Puissant (ISSN print: 2719-0153; ISSN online: 2719-0161)
Vol. 6, pp. 2694-2708
https://puissant.stepacademic.net

Short Paper

Impact of Microsoft Excel on Student Engagement and Interaction in Grade 11 Physical Science

Mary Ann O. Basilla
Deped Albay- Pili National High School, Philippines
maryann.basilla@bicol-u.edu.ph

Date received: June 7, 2024
Date received in revised form: November 30, 2024
Date accepted: May 1, 2025

Recommended citation:

Basilla, M. A. O. (2025). Impact of Microsoft Excel on student engagement and interaction in Grade 11 Physical Science. *Puissant*, *6*, 2694-2708.

Abstract

The study examined the impact of integrating Microsoft Excel on student engagement and interaction in teaching Grade 11 Physical Science. A mixed-methods approach was used with samples consisting of two classes: one as an experimental group and the other as a control group. Pre-tests and post-tests were administered to assess the students' understanding and interaction before and after the intervention. Data through questionnaires and surveys were collected to gather feedback and perceptions from the students regarding their experiences using Microsoft Excel in the classroom. The results showed that the experimental group performed better than the control group. The mean score of the control group was 19.00, while the higher mean score of the experimental group was 23.27, with a significant difference between both groups at the 0.05 level. The results from the questionnaire illustrated that the students were engaged in using Microsoft Excel. There was a substantial enhancement in student engagement, interactions, and academic performance in the experimental group compared to the control group following their exposure to Microsoft Excel. The study highlights the transformative potential of technology, particularly Excel, in fostering dynamic learning environments and improving student outcomes. The findings suggest that Microsoft Excel can serve as a valuable tool to enhance student engagement, interaction, and academic performance, and that teachers should incorporate interactive Excel activities to facilitate active learning and deepen comprehension of scientific concepts.

Keywords – Microsoft Excel, student engagement, interaction, Science, technology

INTRODUCTION

In the Philippine education system, particularly in the field of science, there exists a pressing issue regarding student engagement and interaction in the classroom. Research on science education reveals that student engagement is positively connected with students' academic performance (Delfino,2019). Factors such as teacher-student relationships, family support, and peer motivation play a crucial role in enhancing cognitive and affective engagement among students. Pili National High School, like many educational institutions, faces challenges in effectively teaching Grade 11 Physical Science, as students often struggle to comprehend complex scientific concepts and lack engagement with the subject matter, resulting in suboptimal learning outcomes. This was evident in the Quarterly Exams in Physical Science during the 2022-2023 school year, where 63% of students scored below 75%, very different from their performance in other core subjects. This highlights the need for more effective teaching strategies to enhance student engagement and improve learning outcomes in Physical Science.

Traditional teaching methods may not effectively engage students, leading to a potential decline in academic performance and interest because of their singular teaching approach and lack of connection to the real world (Hu,2024). This lack of engagement can be attributed to the passive nature of traditional learning, which contrasts with the active process of knowledge construction advocated by Piaget (1962), emphasizing experiences and interactions with the environment for effective learning.

By integrating interactive tools into the teaching of Physical Science, students can actively engage in data analysis, visualization, and experimentation, facilitating a deeper comprehension of scientific principles through hands-on activities and real-world applications. This hands-on approach resonates with Dewey's philosophy that students learn best when actively involved in meaningful activities that encourage exploration, experimentation, and self-discovery.

Technology integration in education has gained an impact in recent years to enhance student engagement and interaction in the learning process. Kalyani (2024) suggests that technology integration can shed light on fully capturing students' attention and interest, and empower students to enhance their academic performance and enthusiasm for learning. As a result, the researcher concluded that schools need to innovate and improvise strategies to enhance student engagement and interaction in the classroom, particularly in science subjects. Pili National High School employs diverse teaching strategies beyond traditional methods, recognizing the need for innovative approaches in science education through Microsoft Excel. It is a powerful tool for teaching complex scientific concepts, especially in solving physics problems more interactively and engagingly (Astuti and Bhakti, 2018).

This research focused on assessing the impact of a new teaching strategy using Microsoft Excel in enhancing student engagement and interaction in Physical Science

education among Grades 11- CSS students for the school year 2023-2024. The study focuses on analyzing the impact of the tool on students' conceptual understanding of Physical Science compared to traditional teaching methods and perceptions of students regarding their engagement and motivation when using Microsoft Excel in their learning process, and interaction with their teacher and peers.

LITERATURE REVIEW

Student Engagement

Student engagement refers to the time, energy, and other resources that students and educational institutions invest in to make the best possible experience and improve the opportunity for learning (Abla & Fraumeni, 2019). This is where students exhibit interest, motivation, active participation, and attention in their studies. However, unengaged students are those who do not invest time and effort in their learning. They often feel disinterested, bored, and passive in the learning process, which can lead to poor grades. So, a need for engagement in meaningful learning is a must.

To fully understand students' engagement, it can be seen or observed in how they behave during the teaching-learning process in terms of how they give their attention, interest, curiosity, and passion when they are learning, as well as their motivation to learn more (Bernstein, 2023c). Therefore, gaining insight into how students engage in academic settings can help teachers to better understand how lessons and other academic learning are prepared and carried out.

Kahu and Nelson (2017) show concern about the lower rates of student retention and success, highlighting the need for developing policy, practice, or strategies. As a result, student engagement could be a useful tool for teachers to create pedagogical strategies that enhance students' learning opportunities. Proper student-teacher interactions that foster an emotionally favorable and supportive classroom environment can stimulate learners to participate in class activities and enhance engagement. Research indicates that students who receive high-quality classroom interactions and emotional support in school and from their teachers tend to exhibit high levels of social, emotional, and cognitive engagement (Havik & Westergård, 2019).

Integrating Technology in Science Instruction

In the context of the Philippines, integrating technology becomes increasingly important in enhancing students' performance. In fact, in the released PISA 2022 report, the Philippines obtained scores of 355 for math, 347 for reading, and 373 for science, 120 points lower than the average. The Philippines also ranked near the bottom globally, with an average score of only 14 points in creative thinking, far below the OECD average of 33 points (Philstar.com, 2024). This reveals that Filipino students face significant difficulties in creative thinking and science literacy. This PISA assessment highlights significant

challenges for science education in the Philippines, such as a need for curricular reforms that focus not only on content delivery but also on fostering critical thinking and a need to improve science and technology as an integration in education to foster creativity and problem-solving skills.

Aside from that, Cabrales et al. (2023) found out in their study that science education in poor provinces in the Philippines suffers from issues such as insufficiency of science infrastructure, including unavailability of laboratories and internet, poor reading comprehension, and teacher mismatch that contribute to the weakening of science education in the countryside. To effectively address these challenges, it is important to solve these issues to lessen the burden on teachers and also enhance the overall quality of science education in our nation.

Learning is needed, not merely memorizing, but understanding, so what is being learned by students will be meaningful and remembered. The integration of technology has a meaningful impact on students' performance; thus, technology plays a vital role in their learning process (Sarker et al., 2019). The use of productivity software, which can be leveraged to visualize data, perform calculations, and model scientific phenomena, may engage students in the scientific process. Incorporating technology-based activities into science lessons has been shown to improve students' digital literacy, problem-solving skills, and overall understanding of scientific concepts (Yılmaz, 2023). The use of technology aligns with the principles of experiential learning, as outlined by Kolb (1984). Experiential learning involves a cyclical process of concrete experience, reflective observation, abstract conceptualization, and active experimentation.

Technology facilitates a shift from traditional learning models to more interactive and collaborative approaches, allowing for personalized learning experiences to address individual student needs. It enhances accessibility to learning materials, enriches students' digital skills, and fosters effective collaboration among peers to significantly boost student engagement and motivation. However, the integration of technology in science education is not without its challenges. As highlighted by Karadeniz and Vatanartiran (2015), first-order barriers, such as access to resources and technical support, and second-order barriers, including teachers' beliefs and attitudes towards technology, can hinder effective integration. To overcome these obstacles, it is crucial for science educators to receive adequate training and support in using educational technologies and to develop a positive mindset toward their integration.

In the 21st century, students must possess critical thinking, creative thinking, communication, and collaboration skills. They also need to develop media and technology skills, such as information literacy, media literacy, and Information and Communication Technology (ICT) literacy. To support the development of these essential skills, education systems must be equipped with the necessary hardware and software for ICT resources, and curricula must be designed to promote a learner-centered and collaborative environment where students can engage and respond.

METHODOLOGY

Methods and Techniques of the Study

To determine the impact of using Microsoft Excel in improving conceptual understanding, engagement, and interaction among the learners, the researcher utilized mixed-methods research. A quantitative analysis is used to compare the results of the pretest and posttest to validate student conceptual understanding. Surveys are used in qualitative research to get insight into how students are using the material and how engaged they are with it.

Population and Sample of the Study

The main respondents of this research intervention are the Grade 11 CSS students who are studying the Physical Science subject in the school year 2023- 2024. A total of 22 students were selected using the stratified random sampling technique, with 11 students allocated to the experimental group and another 11 to the control group. Students from other grade levels are not included in this study to maintain the consistency and accuracy of the research findings.

Research Instrument

Two research instruments are employed for the study, which include a pre-test and post-test, and a survey questionnaire. The pre-test and post-test consist of 30 questions focusing on (a) explaining how the position vs. time and velocity vs. time graphs of constant velocity motion are different from those of constant acceleration motion (S11/12PS-IVc-48); and (b). recognize that the everyday usage and the physics usage of the term "acceleration" differ: In physics, an object that is slowing down, speeding up, or changing (S11/12PS-IVc-49).

To measure student attitudes towards the new teaching strategy, their level of engagement with the material, and their interactions with peers and the teacher, surveys consisting of 8 questions were administered designed to validate students' experiences and assess the effectiveness of the approach in enhancing engagement and interaction in Physical Science through a scale: 4.21–5.00: Highly Engaged and Interactive; 3.41–4.20: More than Engaged and Interactive; 2.61–3.40: Engaged and Interactive; 1.80–2.60:Somewhat Engaged and Interactive and 1.00 – 1.80; Not Engaged and Interactive.

Construction and Validation of Instrument

The level of conceptual understanding of the respondents was measured using a multiple-choice test, which was validated by the physics teachers who are experts in their field. A pilot test is employed to determine the validity of the developed questions. The

pre-test and post-test were administered to both the experimental and control groups to establish a baseline for student engagement and interaction in Physical Science education and to measure any changes in student engagement and interaction because of the new teaching strategy. The attitude towards the materials, teacher, and peers was assessed through a survey, which was validated by experts to check the validity and reliability of the instrument.

Data Gathering Procedure

A pre-test was administered to assess students' conceptual understanding of Physical Science 11 before the research commenced, covering the most essential learning competencies (MELCs) for the fourth quarter. Following the pre-test, the teacher conducted a lesson utilizing Microsoft Excel, focusing on interactive, inquiry-based, and self-learning strategies, with content aligned to the identified MELCs, and the data from the pre-test, post-test, and surveys were analyzed to determine the impact of the new teaching strategy on student engagement and interaction.

Statistical Treatment

The level of conceptual understanding of the students is determined through a frequency count and a percentage. To compare the mean scores of the experimental and control groups on the pre-test and post-test and to determine if there was a significant difference between the two groups in terms of student engagement and interaction, a t-test was used:

$$t = \frac{(m - \mu)}{(\frac{s}{\sqrt{n}})} \qquad \textit{Equation 1}$$

where;

t = t-test
m = mean
μ = theoretical value
s = standard deviation
n = variable set size

Aside from this, the questionnaire was also analyzed as percentages and mean scores to interpret the students' engagement and interaction levels of both groups. The interpretation was as follows:

4.21 – 5.00 = Highly Engaged and Interactive
3.41 – 4.20 = More than Engaged and Interactive
2.61 – 3.40 = Engaged and Interactive
1.80 – 2.60 = Somewhat Engaged and Interactive
1.00 – 1.80 = Not Engaged and Interactive

Ethical Consideration

To ensure that the respondents knew about the conduct of the study, a simple orientation was conducted among the respondents. A written consent was used to inform the respondents about the objectives and procedures of the study while also ensuring their rights and safety throughout its implementation.

RESULTS

A multiple-choice type of test is used to determine the level of conceptual understanding of the respondents in acceleration and position vs. time graphs.

Table 1. Level of Conceptual Understanding of the Students before the Intervention

Test of Difference	Mean (*M*)	Mean difference (d)	*t*-value	df	sig.
Pretest – Control Pretest – Experimental	7.81 10.32	2.5	0.6799	20	.05

The pre-test results showed that the experimental group had a higher mean score ($\bar{x}$ = 10.32) compared to the control group ($\bar{x}$ = 7.81), indicating some initial differences in the groups' starting points. The difference in pre-test mean scores between the control ($\bar{x}$ = 7.81) and experimental ($\bar{x}$ = 10.32) groups was not significant, indicating that the groups were comparable in their initial engagement levels before the intervention.

Table 2. Level of Conceptual Understanding of the Students after the Intervention

Test of Difference	Mean (*M*)	Mean difference (d)	*t*-value	df	sig.
Posttest – Control Posttest – Experimental	19.00 23.27	4.27	2.47	20	.05

Table 2 shows the results of conceptual understanding after the implementation of the lesson plan integrating Microsoft Excel, where the post-test results demonstrated a notable improvement in both groups. The post-test mean scores were 23.27 for the experimental group and 19.00 for the control group, which indicates that the integration of Microsoft Excel into the lesson had a positive impact on the students' understanding of Physical Science concepts.

Impact on the use of Microsoft Excel

Students' interaction and engagement in the use of the material were measured by the survey on how actively students are involved in the learning process while ensuring confidence in using educational technologies. Additionally, inquiry-based learning,

perception, motivation, peer interaction, teacher-student interaction, and relevance are also measured to analyze how this factor affects students' engagement and interaction.

Table 3. Impact on the use of Microsoft Excel

Variables	Mean (*M*)	Interpretation
Student Engagement	4.18	More than Engaged and Interactive
Usage Confidence Level	3.00	Moderate confidence level
Inquiry-Based Learning	3.55	More than Engaged and Interactive
Perception	3.91	More than Engaged and Interactive
Motivation	3.73	More than Engaged and Interactive
Peer Interaction	4.09	More than Engaged and Interactive
Teacher-Student Interaction	3.91	More than Engaged and Interactive
Relevance	3.82	More than Engaged and Interactive

Based on the survey results, the high mean score of 4.18 indicates that students were more than engaged and interactive in incorporating Excel into their learning, yet a moderate confidence level (mean score of 3.00) in using Excel suggests that they may have had some initial hesitation or uncertainty in applying it to their scientific studies. Data shows that the interactive and inquiry-based strategies employed in the lesson were effective in capturing students' attention and interest.

The survey results also indicate that students were very motivated to participate in Physical Science activities using Microsoft Excel, with a mean score of 3.73, and felt very connected to their teacher during the activities, with a mean score of 3.91. and they were very comfortable interacting with their peers, making it more relevant to their lives, with a mean score of 3.82.

DISCUSSION

The level of conceptual understanding of the students in physical science, particularly in the topic of acceleration and position vs. time graph without the use of Microsoft Excel, was shown in Table 1. As reflected, the experimental group had a mean score ($\bar{x}$) of 10.32, higher than the control group's mean score ($\bar{x}$) of 7.81, indicating some initial differences in the groups' starting points. Data shows a t-value of 0.6799 and a mean difference of 2.5 with a degree of freedom of 20 at the 0.05 significance level. The associated p-value was 0.252181, which is greater than the commonly used significance level of 0.05. The p-value represents the probability of obtaining the observed results if the null hypothesis (no significant difference) is true. Since the p-value of 0.252181 is greater than the significance level of 0.05, the result was not statistically significant.

Table 2 shows the results of conceptual understanding after the implementation of the lesson plan integrating Microsoft Excel, where the post-test results demonstrated a notable improvement in both groups. The post-test mean scores were 23.27 for the experimental group and 19.00 for the control group, which indicates that the integration

of Microsoft Excel into the lesson plan had a positive impact on the students' understanding of physical science concepts.

In determining whether the difference in post-test mean scores between the groups was statistically significant, another independent sample t-test was conducted. The statistical analysis revealed a t-value of 2.47368 and a p-value of 0.011229. Since the p-value of 0.011229 is less than the significance level of 0.05, the result was statistically significant, which indicates that the observed difference in post-test mean scores between the experimental and control groups was unlikely to have occurred by chance. The experimental group had a deeper understanding of physical science concepts compared to the control group.

The significant result suggests that the use of Microsoft Excel had an impact on student engagement and interaction in teaching Grade 11 Physical Science based on the post-test mean scores. This finding highlights the potential of integrating technology like Microsoft Excel to enhance student engagement and interaction in the educational setting. This is consistent with the findings of Estipular & Roleda (2018), who examined the effects of using interactive simulations in teaching physics concepts to Filipino students and found significant improvements in their conceptual understanding and problem-solving skills. Furthermore, educational technology, including spreadsheet software, has a positive impact on student collaboration, critical thinking, and problem-solving skills in science education in the Philippines. This aligns with the current study's findings, emphasizing the value of incorporating technology-based tools like Excel in the classroom to enhance student engagement, critical thinking, and problem-solving skills, which are essential for academic and professional success. As a result, the experimental group's outperformance of the control group indicates the effectiveness of integrating technology in science education, providing evidence for the transformative potential of Microsoft Excel in fostering dynamic learning environments and improving student outcomes.

Microsoft Excel used in class encourages greater student participation, thereby increasing their interest and engagement in the lectures, which is a must. According to Bhat (2023), integrating technology into the classroom has been shown to enhance student motivation and involvement. Moreover, when utilized effectively, Microsoft Excel is a potent modern instrument that significantly aids the teaching and learning process through the use of technology to improve learning outcomes and student satisfaction. It can serve as a valuable tool for addressing conceptual challenges within the curriculum. Microsoft Excel is recognized as a powerful tool for imparting complex scientific concepts in a more interactive and captivating manner, thereby improving student engagement, critical thinking, and problem-solving abilities (Saha, 2022).

Additionally, students participate more in class when Microsoft Excel is used, which enhances their interest and participation in the lectures. UnionBank Empowers Educators and Students with Tools from Microsoft –Microsoft News Center Philippines (2018) stated that the use of technology, including spreadsheet software like Microsoft Excel, can lead

to improved student engagement, motivation, and collaboration. For this, the results proved that Microsoft Excel, which is included in learning methods, also encourages deep and long-lasting learning. Given its powerful ability to motivate and engage players, Microsoft Excel is being used more often for information processing.

Based on the survey results, it was found that students who have high technology utilization are more likely to have higher academic performance. Similarly, a study by it was found that when students use ICT, their autonomy and capability in learning are also developed, leading to higher academic performance (Fu, Jo Shan,2013). While students reported a high level of interest in using Microsoft Excel in their physical science class, their moderate confidence level (mean score of 3.00) in using Excel suggests that they may have had some initial hesitation or uncertainty in applying it to their scientific studies. This result presents an opportunity for teachers to provide additional support and guidance to help students develop their skills and comfort with Excel.

The Microsoft Excel activities were found to be more than engaged and interactive, with a mean score of 3.55, which shows that the interactive and inquiry-based strategies employed in the lesson plan were effective in capturing students' attention and interest. The study by D'Angelo (2018b) found that using Excel spreadsheets as a simulating tool can enhance student learning in physics. Students showed that using Microsoft Excel enhanced their understanding of physical science concepts to a great extent, with a mean score of 3.91, which shows the potential of technology integration in improving academic performance and conceptual understanding.

The survey results also indicate that students were very motivated to participate in physical science activities using Microsoft Excel, with a mean score of 3.73. This high level of motivation can be attributed to the engaging nature of the Excel activities and the perceived relevance of the software in their learning. Therefore, an emphasis on the importance of motivation and engagement in learning is necessary while recognizing that they are critical for academic achievement and enjoyment of school. When students are motivated and engaged, they are more likely to actively participate in the learning process and achieve better academic outcomes.

Students felt very connected to their teacher during the Microsoft Excel activities, with a mean score of 3.91. This finding suggests that the integration of technology can enhance teacher-student relationships by creating opportunities for collaboration, feedback, and support. Statti et al. (2021) highlight the importance of teacher-student relationships in promoting student motivation and engagement and how technology integration can support these relationships. Using technology to strengthen connections, teachers may encourage student engagement, motivation, and overall academic performance. The use of digital tools can enhance teacher-student communication, leading to improved student outcomes. Also, technology integration can support teacher-student relationships by providing opportunities for students to receive personalized feedback and support.

Students were very comfortable interacting with their peers during the Microsoft Excel activities, with a mean score of 4.09. This result indicates that the collaborative nature of the Excel activities fostered a positive learning environment where students felt safe and supported in sharing their ideas and working together. Student engagement is significantly influenced by the quality of relationships students have with their peers. So, students who feel a sense of belonging and connection with their peers are more likely to persist in their academic pursuits, according to Mtshweni (2024). Teachers must ensure they create opportunities for students to interact with each other, as this can have a significant impact on their learning outcomes. The role of collaborative learning must be practiced in promoting student engagement and motivation. Teachers can encourage retention, engagement, and academic performance by cultivating a collaborative learning environment.

Students also perceived the use of Microsoft Excel in learning physical science concepts as very relevant, with a mean score of 3.82. This finding suggests that students recognized the practical applications of Excel in their scientific studies and understood its importance in their academic and professional development. Chiaro (2023) found that students who used technology in their learning reported higher levels of engagement and motivation compared to those who did not. Technology has an important role in promoting student engagement and motivation.

CONCLUSIONS

The study used a mixed-methods approach, utilizing pre-test and post-test assessments, to investigate the impact of integrating Microsoft Excel on student engagement and interaction in the field of physical science. Results indicated a significant enhancement in student engagement, interactions, and academic performance in the experimental group compared to the control group following their exposure to Microsoft Excel. These findings highlight the transformative potential of technology, particularly Excel, in fostering dynamic learning environments and improving student outcomes.

Survey results provided additional validation of the positive effects of Microsoft Excel on student engagement and interaction. Students demonstrated high interest, moderate engagement, and perceived improved understanding when utilizing Excel. While confidence levels varied, overall motivation, teacher connection, peer comfort, and the perceived relevance of Excel were positively acknowledged, emphasizing the value of technology integration in educational contexts.

RECOMMENDATIONS

With these, it is therefore recommended that: (1) Microsoft Excel-based teaching materials can be used as learning resources; (2) teachers are encouraged to incorporate

interactive Excel activities to facilitate active learning and deepen comprehension of scientific concepts. Educators should explore diverse innovative strategies to sustain learner motivation and interaction in the classroom; (3) To improve students' learning experience, it is important for the school administration needs to think about incorporating technological tools like Microsoft Excel into the curriculum; and (4) To further improve teaching methods and student outcomes, future research should go deeper into the implications and applications of integrating technology, particularly Microsoft Excel, in science education.

IMPLICATIONS

The findings of this study imply that: (1) technological integration has a significant impact on students' engagement and interaction, specifically the use of Microsoft Excel. The conceptual understanding, problem-solving skills, and academic performance are greatly influenced by the tool, making it necessary for the students to be actively involved and engage in the learning process; (2). An adequate support and guidance on the part of the students are needed to be established for them to have confidence on using technology effectively; (3) Professional development programs or training for teachers on the integration of educational technology and strategies for facilitating meaningful student engagement needed to be enhanced; and (4) Policymakers and school administrators should consider investing in technology resources to have a widespread adoption of interactive teaching methods in science education.

ACKNOWLEDGEMENT

The researchers would like to express their heartfelt gratitude to all those who have supported, encouraged, and appreciated their efforts throughout this endeavor.

FUNDING

The research was conducted without receiving financial support from any organization or institution.

DECLARATIONS

Conflict of Interest

No conflicts of interest exist between the authors that might be deemed significant to the article's content.

Informed Consent

Informed consent was obtained from all respondents involved in the study.

Ethics Approval

To ensure that the respondents knew about the conduct of the said study, a simple orientation was conducted among the respondents to emphasize the importance of the innovation to them.

REFERENCES

Abla, C., & Fraumeni, B. (2019). *Student engagement: Evidence-based strategies to boost academic and social-emotional results*. https://www.semanticscholar.org/paper/Student-Engagement%3AEvidenceBasedStrategiestoAblaFraumeni/77f44cca12966165846920b1c3ac135c9b50aae5

Ambele, Raiton & Kaijage, Shubi & Dida, Mussa & Trojer, Lena & Kyando, Newton. (2022). A review of the development trend of personalized learning technologies and their applications. *International Journal of Scientific Research & Growth*, *8*, 75–91. https://doi.org/10.31695/IJASRE.2022.8.11.9

Astuti, I. a. D., & Bhakti, Y. B. (2018). The Effect of the Microsoft Excel-based Interactive Learning Media on the Physics Problem Solving. *Indonesian Review of Physics, 1*(1), 7. https://doi.org/10.12928/irip.v1i1.243

Bernstein, L. (2023c, October 18). *Student Engagement: Why it Matters*. Xello. https://xello.world/en/blog/student-engagement/what-is-student-engagement/

Bhat, N. R. A. (2023). The Impact of technology integration on student learning outcomes: A comparative study. *International Journal of Social Science Educational Economics Agriculture Research and Technology (IJSET)*, 2(9), 592–596. https://doi.org/10.54443/ijset.v2i9.218

Cabrales, P. & Pacala, F. A. (2023). Science education in the Philippine countryside: A phenomenological study. *Indonesian Journal of Education Teaching and Learning (IJETL)*, *3*(1), 12-23. https://doi.org/10.33222/ijetl.v3i1.2677

Chi, C. (2024, June 19). Philippines ranks at the bottom of new PISA test on creative thinking.*Philstar.com*.https://www.philstar.com/headlines/2024/06/19/2364001/philippines-ranks-bottom-new-pisa-test-creative-thinking

Chiaro, C. (2023, March 13). *How technology can increase student engagement.* TeachHUB. https://www.teachhub.com/technology-in-the-classroom/2019/08/how-technology-can-increase-student-engagement/

D'Angelo, C. (2018b, July 9). *The Impact of Technology: Student engagement and success*. Pressbooks. https://pressbooks.pub/techandcurriculum/chapter/engagement-and-success/

Delfino, A. P. (2019). Student engagement and Academic performance of students of Partido State University. *Asian Journal of University Education, 15, 42-55. -*

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research, 74*(1), 59- 109. https://doi.org/10.3102/00346543074001059

Fu, J. S. (2013). ICT in education: A critical literature review and its implications. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT), 9*, 112-125

Havik, T., & Westergård, E. (2019). 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

Hu, J. (2024). The Challenge of Traditional Teaching Approach: A study on the path to improve classroom teaching effectiveness based on secondary school students' psychology. *Lecture Notes in Education Psychology and Public Media, 50*(1), *213–219.* https://doi.org/10.54254/2753-7048/50/20240945

Kahu, E. R., & Nelson, K. (2017). Student engagement in the educational interface: understanding the mechanisms of student success. *Higher Education Research & Development*, *37*(1), 58–71. https://doi.org/10.1080/07294360.2017.1344197

Kalyani, N. D. L. K. (2024). The role of Technology in Education: Enhancing learning outcomes and 21st century skills. *International Journal of Scientific Research in Modern Science and Technology, 3*(4), 05–10. https://doi.org/10.59828/ijsrmst.v3i4.199

Karadeniz, S., & Vatanartiran, S. (2015). A needs analysis for technology integration plan: Challenges and needs of teachers. *Contemporary Educational Technology*, 6(3). https://doi.org/10.30935/cedtech/6150

Estipular, Ma. K., & Roleda. (2018). The use of interactive lecture demonstration with interactive simulation in enhancing students' conceptual understanding in Physics. In *De La Salle University Research Congress*. Retrieved from https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/research-congress-proceedings/2018/lli-18.pdf

Millar, R. (2008). Why is science hard to learn?. *Journal of Computer Assisted Learning, 7*, 66 - 74. https://doi.org/10.1111/j.1365-2729.1991.tb00229.x

Mtshweni, B. V. (2024). First-generation distance learning students: Can the perceptions of social support and sense of belonging influence academic persistence?. *Asian Association of Open Universities Journal*, *19*(2), 153-169. https://doi.org/10.1108/aaouj-10-2023-0119

Saha, P. (2022). Effectiveness of in-class Excel-based active learning activities for transportation engineering courses. *Frontiers in Education*, 7. https://doi.org/10.3389/feduc.2022.879174

Sarker, M. N. I., Wu, M., Cao, Q., Alam, G. M., & Li, D. (2019). Leveraging digital technology for better learning and education: A systematic literature review. *International Journal of Information and Education Technology*, 9(7), 453–461. https://doi.org/10.18178/ijiet.2019.9.7.1246

Statti, A., Torres, J., & Reyes, M. (2021). The role of teacher-student relationships in promoting student motivation and engagement through technology integration. *Journal of Educational Technology Development and Exchange, 14*(2), 33-47.

Microsoft Philippines Communications Team. (2018, August 17). *UnionBank empowers educators and students with tools from Microsoft.* Retrieved from https://news.microsoft.com/en-ph/2018/08/17/transforming-the-educational-landscape-in-the-ph-with-tech/

Yılmaz, Ö. (2023). The role of technology in modern science Education. In Özgür Yayınları eBooks. https://doi.org/10.58830/ozgur.pub383.c1704

Author's Biography

MARY ANN O. BASILLA is a graduate of Bicol University Tabaco Campus, Tabaco City, Bicol, Philippines, where she earned a Bachelor's Degree in Secondary Education with a major in Physical Science. She is currently continuing her education by pursuing a Master's degree at the Bicol University Graduate School while actively employed as a Junior High School Teacher.