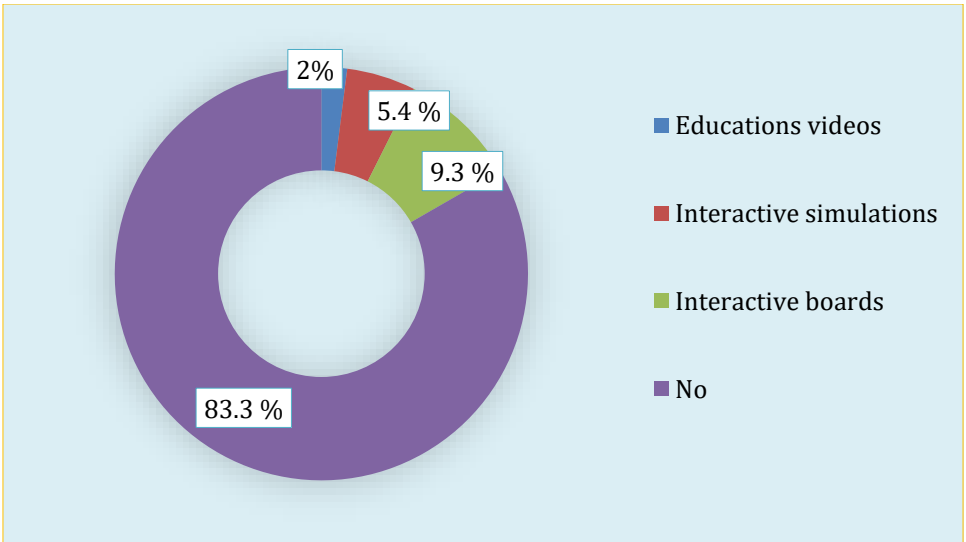

Figure 9. Distribution chart of students' use of digital tools in physical science classes.

Of the total respondents, 83.3% of students do not use digital tools in physical science classes due to a lack of equipment. However, a smaller number of students (9.3%) use interactive whiteboards in their physical science classes, which shows that they are in step with the digital age.

However, those who use interactive simulations (5.4%) are more important than those who use educational videos (2%), but these small numbers are in the era of innovation.

Question 10: Do You Think That Using Digital Technology Helps You Better Understand the Concepts of Physical and Chemistry? (54 Answers)

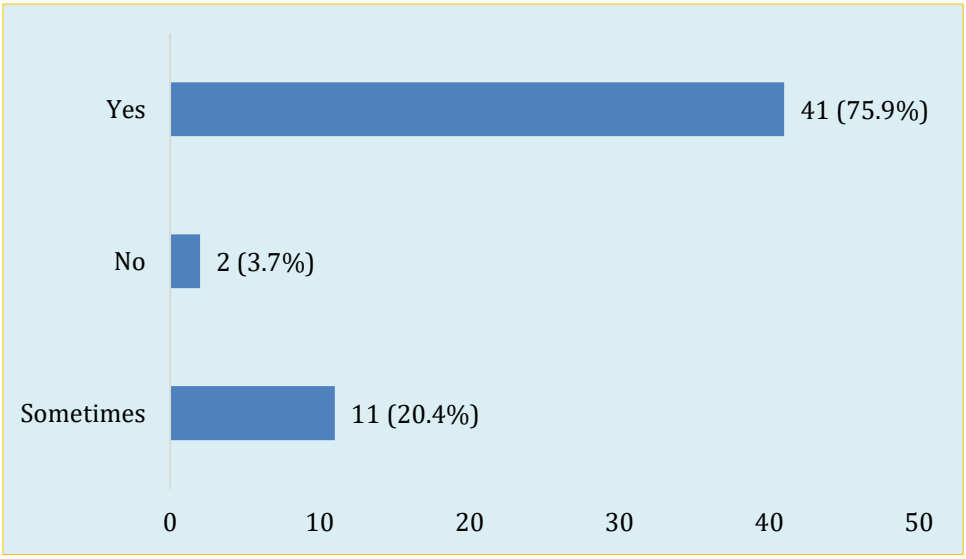

Figure 10. Distribution of respondents regarding the use of digital technology to understand physics and chemistry concepts.

Of the 54 student respondents, 75.9% believe that digital technology helps them better understand physics and chemistry concepts, especially the complexity of certain concepts. Another 20.4% of respondents also revealed that this innovative tool sometimes helps them better understand.

However, a small group of 3.7% of respondents do not see the usefulness of digital technology because it may be out of step with the times.

Question 11: What Do You Admire Most About the Use of Digital Technology in the Classroom? (54 Answers)

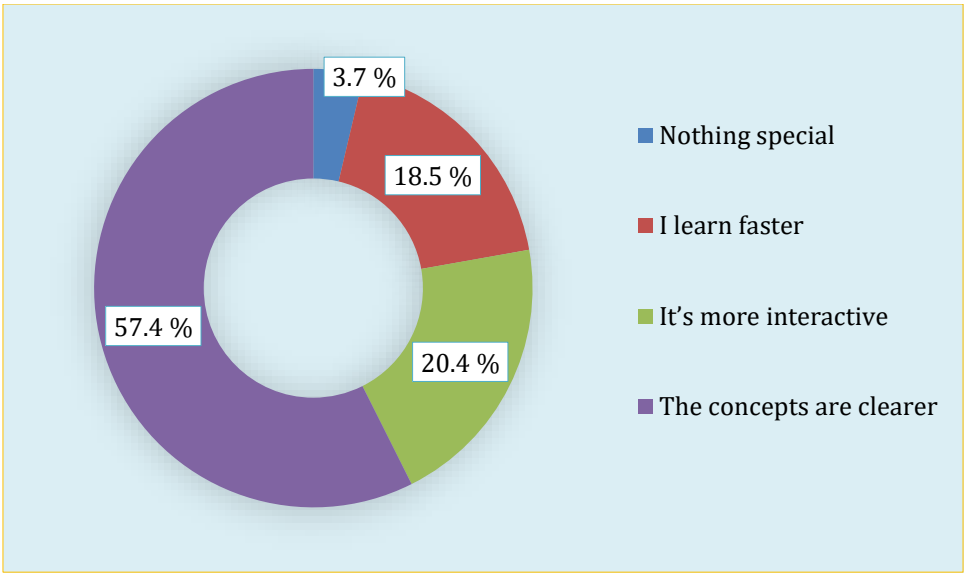

Figure 11. Distribution of admiration for the use of digital technology in the classroom.

Among the students surveyed, 57.4% of respondents said that concepts are clearer with the use of digital technology in the classroom. 20.4% of respondents confirmed that digital tools in the classroom are more interactive. This implies collaborative work. Another 18.5% of respondents believe they learn faster with this digital tool. However, 3.7% of respondents said there was nothing in particular about their admiration for the use of digital technology in the classroom. We have observed student motivation.

Question 12: Are You Having Difficulty with Digital Tools in the Classroom? (54 Answers)

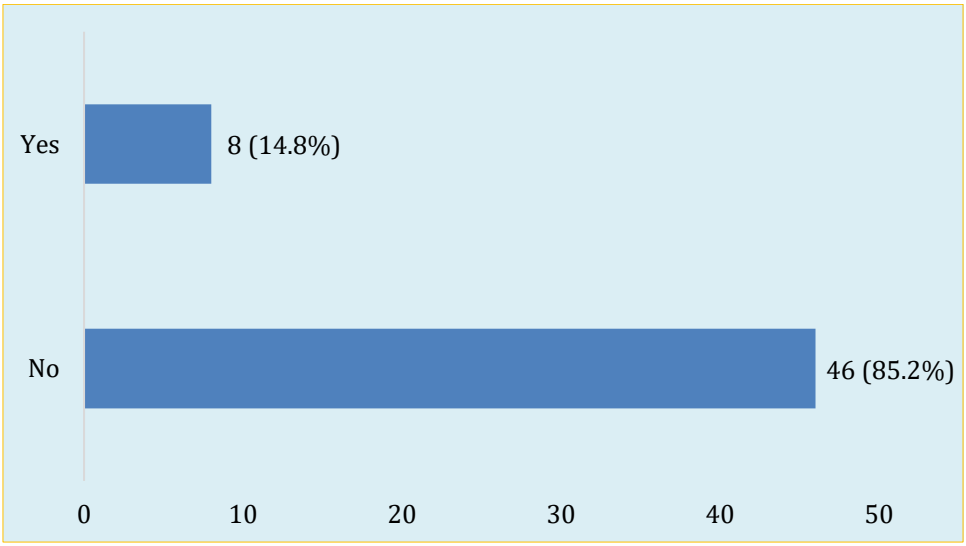

Figure 12. Distribution difficulties encountered with digital tools.

Of the total responses collected, 85.2% did not experience any difficulties using digital tools in the classroom. This suggests that the flipped classroom can lead to learner autonomy. Only 14.8% of respondents encountered difficulties with digital tools in the classroom.

Partial Conclusion

The responses to this questionnaire show that the use of digital technology in teaching practices provides a clear understanding of concepts previously considered complex. This leads to an improvement in course mastery. However, other students in some institutions face barriers from their teachers regarding their learning and infrastructure.

Conclusion

The incorporation of digital technology into the teaching and learning of physical sciences at the Pikine Guédiawaye Academy is greatly changing teaching practices. The results of our questionnaire conducted

with 38 teachers and 54 students at this academy show that the use of this innovative tool helps improve the understanding of certain concepts that seemed complicated and difficult to grasp with traditional media, and allows for interactive simulations that are almost impossible to conduct in class due to security reasons or lack of equipment. A paradigm shift has been noted with collaborative platforms facilitating group work. The sharing of resources between students leads to pooling and collaborative work. The questionnaire responses also showed that with digital technology, students are active participants in their own learning by conducting their own research and building their own knowledge. However, to easily integrate digital technology into physical science teaching at the Pikine Guédiawaye Academy, teachers need to have appropriate training in the related tools and pedagogical approaches. A lack of equipment and sometimes limited internet connection were noted in the responses, which hinders understanding of the lessons but also wastes time during the course. For digital technology to become a real lever for improving learning in physical science, it is necessary to implement continuing education policies, promote the sharing of good practices, and ensure equitable provision of infrastructure.

Declarations

Acknowledgments: My thanks go to Professor Assane TOURE, instructor at the Faculty of Science and Technology in Education and Training (FASTEF) and full professor at Cheikh Anta DIOP University in Dakar/Senegal, Department of Chemistry.

Author Contributions: Both authors have equally contributed in all the steps of the current research.

Conflict of Interest: The authors declare no conflict of interest.

Consent to Publish: The authors agree to publish the article in the International Journal of Recent Innovations in Academic Research.

Data Availability Statement: The data are included in the article.

Funding: This research did not receive any external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Research Content: The research content of the manuscript is original and has not been published elsewhere.

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Citation: Aly DIOUF and Assane TOURE. 2025. Teaching Physical Sciences and Digital Tools: Analysis of Pedagogical Practices in the Pikine-Guediawaye Academy. International Journal of Recent Innovations in Academic Research, 9(3): 207-214.