



# Exploring Teachers' Perceptions of Interactive Presentation Tools for Flipped Classroom Support: A Data-Driven Study in Secondary Physics

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The rapid development of digital technology has encouraged the integration of various interactive presentation platforms into classroom learning, particularly in physics education, which requires active engagement and deep conceptual understanding. However, the wide range of available platforms often makes it challenging for teachers to identify tools that are pedagogically appropriate for classroom instruction and flipped classroom implementation. This study aimed to explore physics teachers' perceptions of interactive presentation platforms and to examine their potential in supporting student engagement and flipped classroom learning. A descriptive quantitative survey approach was employed involving 17 pre-service physics teachers enrolled in the Teacher Professional Education Program at Universitas Terbuka. Data were collected using a Likert-scale questionnaire supported by open-ended responses and analyzed using descriptive statistics, including mean scores and standard deviations, complemented by limited qualitative interpretation. The findings revealed that most platforms were generally perceived positively by respondents. However, Nearpod and Lumio consistently received the highest evaluations, particularly in supporting structured learning flow, classroom interaction, and learning continuity within flipped classroom environments. Qualitative responses further highlighted instructional control, integrated learning activities, and feature flexibility as important considerations in platform selection. These findings suggest that the selection of interactive presentation platforms should consider pedagogical alignment in addition to technical interactivity. This study provides empirical insights that may support teachers and educators in selecting digital platforms that are better suited to flipped classroom learning in physics education.

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## INTRODUCTION

In the landscape of twenty-first-century education, the integration of digital technology has become a fundamental element in efforts to transform learning processes so that they are more relevant, interactive, and aligned with the characteristics of the digital generation. Advances in information and communication technology (ICT) have not only changed the ways teachers deliver instructional content but have also reshaped how students interact with learning materials, construct understanding, and actively engage in the learning process. A growing body of research indicates that learning approaches that incorporate interactive technologies are more effective in enhancing student engagement and conceptual understanding than conventional instructional methods ([Haleem et al., 2022](#); [Holderied, 2011](#)).

Along with these developments, a wide range of interactive presentation platforms such as Nearpod, Lumio, Mentimeter, Quizizz, and similar tools have increasingly been adopted in instructional practices. These platforms enable teachers to present content visually, embed interactive activities, and obtain real-time feedback from students during the learning process. Previous studies have demonstrated that the use of interactive presentation media can enhance students' focus, participation, and overall engagement in learning activities ([Ullah & Anwar, 2020](#); [Wekerle et al., 2022](#)). Student engagement itself has long been recognized as a critical factor in successful learning, particularly in science education, which requires deep conceptual understanding.

In this context, the role of teachers is crucial. Teachers are not only expected to master subject matter knowledge but also to manage and integrate technology as part of their instructional strategies. As the primary facilitators of learning, teachers play a decisive role in determining the success of technology integration, including the use of interactive presentation tools in the classroom. However, classroom realities are often less than ideal, and the implementation of educational technology is frequently accompanied by various challenges. Several studies have highlighted that teachers' perceptions of interactive media strongly influence both their decisions to adopt such tools and the effectiveness of their use in teaching and learning processes ([Abel et al., 2022](#); [Akram et al., 2023](#)). Unfortunately, significant disparities remain in terms of training opportunities, infrastructure support, and access to technology across regions, particularly in developing countries such as Indonesia ([Diamah et al., 2022](#)). Although many teachers express positive attitudes toward the use of technology, a substantial number still struggle to optimize its pedagogical potential due to limited digital and instructional competencies, as well as insufficient institutional

support and professional development. Moreover, social and geographical differences across regions further shape how teachers access and utilize technology, indicating that digital readiness among teachers remains uneven despite the increasing availability of technological tools.

Physics, as a subject often perceived as difficult due to its abstract nature, presents a strong case for the integration of digital technology as an instructional support tool. The urgency of employing interactive media in physics learning has become more apparent considering persistent issues related to low student interest and engagement, which ultimately contribute to suboptimal learning outcomes ([Nyirahabimana et al., 2023](#); [Pinargote Bravo & Pita Asan, 2023](#)). Although previous studies have reported the effectiveness of interactive technologies in physics education, much of the existing literature has primarily focused on students' perspectives, general educational contexts, or the effectiveness of specific technologies in isolation. Physics learning, with its conceptual and abstract characteristics, requires instructional approaches that are often different from those used in other subject areas. Therefore, understanding teachers' perspectives on the use of interactive presentation platforms becomes increasingly important in identifying technologies that are not only engaging, but also pedagogically suitable for meaningful physics learning.

Furthermore, ([Santoso et al., 2022](#)) reported that physics teachers in Indonesia are required to dynamically adapt instructional processes to students' abilities with the support of technological media, while simultaneously facing challenges related to assessment accuracy and high workload demands. Similarly, ([Bancong et al., 2023](#)) emphasized the importance of visual, experiment-based media for supporting the learning of microscopic concepts in physics yet did not explicitly examine teachers' perceptions of such media. A systematic review by ([Vidak et al., 2024](#)) also demonstrated that augmented reality-based technologies can enhance conceptual understanding and reduce students' cognitive load; however, reflective perspectives from teachers remain less frequently discussed in relation to interactive presentation platforms used in everyday classroom instruction.

These findings suggest that although the integration of technology in science and physics education has been widely discussed in the literature, the primary focus has largely been placed on simulation-based or experimental technologies. In contrast, interactive presentation media, which are relatively lightweight, easily accessible, and highly practical for classroom use, have received comparatively less attention in empirical research. Previous studies have explored the use of platforms such as Nearpod, Mentimeter, and other interactive technologies in educational settings; however, research specifically examining how physics teachers perceive and

compare these platforms particularly in relation to student engagement and instructional suitability remains relatively limited, especially within Indonesian secondary education contexts.

In parallel, developments in digital pedagogy have also given rise to instructional models that emphasize active, student-centered learning, one of which is the flipped classroom approach. This model shifts content delivery to the pre-class phase and utilizes face-to-face class time for discussion, problem-solving, and other meaningful learning activities. Previous research has shown that flipped classroom learning has the potential to enhance student engagement and conceptual understanding when supported by appropriate digital media (Bishop & Verleger, 2013; Lo & Hew, 2017). Within this framework, interactive presentation platforms hold considerable promise as supporting tools for flipped classroom implementation, as they facilitate pre-class content delivery, in-class interaction, and post-class reflection in an integrated manner.

Despite this potential, empirical studies that explicitly examine how physics teachers evaluate interactive presentation platforms in relation to both student engagement and flipped classroom support remain relatively limited. Understanding teachers' perspectives is important for identifying platforms that are not only interactive, but also pedagogically relevant and practically applicable for physics instruction in authentic classroom settings.

## METHOD

This study employed a descriptive quantitative approach using a survey method to describe trends in physics teachers' perceptions of the use of interactive presentation platforms and their perceived potential in supporting flipped classroom learning. A descriptive quantitative approach was selected as it is appropriate for systematically summarizing and presenting numerical data to obtain an empirical overview of respondents' attitudes, perceptions, and experiences related to technology-based educational phenomena, without manipulating variables or conducting inferential hypothesis testing (Creswell & Creswell, 2018; Fraenkel et al., 2019). This approach has been widely used in educational technology research to map users' perceptions and readiness toward digital learning innovations (Akram et al., 2023; Veytia Bucheli et al., 2024).

Data were collected using an online questionnaire administered through Google Forms and distributed using purposive sampling. The questionnaire link was shared through academic communication channels used within the PPG program. Before completing the questionnaire,

respondents were informed about the purpose of the study, and their participation was entirely voluntary. No personally identifiable information was collected, and all responses were analyzed anonymously for research purposes only. Purposive sampling was chosen because it allowed the researchers to recruit participants with experiences directly relevant to the research objectives, thereby ensuring that the data obtained were contextual and meaningful (Campbell et al., 2020; Palinkas et al., 2015). The respondents were students enrolled in the Pre-service Teacher Professional Education Program (Program Pendidikan Profesi Guru / PPG Prajabatan) at the Faculty of Teacher Training and Education, Universitas Terbuka. A total of 17 respondents participated in this study, consisting of 9 male and 8 female pre-service physics teachers. All participants had prior experience using interactive presentation platforms during university coursework and teaching practicum activities in secondary schools. In addition, several respondents had teaching experience before entering the PPG program, which enabled them to provide more reflective perspectives on the use of educational technology.

Throughout the PPG coursework, respondents were introduced to and actively used various interactive presentation platforms, including Nearpod, Lumio, Quizizz, and Mentimeter, as part of the instructors' instructional strategies. Furthermore, these platforms were also implemented by the respondents during their Teaching Practicum (*Praktik Pengalaman Lapangan / PPL*) in secondary schools. This dual exposure allowed respondents to evaluate the effectiveness and challenges of interactive platforms from both learner and prospective physics teacher perspectives. Such combined experiences provide a strong basis for a more comprehensive evaluation of interactive platforms within authentic instructional contexts (Schindler et al., 2017).

The questionnaire items were developed based on indicators derived from previous studies on interactive learning technologies, student engagement, and flipped classroom pedagogy. The instrument was also internally reviewed to ensure the clarity and relevance of each item in relation to the objectives of the study. The research instrument consisted of a Likert-scale questionnaire ranging from 1 to 4 (1 = strongly disagree to 4 = strongly agree) and was divided into two main sections. The first section assessed respondents' perceptions of interactive presentation platforms through 22 items (P1–P22) covering six dimensions: student engagement, alignment with physics learning, ease of use for teachers, support for evaluation and feedback, infrastructure readiness, and relevance to teachers' instructional needs. Each item was used to evaluate six interactive platforms—Nearpod, Lumio, Quizizz, Mentimeter, Genially, and EdPuzzle—allowing for direct comparison across platforms based on respondents' perceptions. Reliability analysis was conducted using

Cronbach's Alpha to examine the internal consistency of the questionnaire items. The analysis yielded a Cronbach's Alpha coefficient of 0.969, indicating a very high level of internal consistency and suggesting that the instrument was sufficiently reliable for exploratory descriptive research.

The second section of the instrument assessed respondents' perceptions of the extent to which interactive platforms support the implementation of a flipped classroom through seven items (F1–F7). These items addressed support for pre-class activities, the effectiveness of in-class interaction, post-class reflection, learning flow management, monitoring students' learning readiness, support for discussion and problem-solving activities, and overall integration of the platforms with the flipped classroom model. A detailed overview of the instrument indicators is presented in Table 1 and Table 2.

[\[Table 1 about here.\]](#)

[\[Table 2 about here.\]](#)

The collected data were analyzed using descriptive quantitative analysis by calculating the mean scores, standard deviations, and the distribution of respondents' answers for each platform and each assessment aspect. To facilitate the interpretation of the descriptive results, the mean scores derived from the 1–4 Likert scale were classified into four levels of perception. The criteria for interpreting the mean scores are presented in Table 3. This approach is commonly employed in descriptive quantitative studies using Likert-scale instruments to provide a more objective and standardized interpretation of respondents' perceptual tendencies (Lo & Hew, 2017).

[\[Table 3 about here.\]](#)

In addition to the quantitative analysis, data obtained from the open-ended questions were analyzed using a limited qualitative approach to provide contextual support for the research findings. The open-ended items in the questionnaire addressed respondents' experiences in using interactive presentation platforms, their reasons for selecting platforms, perceived strengths and challenges of platform use, as well as their views on the use of these platforms in supporting flipped classroom learning. Open-ended responses were reviewed and grouped into several recurring themes related to platform usability, classroom interaction, learning control, and flipped classroom support. This qualitative analysis was employed solely as supplementary data to strengthen the interpretation of the quantitative results and to offer pedagogical illustrations of respondents' perceptions, rather than as an in-

depth qualitative investigation (Chandrasekar et al., 2024; Creswell & Plano Clark, 2018).

## RESULT AND DISCUSSION

This study aims to explore teachers' perceptions of interactive presentation platforms and to examine their potential in supporting flipped classroom learning in secondary physics education. This focus is particularly relevant given previous research indicating that the integration of interactive technologies in science learning contributes positively to student engagement and the quality of classroom interactions (Havik & Westergård, 2020; Ullah & Anwar, 2020; Wekerle et al., 2022).

### *Teachers' Perceptions of Interactive Presentation Platforms*

Most interactive presentation platforms evaluated in this study received generally positive perceptions from respondents, although noticeable differences emerged in terms of pedagogical suitability and consistency of use across platforms. This finding is consistent with earlier studies reporting that interactive presentation media can enhance student participation and foster more dynamic classroom interactions (Nyirahabimana et al., 2023; Shatri & Shala, 2022).

[\[Table 4 about here.\]](#)

Quizizz ranked first with a mean score of 3.221 (SD = 0.748), followed by Mentimeter (M = 3.164; SD = 0.773), Nearpod (M = 3.149; SD = 0.739), and Lumio (M = 3.140; SD = 0.790). Although all platforms were categorized as high based on the mean score criteria, Genially (M = 2.711; SD = 0.863) and EdPuzzle (M = 2.565; SD = 0.813) obtained comparatively lower scores than the four leading platforms. This pattern suggests that teachers perceived interactive presentation platforms positively overall, but their level of acceptance varied depending on the features and instructional affordances offered by each platform.

[\[Figure 1 about here.\]](#)

The visualization presented in Figure 1 indicates that Nearpod and Lumio fall within the group of platforms characterized by high perceived scores and relatively stable score distributions. This stability is noteworthy, as several studies emphasize that the successful implementation of educational technology is influenced not only by initial levels of engagement but also by the consistency of user experience over time (Almaiah et al., 2022; Feng et al., 2025).

Qualitative data derived from the open-ended responses further enrich the interpretation of these quantitative findings.

When asked about the platforms most frequently used in teaching, many respondents mentioned Mentimeter and Quizizz due to their ease of use and their ability to facilitate rapid classroom interaction. These platforms were commonly associated with gamified quizzes, instant feedback, and quick classroom engagement. However, when respondents were asked to identify platforms that are most suitable for more in-depth physics learning, more complex pedagogical considerations emerged. Several respondents highlighted the importance of instructional control, learning flow management, and maintaining students' focus during learning activities. One respondent noted that Lumio allows teachers to control the display of instructional content on students' devices, thereby reducing distractions from other applications and helping students remain focused on the lesson.

In contrast, respondents perceived platforms such as Quizizz and Mentimeter as more effective for short-term engagement and classroom participation rather than for supporting structured learning sequences commonly required in flipped classroom settings. This distinction suggests that teachers may differentiate between platforms designed primarily for rapid interaction and those that support broader pedagogical organization, learning continuity, and deeper conceptual learning.

These findings align with the view that the effectiveness of educational technology is determined not only by the presence of interactive features but also by its capacity to support digital classroom management and guide learning processes in a structured manner (Alam & Mohanty, 2023; Almaiah et al., 2022; Singh, 2021). In physics education, which requires the visualization of abstract concepts and deep conceptual understanding, platforms that can integrate instructional materials, interactive activities, and assessment within a coherent structure offer greater pedagogical value.

### ***Support of Interactive Platforms for Flipped Classroom Learning***

When the analytical focus is directed specifically toward the support provided by interactive platforms for flipped classroom learning, a more distinct pattern emerges. Based on the analysis of the seven flipped classroom indicators, Nearpod ranked first with a mean score of 3.239 (SD = 0.553), followed by Lumio (M = 3.180; SD = 0.563). Mentimeter and Quizizz occupied subsequent positions, while Genially and EdPuzzle once again ranked lowest, as presented in Table 5.

[\[Table 5 about here.\]](#)

[\[Figure 2 about here.\]](#)

Figure 2 illustrates a more pronounced distinction when the analysis is focused on support for flipped classroom

learning. Nearpod and Lumio occupy the highest positions, with higher mean scores and relatively moderate standard deviations, indicating positive and consistent perceptions among respondents. These findings suggest that not all interactive platforms possess equivalent capacities to support the flipped classroom workflow in a comprehensive manner, particularly in facilitating pre-class activities, meaningful in-class interaction, and post-class reinforcement.

These characteristics are consistent with the core principles of the flipped classroom model, which emphasize self-directed learning before face-to-face sessions and collaborative, problem-solving-oriented activities during class time (Han, 2022; Ohlenburg et al., 2024). Previous studies have also shown that integrated digital platforms that allow teachers to manage and control the learning flow tend to be more effective in supporting flipped classroom implementation than platforms that focus primarily on isolated interactive activities (Loizou, 2022). Accordingly, the positive perceptions of Nearpod and Lumio identified in this study can be understood as a reflection of the alignment between their features and structural design and the pedagogical requirements of flipped classroom learning in physics education.

Several recurring themes emerged from the open-ended responses. Quizizz and Mentimeter were frequently associated with ease of interaction, rapid classroom engagement, and gamified learning activities. One respondent explained that "Quizizz is easy to use and helps students become more active during classroom activities" (Respondent 5). In contrast, Nearpod and Lumio were more commonly linked to structured learning flow, classroom control, and support for independent learning activities. One respondent noted that "Lumio allows teachers to control the learning display on students' devices, making students more focused during learning" (Respondent 11). Some respondents also emphasized that platforms with integrated instructional sequencing were more helpful for maintaining students' focus and supporting deeper conceptual understanding in physics learning contexts. For example, one respondent stated that "Nearpod supports learning activities from pre-class preparation to classroom discussion in a more organized way" (Respondent 8).

Open-ended responses from the participants further reinforced these findings. Several respondents reported that platforms such as Lumio enable students to access and study learning materials independently before class sessions begin. During face-to-face instruction, structured interactive activities were perceived to help sustain student engagement in discussion and problem-solving tasks. Respondents also noted that the use of interactive platforms facilitated teachers' ability to monitor students' learning readiness before classroom meetings.

The characteristics of Nearpod and Lumio, which allow for

the integration of instructional content, interactive activities, and formative assessment, are closely aligned with flipped classroom principles that emphasize the use of class time for higher-order learning activities such as discussion, analysis, and problem solving (Sablić & Miroslavljević, 2024; Sukma et al., 2024). In physics learning, this approach is particularly relevant, as it supports the gradual and deeper development of conceptual understanding.

The findings of this study also provide practical implications for physics teachers and schools in Indonesia, particularly in selecting digital platforms that align with classroom needs and instructional goals. Rather than focusing solely on highly interactive features, teachers may need to consider how a platform supports learning continuity, classroom management, student readiness, and conceptual understanding in physics learning contexts. Schools and teacher education programs may also benefit from providing more targeted training on the pedagogical use of interactive presentation platforms within flipped classroom environments.

Taken together, the findings of this study indicate that while various interactive platforms can enhance student engagement, Nearpod and Lumio appear to offer stronger pedagogical support when educational technology is evaluated from the perspective of learning structure, classroom continuity, and flipped classroom implementation. The selection of Nearpod and Lumio as the focus of subsequent research on flipped classroom learning is therefore not based merely on subjective preference, but is supported by empirical findings and respondents' experiences that align with relevant international and national literature.

## CONCLUSION

This study provides empirical insights into physics teachers' perceptions of interactive presentation platforms in learning. The findings indicate that interactive presentation technologies are generally perceived positively in supporting student engagement in physics education. However, clearer distinctions emerged when the analysis focused specifically on support for flipped classroom learning. Nearpod and Lumio consistently received the highest evaluations, suggesting that these platforms are perceived as more suitable for supporting structured learning flow, classroom interaction, and learning continuity within flipped classroom environments. Qualitative findings further reinforced the importance of instructional control, integrated learning activities, and feature flexibility as key considerations in platform selection. These findings highlight that the selection of interactive presentation platforms should be guided not only by technical features, but also by their pedagogical

alignment with instructional goals and learning contexts. Nevertheless, this study was limited by the relatively small number of respondents and its reliance on perception-based data rather than direct classroom implementation. Future studies are therefore encouraged to examine the effectiveness of interactive presentation platforms through broader samples and classroom-based flipped classroom interventions in physics learning contexts.

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## REFERENCES

- Abel, V. R., Tondeur, J., & Sang, G. (2022). Teacher Perceptions about ICT Integration into Classroom Instruction. *Education Sciences*, 12(9), 609. <https://doi.org/10.3390/educsci12090609>
- Akram, R., Waqar, Y., & Raza, A. (2023). Learning Innovation Utilization in Technical Education: A Quantitative Study. *Research Journal for Societal Issues*, 5(4), 131–142. <https://doi.org/10.56976/rjsi.v5i4.171>
- Alam, A., & Mohanty, A. (2023). Educational technology: Exploring the convergence of technology and pedagogy through mobility, interactivity, AI, and learning tools. *Cogent Engineering*, 10(2). <https://doi.org/10.1080/23311916.2023.2283282>
- Almaiah, M. A., Alhumaid, K., Aldhuhoori, A., Alnazzawi, N., Aburayya, A., Alfaisal, R., Salloum, S. A., Lutfi, A., Al Mulhem, A., Alkhodour, T., Awad, A. B., & Shehab, R. (2022). Factors Affecting the Adoption of Digital Information Technologies in Higher Education: An Empirical Study. *Electronics*, 11(21), 3572. <https://doi.org/10.3390/electronics11213572>
- Bancong, H., Nurazmi, & Sirajuddin. (2023). High school physics teachers' perceptions and attitudes towards thought experiments in Indonesia. *Physics Education*, 58(4), 045011. <https://doi.org/10.1088/1361-6552/acdb37>
- Bishop, J., & Verleger, M. (2013). The Flipped Classroom: A Survey of the Research. *2013 ASEE Annual Conference & Exposition Proceedings*, 23.1200.1-23.1200.18. <https://doi.org/10.18260/1-2--22585>
- Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*, 25(8), 652–661. <https://doi.org/10.1177/1744987120927206>
- Chandrasekar, A., Clark, S. E., Martin, S., Vanderslott, S., Flores, E. C., Aceituno, D., Barnett, P., Vindrola-Padros, C., & Vera San Juan, N. (2024). Making the most of big qualitative datasets: a living systematic review of analysis methods. *Frontiers in Big Data*, 7. <https://doi.org/10.3389/fdata.2024.1455399>
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research*. SAGE.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative and mixed methods approaches (5th ed.)*. Sage edge.
- Diamah, A., Rahmawati, Y., Paristiwati, M., Fitriani, E., Irvanto, I., Dobson, S., & Sevilla, D. (2022). Evaluating the effectiveness of technological pedagogical content knowledge-based training program in enhancing pre-service teachers' perceptions of technological pedagogical content knowledge. *Frontiers in Education*, 7. <https://doi.org/10.3389/educ.2022.897447>
- Feng, J., Yu, B., Tan, W. H., Dai, Z., & Li, Z. (2025). Key factors influencing educational technology adoption in higher education: A systematic review.

- PLOS Digital Health*, 4(4), e0000764. <https://doi.org/10.1371/journal.pdig.0000764>
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). *How to design and evaluate research in education (8th ed)*. McGraw-Hill Education.
- Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, 3, 275–285. <https://doi.org/10.1016/j.susoc.2022.05.004>
- Han, S. (2022). Flipped classroom: Challenges and benefits of using social media in English language teaching and learning. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.996294>
- Havik, T., & Westergård, E. (2020). Do Teachers Matter? Students' Perceptions of Classroom Interactions and Student Engagement. *Scandinavian Journal of Educational Research*, 64(4), 488–507. <https://doi.org/10.1080/00313831.2019.1577754>
- Holderied, A. (2011). Instructional design for the active: *Journal of Information Literacy*, 5(1). <https://doi.org/10.11645/5.1.1519>
- Lo, C. K., & Hew, K. F. (2017). A critical review of flipped classroom challenges in K-12 education: possible solutions and recommendations for future research. *Research and Practice in Technology Enhanced Learning*, 12(1), 4. <https://doi.org/10.1186/s41039-016-0044-2>
- Loizou, M. (2022). Digital Tools and the Flipped Classroom Approach in Primary Education. *Frontiers in Education*, 7. <https://doi.org/10.3389/educ.2022.793450>
- Nyirahabimana, P., Minani, E., Nduwingoma, M., & Kemeza, I. (2023). STUDENTS' PERCEPTIONS OF MULTIMEDIA USAGE IN TEACHING AND LEARNING QUANTUM PHYSICS: POST-ASSESSMENT. *Journal of Baltic Science Education*, 22(1), 37–56. <https://doi.org/10.33225/jbse/23.22.37>
- Ohlenburg, H., Arnemann, P.-H., Hessler, M., Görlich, D., Zarbock, A., & Friederichs, H. (2024). Flipped Classroom: Improved team performance during resuscitation training through interactive pre-course content – a cluster-randomised controlled study. *BMC Medical Education*, 24(1), 459. <https://doi.org/10.1186/s12909-024-05438-7>
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), 533–544. <https://doi.org/10.1007/s10488-013-0528-y>
- Pinarbote Bravo, B. J., & Pita Asan, M. J. (2023). Interactive strategy to strengthen the teaching-learning process of the subject of Atomic and Nuclear Physics. *Minerva*, 2023(Special), 51–63. <https://doi.org/10.47460/minerva.v2023iSpecial.117>
- Sablić, M., & Mirosavljević, A. (2024). Implementing Flipped Classroom in the Digital Learning Environment. *Education and Self Development*, 19(1), 38–49. <https://doi.org/10.26907/esd.19.1.04>
- Santoso, P. H., Istiyono, E., & Haryanto. (2022). Physics Teachers' Perceptions about Their Judgments within Differentiated Learning Environments: A Case for the Implementation of Technology. *Education Sciences*, 12(9), 582. <https://doi.org/10.3390/educsci12090582>
- Schindler, L. A., Burkholder, G. J., Morad, O. A., & Marsh, C. (2017). Computer-based technology and student engagement: a critical review of the literature. *International Journal of Educational Technology in Higher Education*, 14(1), 25. <https://doi.org/10.1186/s41239-017-0063-0>
- Shatri, K., & Shala, L. (2022). Evaluating the Effect of Interactive Digital Presentations on Students' Performance during Technology Class. *Education Research International*, 2022, 1–9. <https://doi.org/10.1155/2022/3337313>
- Singh, M. N. (2021). Inroad of Digital Technology in Education: Age of Digital Classroom. *Higher Education for the Future*, 8(1), 20–30. <https://doi.org/10.1177/2347631120980272>
- Sukma, E., Ramadhan, S., & Ikhlasani, I. (2024). Elementary teachers' perspective on Nearpod in flipped classrooms. *South African Journal of Childhood Education*, 14(1). <https://doi.org/10.4102/sajce.v14i1.1472>
- Ullah, A., & Anwar, S. (2020). The Effective Use of Information Technology and Interactive Activities to Improve Learner Engagement. *Education Sciences*, 10(12), 349. <https://doi.org/10.3390/educsci10120349>
- Veytia Bucheli, M. G., Gómez-Galán, J., Cáceres Mesa, M. L., & López Catalán, L. (2024). Digital technologies as enablers of universal design for learning: higher education students' perceptions in the context of SDG4. *Discover Sustainability*, 5(1), 473. <https://doi.org/10.1007/s43621-024-00699-0>
- Vidak, A., Movre Šapić, I., Mešić, V., & Gomzi, V. (2024). Augmented reality technology in teaching about physics: a systematic review of opportunities and challenges. *European Journal of Physics*, 45(2), 023002. <https://doi.org/10.1088/1361-6404/ad0e84>
- Wekerle, C., Daumiller, M., & Kollar, I. (2022). Using digital technology to promote higher education learning: The importance of different learning activities and their relations to learning outcomes. *Journal of Research on Technology in Education*, 54(1), 1–17. <https://doi.org/10.1080/15391523.2020.1799455>

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**TABLE 1** / Indicators of the Research Instrument – Teachers' Perceptions of Interactive Presentation Platforms

<b>Dimension</b>	<b>Key Indicators</b>	<b>Item Code</b>
Student Engagement & Interactivity	Activeness; real-time quizzes: individual/group participation; class interaction	P1-P4
Suitability for Physics Learning	Visualization of abstract concepts; simulations; problem solving	P5-P7
Ease of Use for Teachers	User-friendly interface; preparation time; training needs; availability of tutorials	P8-P11
Evaluation & Feedback	Formative assessment; automatic feedback; student progress monitoring	P12-P14
Infrastructure Readiness	Stable under limited internet; multi-device compatibility	P15-P16
Relevance to Teachers' Needs	Control over learning pace; ability to attract students' attention; media integration (video/animation/simulation); real-time student's understanding	P17-P20
General Perception & Recommendation	Satisfaction; recommendation to other teachers	P21-P22

**TABLE 2 /** Indicators of the Research Instrument – Flipped Classroom with Interactive Platforms

<b>Flipped Classroom Aspect</b>	<b>Indicator</b>	<b>Item Code</b>
Pre-Class	Ease of delivering materials before class	F1
During-Class	Effectiveness for interactive in-class activities	F2
Post-Class	Support for reflection and reinforcement after class	F3
Classroom Flow	Organizing flipped classroom sequence effectively	F4
Pre-Class Monitoring	Monitoring students' readiness before face-to-face sessions	F5
In-Class Problem Solving	Enhancing discussions or problem-solving activities	F6
Integration	Integration with flipped classroom model	F7

**TABLE 3** / Criteria for Interpreting Mean Scores

<b>Mean Score Range</b>	<b>Interpretation</b>
3.26 – 4.00	Very High
2.51 – 3.25	High
1.76 – 2.50	Moderate
1.00 – 1.75	Low

(Adapted from [Creswell & Creswell, 2018](#); [Fraenkel et al., 2019](#))

**TABLE 4 / Descriptive Statistics of Teachers' Perceptions of Interactive Presentation Platforms**

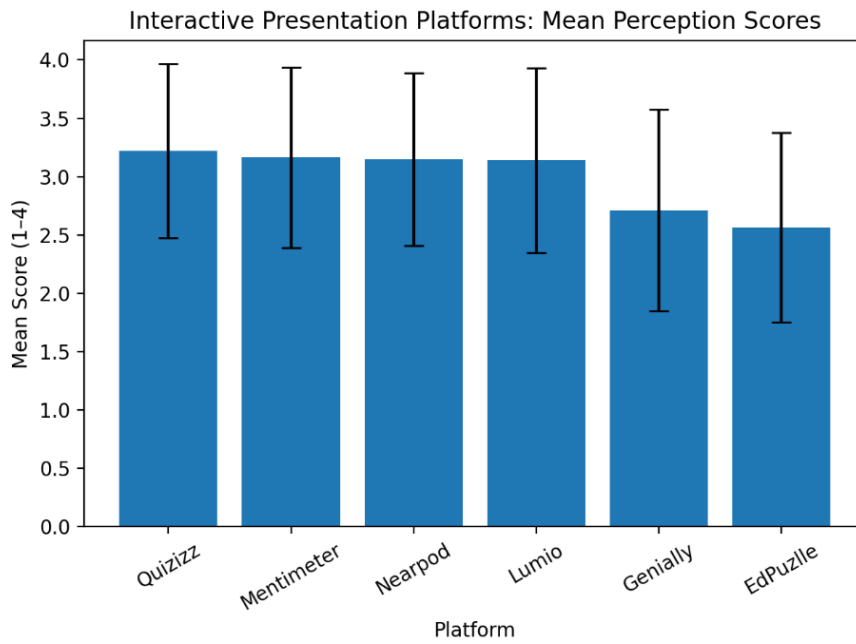
<b>Platform</b>	<b>Mean</b>	<b>SD</b>	<b>Category</b>
Quizizz	3.221	0.748	High
Mentimeter	3.164	0.773	High
Nearpod	3.149	0.739	High
Lumio	3.140	0.790	High
Genially	2.711	0.863	High
EdPuzzle	2.565	0.813	High

**TABLE 5 / Descriptive Statistics of Platform Support for Flipped Classroom**

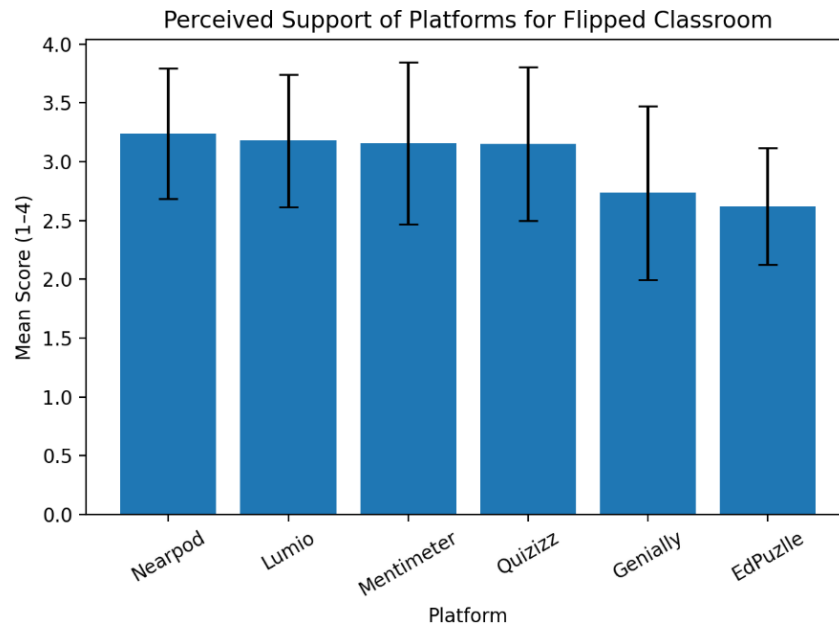
<b>Platform</b>	<b>Mean</b>	<b>SD</b>	<b>Category</b>
Nearpod	3.239	0.553	High
Lumio	3.180	0.563	High
Mentimeter	3.159	0.689	High
Quizizz	3.149	0.654	High
Genially	2.736	0.738	High
EdPuzzle	2.619	0.498	High

## LIST OF FIGURES

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**FIGURE 1** / Mean Perception Scores of Interactive Presentation Platforms



**FIGURE 2 /** Perceived Support of Interactive Presentation Platforms for Flipped Classroom Implementation