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Influence of Technology Integration on Students' Engagement on Physical Education

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Abstract: As a physical education worker, integrating technology into learning in physical education curriculum will improve students' self-efficacy, increase students' motivation and enjoyment of exercise, and improve students' attitude towards physical activities. The quantitative research and design of TPACK knowledge of PE teachers are carried out. Surveys or structured assessments will be used to measure the proficiency of physical education teachers in integrating technology in the context of their teaching practices. The integration of technology in the physical education curriculum presents a dynamic and evolving landscape with potential implications for student engagement and learning outcomes. Since most research has been conducted within the confluence of traditional physical education teaching practices and technological tools, there is an urgent need to examine the multifaceted impact on students' educational experiences.

Keywords: Influence of Technology; Students; Engagement on Physical Education.

1. Introduction

The Influence of Technology Integration in Physical Education on Students' Engagement is a critical topic in today's educational landscape. The incorporation of technology into physical education has the potential to revolutionize the way students engage with the subject and, in turn, impact their overall learning outcomes. In recent years, the integration of technology into the field of physical education has gained momentum, reshaped traditional teaching methods and provided new avenues for enhancing student engagement and learning outcomes.

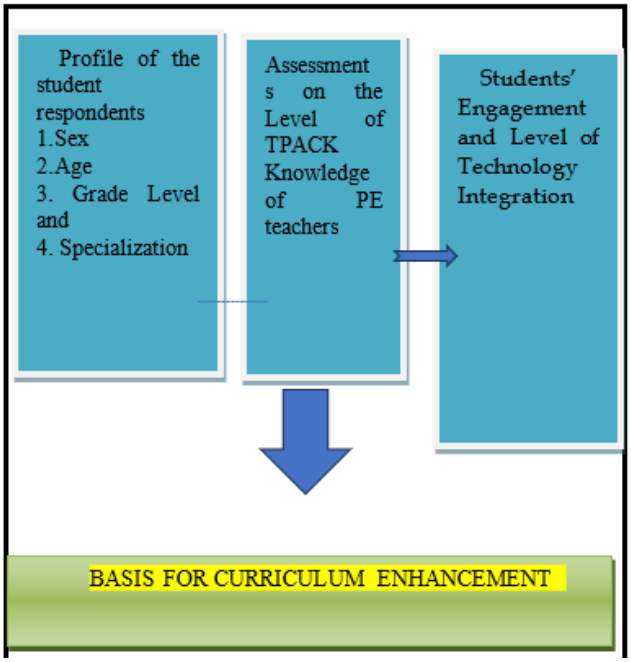
In physical education, technology integration can provide students with interactive and engaging experiences, such as gamification, wearable fitness trackers and virtual reality simulations, which can make physical activities more engaging for students, motivate students to actively participate and strive to improve, and increase their participation in physical activities. Suelves, d.m. et al. (2023).

At the same time, educators use technology to collect and analyze data on student performance and progress, allowing them to identify strengths and weaknesses in the curriculum. This approach enables educators to make informed adjustments to optimize learning outcomes (Smith & Johnson, 2019; Brown et al., 2020). Technology integration promotes a more comprehensive understanding of student engagement, participation rates, and skill development. By leveraging analytics, educators can make evidence-based decisions to improve curriculum effectiveness, thereby promoting a conducive learning environment (Garcia & Lee, 2018; Jones & Martinez, 2021).

Despite growing recognition of the impact of technology integration on all aspects of education, there are still significant gaps in understanding the subtle impact of technology integration on student participation in physical education. This study explores the multifaceted impact of technology in the context of physical education curriculum, aiming to understand how various technological tools and strategies affect student engagement and learning outcomes. Understanding these dynamics can provide valuable insights into the design of effective technology to enhance physical education curriculum and curriculum development strategies.

2. Research Paradigm

Table 1. Research Paradigm



After determining the research content, the corresponding research paradigm is established. This paper introduces the significant impact of technology integration on students' sports participation. The research framework is as follows: first, to understand the phenomenon and development trend of science and technology integration; Second, understand the impact of technology integration on student engagement; Third, the impact of technology integration on teachers'

professional development. According to the research framework, what impact will these effects have on students' participation in physical education curriculum and the professional development of physical education teachers? Through the process of the above research paradigm, the influence of technology integration on students' physical education input is analyzed and discussed.

3. Sampling Method (Locale, Population, Sampling Technique)

The study utilized purposive sampling for students who have experienced technology integration in physical education classes. Participants will be chosen based on their demographic profiles. Collaboration with educators and administrators will facilitate the identification of relevant participants. A balanced sample size will ensure meaningful insights into the influence of technology on student engagement in physical education.

There were total of 480 students who participated in the survey to find out the level of technology integration of college PE teachers and students' engagement in Changsha, Hunan Province. 5 PE teachers were selected from each university totalling 20 PE faculty members to participate in the focused group discussion on the challenges and difficulties faced by them when integrating different technologies in the classroom.

4. Statistical Treatment

Two research tools were used in this study. The first, in terms of assessing teachers' level of technology integration, used a TPACK (2021) level research questionnaire. To assess student engagement, it used a questionnaire used in the Phuong (2023) study. The second tool used is the SPSS software. The data collected during the course of the study will be statistically analyzed using SPSS, allowing for correlated analysis.

In analyzing the data to be gathered, the following statistical treatments will be used in the study at 0.05 level of significance using Statistical Package for Social Sciences or SPSS software:

4.1Frequency Count and Percentage

This is used by the researcher in its analysis of the profile of the respondents.

4.2Weighted Mean

This is used in giving different weights to the individual values as indicated in the demographics of the participants as well as to the assessment of the teachers' pedagogical practices in the classroom in relation to: cooperative learning. competitive games, and linking school sport to community sports club.

4.3T-test /ANOVA

The T-test and/or Analysis of Variance or F-test is used by the researcher to determine if there are significant differences in the member respondents as assessed by themselves when their profiles are taken as factors.

4.4Pearson Product Moment Correlation. In the context of the study "Technology

Integration in Physical Education Curriculum Influencing Students' Engagement and Learning Outcomes," the Pearson product-moment correlation is a statistical method used to measure the strength and direction of the linear relationship between two continuous variables. In this study, it might be applied to examine the degree and nature of the correlation between the extent of technology integration in the physical education curriculum and students' levels of engagement as well as their learning outcomes.

This statistical analysis is used in this study to explore whether there is a significant association between the degree of technology integration and students' engagement, in the context of the physical education. The findings could provide quantitative insights into the potential impact of technology on both engagement and academic achievements in this educational setting.

The results are interpreted as follows:

Table 2. LEVEL OF TPACK Pedagogical Practices and Student Engagement in PE

WeightScale/Range	Description	Interpretation
4	3.51-4.00 Strongly Agree	Always
3	2.51-3.50 Agree	Often
2	1.51-2.50 Disagree	Seldom
1	1.00-1.50 Strongly Disagree	Not at all

5. Research Results and Analysis

Table 3. Basic information of the interviewees

		Frequency	Percent
Sex	Male	82	17.1
	Female	398	82.9
	Total	480	100.0
Age	<18	12	2.5
	18-25	435	90.6
	26-30	15	3.1
	31-40	18	3.8
	Total	480	100.0
Grade Level	I	296	61.7
	II	151	31.5
	III	20	4.2
	IV	13	2.7
	Total	480	100.0
Specialization	Education Management	37	7.7
	Art Pre-school Education	54	11.3
	Music Education	336	70.0
	Chinese Language and Literature	53	11.0
	Total	480	100.0

We will present the collected data in the form of a table and analyze and interpret it. The conclusion is based on the statistical analysis performed on SPSS version 27. The research questions raised in this study are revisited. Therefore, this paper presents the results of the study and their

interpretation and analysis.

Presented in the table are the profile of the respondents as to sex, age, grade level, and specialization. As to sex, majority are females, 398 or 82.90%. As to age, majority comes from the age group 18-25, 435 or 90.60%. As to grade level, majority are grade I, 296 or 61.70%. As to specialization, majority are into Music Education, 336 or 70.00%. The foregoing profile of the respondents denote they come from a varied profile. This further means that there is diversity of academic standpoints on the thesis of the study from the framed respondents.

Table 4. Integrated assessment of respondents' technical teaching content knowledge (TPACK)

Technological Pedagogical Content Knowledge	Mean	SD	Description	Interpretation	Rank
Knows how to choose the technology to be used in class to improve his/her teaching method	3.33	.731	Agree	Often	1.5
Knows how to combine content, technology and teaching method in the classroom	3.28	.716	Agree	Often	3
Can guide other teachers in coordinating the use of content, technology and teaching method at school	3.23	.946	Agree	Often	4
Can use the technology that gives value to the subject context for the purpose of teaching	3.04	.669	Agree	Often	6
Knows how to choose the technology to be used in class to improve his/her teaching method	3.33	.800	Agree	Often	1.5
Knows the latest development pertaining to PE classes	3.08	.828	Agree	Often	5
Knows different types of technology in PE classes	2.99	.837	Agree	Often	7
Grand Mean	3.18	.657	Agree	Often	

Legend: 1.00-1.50-Strongly disagree (Not at all); 1.51-2.50-Disagree (Seldom); 2.51-3.50-Agree (Often); 3.51-4.00-Strongly agree (Always)

Presented in the table are the parameters of Integration of Technological Pedagogical Content Knowledge (TPACK). It shows that the grand mean is 3.18 (SD=.657) and interpreted as often.

The foregoing results draw implications for educators and educational institutions. Firstly, the high rankings of indicators 1 and 5, emphasizing technology selection for enhancing teaching methods, underscore the critical role of technological pedagogical content knowledge (TPACK) in instructional design. This highlights the necessity for targeted professional development initiatives focusing on the acquisition of competencies related to the strategic integration of technology tools aligned with instructional objectives.

Secondly, the low ranking of indicator 7, which pertains to familiarity with technology in the context of physical education (PE) classes, signals a potential gap in TPACK domain knowledge among educators in specialized subject areas. This underscores the importance of subject-specific TPACK development programs, particularly for niche disciplines such as PE, where the integration of technology may pose unique challenges or opportunities.

Table 5. Assessment on the Technological Content Knowledge (TCK)

Technological Content Knowledge	Mean	SD	Description	Interpretation	Rank
Knows about the technology that can be used to increase students' understanding of the PE subject	3.34	.858	Agree	Often	2
Knows about the technology that can be used to explain the difficult topics and PE execution	3.28	.783	Agree	Often	4
Knows about the Information Communication Technology (ICT) application that can be used to increase my understanding of the teaching content in PE	3.44	.748	Agree	Often	1
Knows how to use ICT in teaching as a tool for the student to plan their own learning in PE	3.18	.873	Agree	Often	5
Thinks critically about how to use technology in the classroom	3.33	.732	Agree	Often	3
Keeps herself/ himself updated with new PE technologies	3.08	.829	Agree	Often	7
knows various latest applications that are effective with PE subject.	3.14	.858	Agree	Often	6
Grand Mean	3.26	.739	Agree	Often	

Legend: 1.00-1.50-Strongly disagree (Not at all); 1.51-2.50-Disagree (Seldom); 2.51-3.50-Agree (Often); 3.51-4.00-Strongly agree (Always)

Presented in the table are the assessment on the parameters of Technological Content Knowledge. The assessment provides valuable insights into the Technological Content Knowledge (TCK) of educators, revealing a mean score of 3.26 with a standard deviation (SD) of 0.739. This mean, interpreted as "often," indicates a moderate to high frequency of integrating technology into teaching practices to augment content knowledge in Physical Education (PE). The low SD across indicators suggests minimal variation from the mean, implying a high level of consistency in TCK proficiency among respondents.

Table 6. Assessment on the Pedagogical Content Knowledge (PCK)

Pedagogical Content Knowledge	Mean	SD	Description	Interpretation	Rank
Knows how to select effective teaching approaches to guide the student in our PE class	3.43	.748	Agree	Often	2.5
Knows about different teaching approaches that are relevant to facilitate our PE class	3.22	.770	Agree	Often	7
Can adapt the latest teaching method to match the learning outcomes that need to be achieved	3.49	.751	Agree	Often	1
Can choose a suitable assessment method	3.33	.731	Agree	Often	5
Knows how to select effective teaching approaches to guide the student in our PE class	3.33	.799	Agree	Often	5
Knows about different teaching approaches that are relevant to facilitate the teaching in PE	3.43	.748	Agree	Often	2.5
Knows how to assess students' performance in PE	3.33	.732	Agree	Often	5
Grand Mean	3.37	.704	Agree	Often	

Legend: 1.00-1.50-Strongly disagree (Not at all); 1.51-2.50-Disagree (Seldom); 2.51-3.50-Agree (Often); 3.51-4.00-Strongly agree (Always)

Presented in the table are the parameters of Assessment on the Pedagogical Content Knowledge (PCK). The assessment reveals a mean score of 3.37 with a standard deviation (SD) of 0.704, indicating a moderate to high frequency of integrating Pedagogical Content Knowledge (PCK) among educators. This mean, interpreted as "often," suggests a consistent application of pedagogical principles in the context of teaching Physical Education (PE). The low SD across indicators indicates minimal variation from the mean, reflecting a high level of uniformity in PCK proficiency among respondents. This statistical consistency implies a consistent pattern of PCK application across various aspects assessed, facilitating targeted intervention strategies for PCK enhancement.

Table 7. Assessment on the Technological Pedagogical Knowledge (TPK)

Technological Pedagogical Knowledge	Mean	SD	Description	Interpretation	Rank
Knows how to use ICT in teaching as a tool for the student to plan their own learning	2.89	.999	Agree	Often	7
Thinks critically about how to use technology in the classroom	3.28	.782	Agree	Often	5
Can adapt/modify the use of technology to diversify teaching activities in PE	3.38	.741	Agree	Often	2.5
Enhances her ability to integrate technology into PE lessons effectively.	3.38	.809	Agree	Often	2.5
Demonstrates proficiency in using technology to support learning and engagement.	3.23	.770	Agree	Often	6
Seamlessly combines technological tools with pedagogical strategies for optimal student understanding.	3.28	.787	Agree	Often	4
Ensures that technology enhances, rather than detracts from, the overall PE learning experience.	3.39	.804	Agree	Often	1
Grand Mean	3.26	.707	Agree	Often	

Legend: 1.00-1.50-Strongly disagree (Not at all); 1.51-2.50-Disagree (Seldom); 2.51-3.50-Agree (Often); 3.51-4.00-Strongly agree (Always)

Presented in the table are the parameters of Technological Pedagogical Knowledge (TPK). The assessment reveals a mean score of 3.26 with a standard deviation (SD) of 0.707, indicating a moderate to high frequency of integrating Technological Pedagogical Knowledge (TPK) among educators. This mean, interpreted as "often," suggests a consistent application of technology-enhanced pedagogical strategies in the context of teaching Physical Education (PE). The low SD across indicators indicates minimal variation from the mean, reflecting a high level of uniformity in TPK proficiency among respondents. This statistical consistency implies a consistent pattern of TPK application across various aspects assessed, facilitating targeted intervention strategies for TPK enhancement.

Presented in the table are the results of a comparative analysis on the level of teachers' technology integration when grouped by sex. The analysis covered four key parameters: Technological Pedagogical Content Knowledge (TPCK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). The p-values associated with these parameters were found to be .626, .381, .777, and .951, respectively. These p-values indicate that there is no significant difference in technology integration levels between male and female teachers.

Table 8. Significant Difference on the Level of Teachers' Technology Integration when grouped by Sex

	Sex	Mean	SD	t-value	p-value	Decision
Technological Pedagogical Content Knowledge	Male	3.21	.662	.487	.626	Accept Ho
	Female	3.17	.656			
Technological Content Knowledge	Male	3.32	.726	.877	.381	Accept Ho
	Female	3.24	.743			
Pedagogical Content Knowledge	Male	3.39	.702	.284	.777	Accept Ho
	Female	3.36	.705			
Technological Pedagogical Knowledge	Male	3.27	.684	.062	.951	Accept Ho
	Female	3.26	.712			

Table 9. Significant Difference on the Level of Teachers' Technology Integration when grouped by age

	age	Mean	SD	F-value	p-value	Decision
Technological Pedagogical Content Knowledge	<18	3.13	.725	.403	.751	Accept Ho
	18-25	3.18	.655			
	26-30	3.03	.6575			
	31-40	3.27	.6895			
Technological Content Knowledge	<18	3.20	.7815	.172	.915	Accept Ho
	18-25	3.26	.738			
	26-30	3.19	.754			
	31-40	3.36	.794			
Pedagogical Content Knowledge	<18	3.30	.807	.139	.937	Accept Ho
	18-25	3.37	.699			
	26-30	3.28	.772			
	31-40	3.34	.737			
Technological Pedagogical Knowledge	<18	3.30	.798	.098	.961	Accept Ho
	18-25	3.2682	.704			
	26-30	3.17	.739			
	31-40	3.24	.7384			

Presented in the table are the results of a comparative analysis on the level of teachers' technology integration when grouped by age. The analysis covered four key parameters: Technological Pedagogical Content Knowledge (TPCK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). The p-values associated with these parameters were found to be .751, .915, .937, and .961, respectively. These p-values indicate that there is no significant difference in technology integration levels across different age groups of teachers.

Table 10. Significant Difference on the Level of Teachers' Technology Integration when grouped by Grade Level

	Grade	Mean	SD	F-value	p-value	Decision
Technological Pedagogical Content Knowledge	I	3.19	.648	1.464	.224	Accept Ho
	II	3.15	.680			
	III	3.44	.488			
	IV	3.02	.753			
Technological Content Knowledge	I	3.26	.724	.637	.591	Accept Ho
	II	3.23	.783			
	III	3.44	.590			
	IV	3.13	.796			
Pedagogical Content Knowledge	I	3.39	.686	1.881	.132	Accept Ho
	II	3.29	.746			
	III	3.66	.418			
	IV	3.37	.854			
Technological Pedagogical Knowledge	I	3.27	.686	1.703	.165	Accept Ho
	II	3.21	.756			
	III	3.56	.502			
	IV	3.12	.773			

Presented in the table are the results of a comparative analysis on the level of teachers' technology integration when grouped by grade level. The analysis covered four key parameters: Technological Pedagogical Content Knowledge (TPCK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). The p-values associated with these parameters were found to be .224, .591, .132, and .165, respectively. These p-values indicate that there is no significant difference in technology integration levels across

different grade levels of teachers.

Table 11. Significant Difference on the Level of Teachers' Technology Integration when grouped by Specialization

	Major	Mean	SD	F-value	p-value	Decision
Technological Pedagogical Content Knowledge	Education Management	3.19	.802	.348	.790	Accept Ho
	Art Pre-school Education	3.26	.513			
	Music Education	3.17	.660			
	Chinese Lang and Literature	3.19	.668			
Technological Content Knowledge	Education Management	3.28	.838	.110	.954	Accept Ho
	Art Pre-school Education	3.30	.607			
	Music Education	3.24	.750			
	Chinese Language and Literature	3.26	.740			
Pedagogical Content Knowledge	Education Management	3.37	.827	.995	.395	Accept Ho
	Art Pre-school Education	3.51	.532			
	Music Education	3.35	.714			
	Chinese Language and Literature	3.30	.700			
Technological Pedagogical Knowledge	Education Management	3.29	.817	.551	.647	Accept Ho
	Art Pre-school Education	3.37	.557			
	Music Education	3.24	.7124			
	Chinese Language and Literature	3.28	.732			

Presented in the table are the results of a comparative analysis on the level of teachers' technology integration when grouped by specialization. The analysis covered four key parameters: Technological Pedagogical Content Knowledge (TPCK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). The p-values associated with these parameters were found to be .790, .954, .395, and .647, respectively. These p-values indicate that there is no significant difference in technology integration levels across different specializations of teachers.

Table 12. Assessment on the Students' Engagement in their PE classes as to Intellectual Engagement

Intellectual Engagement	Mean	SD	Description	Interpretation	Rank
1.I am willingly participate in answering teacher's questions, provide additional answers, and exchange opinions with classmate	3.56	.644	Strongly agree	Always	1
2.I can memorize the movements and perform them effectively	3.19	.776	Agree	Often	5
3.I think critically and ask for detailed explanations of unclear exercises and movements	3.30	.765	Agree	Often	3
4.I engage in associative thinking, compare and contrast the issues found in PE lesson	3.15	.803	Agree	Often	6
5.I actively apply prior knowledge and skills flexibility to new exercises.	3.22	.784	Agree	Often	4
6.I assess intellectual engagement and critical thinking skills during physical activities	3.35	.740	Agree	Often	2
Grand Mean	3.29	.657	Agree	Often	

Legend: 1.00-1.50-Strongly disagree (Not at all); 1.51-2.50-Disagree (Seldom); 2.51-3.50-Agree (Often); 3.51-4.00-Strongly agree (Always)

Presented in the table are the assessment of the respondents along their intellectual engagement in PE classes. The assessment reveals a mean score of 3.29 with a standard deviation (SD) of 0.657, indicating a moderate to high frequency of intellectual engagement among respondents in Physical Education (PE) classes. This mean, interpreted as "often," suggests a consistent level of active participation and cognitive involvement in PE learning activities. The low SD across indicators indicates minimal variation from the mean, reflecting a high level of uniformity in intellectual engagement among respondents. This statistical consistency implies a consistent pattern of intellectual engagement across various aspects assessed, facilitating targeted intervention strategies for further enhancing intellectual engagement in PE classes.

Presented in the table are the assessment of the respondents along their cognitive engagement in PE classes. The assessment reveals a mean score of 3.63 with a standard deviation (SD) of 0.521, indicating a high frequency of cognitive engagement among respondents in Physical Education (PE) classes. This mean, interpreted as "always," suggests a consistent level of cognitive involvement and active mental processing of information during PE learning activities. The low SD across indicators indicates minimal variation from the mean, reflecting a high level of uniformity in cognitive engagement among respondents. This statistical

consistency implies a consistent pattern of cognitive engagement across various aspects assessed, facilitating targeted intervention strategies for further enhancing cognitive engagement in PE classes.

Table 13. Assessment on the Students' Engagement in their PE classes as to Cognitive Engagement

Cognitive Engagement	Mean	SD	Description	Interpretation	Rank
1.My teacher enhances my motor skills ability	3.65	.557	Strongly agree	Always	2
2.My teacher encourages me to develop regular physical exercise habits	3.64	.563	Strongly agree	Always	3
3.My teacher guides me towards healthy activities and keep them away from social vices	3.62	.590	Strongly agree	Always	5
4.My teacher serves as a means of social communication	3.59	.600	Strongly agree	Always	6
5.My teacher focuses on evaluating students' mental involvement and active processing of information during physical activities.	3.63	.567	Strongly agree	Always	4
6.My teacher measures students' abilities to understand, remember, and apply concepts related to movement, strategy, and skill development.	3.67	.534	Strongly agree	Always	1
Grand Mean	3.63	.521	Strongly agree	Always	

Legend: 1.00-1.50-Strongly disagree (Not at all); 1.51-2.50-Disagree (Seldom); 2.51-3.50-Agree (Often); 3.51-4.00-Strongly agree (Always)

Table 14. Assessment on the Students' Engagement in their PE Classes as to Learning Engagement

Learning Engagement	Mean	SD	Description	Interpretation	Rank
1.I attentively listen to the teachers' guidance	3.63	.567	Strongly agree	Always	6
2.I enthusiastically participate in all forms of learning activities like expressing opinions, taking notes, participating in group games	3.67	.530	Strongly agree	Always	2
3.I demonstrate determination in handling challenges and completing assigned tasks and exercises	3.65	.526	Strongly agree	Always	4.5
4.I easily grasp the lesson, have good retention, and effectively perform the taught exercises and movements	3.65	.517	Strongly agree	Always	4.5
5.I am self-motivated and actively practice outside of class.	3.66	.527	Strongly agree	Always	3
6.I attend classes regularly and take the exams seriously.	3.69	.500	Strongly agree	Always	1
Grand Mean	3.66	.487	Strongly agree	Always	

Legend: 1.00-1.50-Strongly disagree (Not at all); 1.51-2.50-Disagree (Seldom); 2.51-3.50-Agree (Often); 3.51-4.00-Strongly agree (Always)

Presented in the table are the assessment of the respondents along their learning engagement in PE classes. The assessment reveals a mean score of 3.66 with a standard deviation (SD) of 0.487, indicating a high frequency of learning engagement among respondents in Physical Education (PE) classes. This mean, interpreted as "always," suggests a consistent level of active participation and commitment to learning during PE activities. The low SD across indicators indicates minimal variation from the mean, reflecting a high level of uniformity in learning engagement among respondents. This statistical consistency implies a consistent pattern of learning engagement across various aspects assessed, facilitating targeted intervention strategies for further enhancing learning engagement in PE classes.

Table 15. Significant Difference on the Students' Engagement in PE Classes when grouped by Sex

	Sex	Mean	SD	t-value	p-value	Decision
Intellectual Engagement	Male	3.39	.691	1.394	.164	Accept Ho
	Female	3.28	.350			
Cognitive Engagement	Male	3.60	.524	.651	.516	Accept Ho
	Female	3.64	.520			
Learning Engagement	Male	3.60	.485	1.130	.259	Accept Ho
	Female	3.67	.488			

Presented in the table are the results of the comparative analysis on the students' engagement in PE classes through t-Test. The comparative analysis examines students' engagement across three parameters: intellectual engagement, cognitive engagement, and learning engagement, through t-Test results. The obtained p-values for these parameters are .164, .516, and .259, respectively. These values suggest that there are no significant differences in the assessed parameters. As a result, the null hypothesis, which assumes no difference in engagement levels, is accepted.

Presented in the table are the results of a comparative analysis on students' engagement in Physical Education (PE) classes when grouped by age, conducted through F-test. The analysis covered three key parameters: intellectual engagement, cognitive engagement, and learning engagement. The obtained p-values for these parameters were .916, .900, and .576, respectively. These p-values indicate that there are no significant differences in engagement levels across different age groups. As a result, the null hypothesis, which assumes no difference in engagement levels based on age, is accepted. This finding suggests that regardless of age, students demonstrate similar levels of engagement across intellectual, cognitive, and learning dimensions during PE classes. It implies that the factors influencing students'

engagement in PE, such as interest, motivation, and understanding of the subject matter, are consistent across different age groups. Therefore, age may not be a determining factor in shaping students' engagement levels in PE classes.

Table 16. Significant Difference on the Students' Engagement in PE Classes when grouped by Age

	Age	Mean	SD	F-value	p-value	Decision
Intellectual Engagement	<18	3.31	.717	.171	.916	Accept Ho
	18-25	3.30	.651			
	26-30	3.30	.649			
	31-40	3.19	.804			
Cognitive Engagement	<18	3.71	.503	.195	.900	Accept Ho
	18-25	3.64	.522			
	26-30	3.66	.434			
	31-40	3.57	.592			
Learning Engagement	<18	3.82	.423	.661	.576	Accept Ho
	18-25	3.66	.486			
	26-30	3.64	.448			
	31-40	3.57	.595			

Table 17. Significant Difference on the Students' Engagement in PE Classes when grouped by Grade Level

	Grade	Mean	SD	F-value	p-value	Decision
Intellectual Engagement	I	3.27	.665	.744	.526	Accept Ho
	II	3.33	.634			
	III	3.43	.589			
	IV	3.14	.847			
Cognitive Engagement	I	3.64	.538	.304	.822	Accept Ho
	II	3.62	.503			
	III	3.73	.444			
	IV	3.68	.454			
Learning Engagement	I	3.67	.486	.648	.584	Accept Ho
	II	3.62	.504			
	III	3.76	.414			
	IV	3.63	.447			

Presented in the table are the results of a comparative analysis on students' engagement in Physical Education (PE) classes when grouped by grade level, conducted through F-test. The analysis encompassed three critical parameters: intellectual engagement, cognitive engagement, and learning engagement. The obtained p-values for these parameters were .526, .822, and .584, respectively. These p-values suggest that there are no significant differences in engagement levels across different grade levels. Consequently, the null hypothesis, which posits no difference in engagement levels based on grade level, is accepted. This finding indicates that students exhibit similar levels of engagement across intellectual, cognitive, and learning dimensions during PE classes, irrespective of their grade level.

Table 18. Significant Difference on the Students' Engagement in PE Classes when grouped by Specialization

	Major	Mean	SD	F-value	p-value	Decision
Intellectual Engagement	Education Management	3.47	.583	2.979	.031*	Reject Ho
	Art Pre-school Education	3.18	.739			
	Music Education	3.32	.631			
	Chinese Language and Literature	3.12	.739			
Cognitive Engagement	Education Management	3.69	.423	.447	.720	Accept Ho
	Art Pre-school Education	3.57	.529			
	Music Education	3.63	.525			
	Chinese Language and Literature	3.67	.551			
Learning Engagement	Education Management	3.69	.409	.888	.447	Accept Ho
	Art Pre-school Education	3.58	.551			
	Music Education	3.66	.489			
	Chinese Language and Literature	3.73	.461			

*Significant at .05 level

It implies that the factors influencing students' engagement in PE, such as interest, motivation, and understanding of the

subject matter, are consistent across different grade levels. Therefore, grade level may not be a decisive factor in shaping students' engagement levels in PE classes.

Presented in the table are the results of a comparative analysis on students' engagement in Physical Education (PE) classes when grouped by specialization, conducted through F-test. The analysis covered three key parameters: intellectual engagement, cognitive engagement, and learning engagement. The obtained p-values for cognitive engagement and learning engagement were .720 and .447, respectively, suggesting no significant differences in these parameters across different specializations. Consequently, the null hypothesis, which assumes no difference in engagement levels based on specialization, is accepted for these parameters. However, a significant result is observed for intellectual engagement, with a p-value of .031. This suggests that there are significant differences in intellectual engagement across different specializations.

Table 19. Post hoc test on the Students' Engagement in PE Classes when grouped by Specialization

	Group	Group	Mean Diff	p-value	Decision
Intellectual Engagement	Educ Mngt	Arts Pre-school	.293	.036*	Reject Ho
		Chinese Lang & Lit	.352	.012*	Reject Ho
	Music Edu	Chinese Lang & Lit	.206	.034*	Reject Ho

*Significant at .05 level

Presented in the table are the post hoc test on the student's engagement in PE particularly along intellectual engagement. It shows that the education management respondents differ significantly with their counterparts from the arts pre-school and Chinese language and literature. The respondents from the music, comparable with the education management, also differ significantly with the respondents from the Chinese language and literature.

Table 20. Significant Relationship in the Assessment on the level of teachers' Technology Integration and Students' Engagement

		Intellectual Engagement	Cognitive Engagement	Learning Engagement
Technological Pedagogical Content Knowledge	Pearson Correlation	.922**	.869**	.910**
	Sig. (2-tailed)	<.001	<.001	<.001
	N	480	480	480
Technological Content Knowledge	Pearson Correlation	.869**	.847**	.893**
	Sig. (2-tailed)	<.001	<.001	<.001
	N	480	480	480
Pedagogical Content Knowledge	Pearson Correlation	.910**	.893**	.922**
	Sig. (2-tailed)	<.001	<.001	<.001
	N	480	480	480
Technological Pedagogical Knowledge	Pearson Correlation	.037	.014	.051
	Sig. (2-tailed)	.421	.756	.261
	N	480	480	480

**. Correlation is significant at the 0.05 level (2-tailed)

Presented in the table are the correlation results between the respondents' levels of teachers' technology integration and students' engagement, analyzed through Pearson's r correlation. The constructs for teachers' technology integration include Technological Pedagogical Content Knowledge (TPCK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical Knowledge (TPK). Meanwhile, the constructs of students' engagement comprise intellectual, cognitive, and learning engagements.

6. Conclusion

Based on the findings of this study, the following are concluded:

1 The profile of the respondents denote they come from a varied group. This further means that there is diversity of academic standpoints on the thesis of the study from the framed respondents.

2 The consistent ratings of "agree" across all dimensions of technology integration suggest that educators effectively integrate technology into teaching practices, aligning with educational goals and fostering enhanced student learning experiences. Continued professional development remains essential to ensure educators stay current with evolving technologies and best practices.

3 The no significant differences on the measures of technology integration underscores the universality and equitable distribution of technology-related skills among educators, emphasizing the importance of comprehensive technology integration training and support programs to ensure all teachers can effectively utilize technology in their teaching practices, regardless of demographic or professional characteristics.

4 This assessment on students' engagement suggests that students consistently demonstrate active participation, critical thinking, and a strong commitment to learning in the context of their academic pursuits.

5 The significant difference in intellectual engagement by specialization underscores the need for tailored instructional approaches. However, consistent levels of cognitive and learning engagement across all groups emphasize the universal commitment to active learning among students.

6 The significant variation in intellectual engagement by specialization suggests the importance of tailoring teaching strategies to foster critical thinking skills specific to subject areas. Conversely, the consistent levels of cognitive and learning engagement across demographic categories highlight the effectiveness of pedagogical practices in promoting active learning universally.

7 Identifying the challenges of the teachers on technology

integration in PE highlights the need for targeted support and professional development to help educators overcome barriers to technology integration. Addressing these challenges effectively can enhance teaching practices and improve student learning outcomes in the digital age.

7. Recommendations

1 Establish ongoing professional development programs tailored to educators' evolving needs, ensuring they stay abreast of new technologies and best practices to enhance technology integration in teaching practices.

2 Implement comprehensive technology integration training and support programs to ensure equitable access to technology-related skills among educators, irrespective of demographic or professional characteristics.

.3 Foster a student-centered approach to teaching by encouraging active participation, critical thinking, and a strong commitment to learning across all academic pursuits.

4 Tailor instructional approaches to foster critical thinking skills specific to subject areas, while also promoting universal engagement and active learning practices.

5 Address challenges in technology integration through targeted support and professional development initiatives, enhancing teaching practices and student learning outcomes in the digital age.

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