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# TECHNOLOGY INTEGRATION PERSPECTIVES OF ITS EFFECT ON STUDENTS' ENGAGEMENT AND LEARNING OUTCOMES

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## ABSTRACT

This study aimed to determine the perceived effects of technology integration on student engagement and learning outcomes in Physical Education (PE) among selected middle and high schools in Maryland, USA, during the school year 2023–2024. Employing a descriptive-qualitative research design, the study gathered data from Physical Education teachers and selected student representatives through a researcher-developed, validated open-ended questionnaire administered using Google Forms. Thematic analysis was utilized to identify recurring patterns concerning technology integration, student engagement, learning outcomes, implementation challenges, and educational leadership implications. Findings revealed that technology integration was perceived to enhance student participation, intrinsic motivation, collaborative learning, and the overall learning environment. Participants also associated technology-supported instruction with improved performance, constructive feedback, goal achievement, and better comprehension of instructional content. However, limited technological resources, budgetary constraints, curriculum alignment difficulties, insufficient teacher training, and technical issues emerged as significant implementation challenges. The findings further emphasized the importance of adaptive educational leadership, continuous professional development, collaborative decision-making, and responsible technology use. Based on these findings, an Enhanced Technology Integration Program was proposed to strengthen technological accessibility, instructional practices, teacher competencies, and institutional support. The study concluded that technology integration offered opportunities to improve Physical Education experiences, provided that instructional and organizational challenges were adequately addressed.

**Keywords:** *Technology Integration, Physical Education, Student Engagement, Learning Outcomes, Educational Leadership, Qualitative Research*

## INTRODUCTION

Technology integration has become an important component of contemporary educational management, transforming instructional practices and creating opportunities to enhance student engagement and learning outcomes. Educational institutions have increasingly utilized digital platforms, interactive applications, and technology-supported learning resources to improve instructional delivery and respond to diverse learning needs. However, successful technology integration requires effective educational leadership, adequate technological resources, and appropriate instructional strategies to ensure that digital innovations contribute meaningfully to teaching and learning.

The integration of technology in Physical Education (PE) has provided opportunities to enhance students' participation, motivation, and acquisition of practical skills. Jastrow et al. (2022), in their systematic review of digital technology in Physical Education, identified potential benefits in student motivation and sport-specific motor skills, although challenges related to teachers' technological preparation remained evident. Similarly, Villena-Taranilla et al. (2022) found that virtual reality applications positively influenced learning outcomes among elementary learners, demonstrating the potential of interactive technologies to support educational achievement. These findings highlighted the importance of selecting appropriate technological tools that complement instructional objectives and promote meaningful learning experiences.

Despite these benefits, technology integration has presented challenges related to accessibility, instructional readiness, classroom management, and student participation. Flanigan and Babchuk (2022) found that digital distractions influenced instructors' pedagogical decisions and relationships with students, emphasizing the importance of managing technology-supported learning environments. In Physical Education, these challenges are particularly relevant because instruction requires active movement, practical demonstrations, and direct participation. Consequently, the integration of digital technologies must support rather than replace the physical activities and learning experiences essential to the subject.

The study was guided by the classroom technology innovation framework of Zhao et al. (2002), which emphasized the interaction among teachers, technological innovations, and institutional contexts in determining successful technology implementation. This framework underscored the importance of teachers' technological competencies, appropriate instructional applications, and institutional support. From an educational leadership and management perspective, these factors highlighted the responsibilities of school administrators in providing resources, strengthening teachers' professional competencies, and establishing supportive conditions for effective technology integration. The framework also provided a basis for examining the

implications of technology integration for educational leadership and management practices.

Although previous studies have examined the benefits and challenges of educational technology, further investigation was necessary to understand its effects on student engagement and learning outcomes within the distinctive instructional environment of Physical Education. Existing evidence indicated that digital technologies could support motivation and skill development, but their effectiveness depended on instructional practices and implementation conditions. Examining these dimensions in selected schools in Maryland, USA, provided an opportunity to understand how technology integration influenced Physical Education instruction and identify areas requiring improvement.

Hence, the study aimed to determine the impact of technology integration in Physical Education on student engagement and learning outcomes in selected schools in Maryland, USA, during the school year 2023–2024. Specifically, it examined the effects of technology integration on student engagement and learning outcomes, identified the challenges encountered in its implementation, and explored its implications for educational leadership and management theory. The findings also served as the basis for proposing an enhanced technology integration program to strengthen instructional practices and improve the teaching and learning of Physical Education.

### Research Questions

This study aimed to determine the impact of technology integration in Physical Education on student engagement and learning outcomes viewed in the area of Physical Education in selected schools in Maryland, USA, for the school year 2023-2024.

Specifically, it sought to answer the following questions:

1. What is the effect of technology integration on students' engagement?
2. What is the effect of technology integration on learning outcomes?
3. What are the challenges encountered in integrating technology into Physical Education classes?
4. What are the implications of technology integration to the educational leadership management theory?
5. What enhanced technology integration program can be proposed based on the findings of this study?

## METHODOLOGY

### Research Design

The study employed a descriptive-qualitative research design to explore the perceived effects of technology integration on student engagement and learning outcomes in Physical Education (PE). This approach enabled the researcher to examine

the experiences, perceptions, and challenges encountered by teachers and students in technology-supported instruction. Through open-ended responses, the study gathered contextual information on how digital technologies influenced classroom participation, learning experiences, and instructional practices. The qualitative approach also provided a basis for examining the implications of technology integration for educational leadership and management and developing an enhanced technology integration program.

## Research Environment

The study was conducted in selected middle and high schools in Maryland, USA, during the school year 2023–2024. These schools operated within an educational system supervised by the Maryland State Department of Education, which established educational standards and supported instructional quality across the state. The selected institutions provided the context for examining technology integration in Physical Education, particularly its perceived effects on student engagement and learning outcomes and the challenges associated with its implementation.

## Research Participants

The participants consisted of Physical Education teachers and selected student representatives from middle and high schools in Maryland, USA. Teachers were selected based on their current employment, a minimum of three years of PE teaching experience, and at least one year of experience integrating technology into instruction. Student participants were enrolled in middle or high school and had regular exposure to technology-supported PE activities, including digital applications, online platforms, and other instructional resources. Participants were selected based on these eligibility criteria to obtain relevant insights into their experiences, perceptions, and challenges associated with technology integration.

## Research Instrument

The study utilized a researcher-developed interview guide consisting of open-ended questions administered through Google Forms. The instrument was validated by graduate school professors to establish its appropriateness for the study's objectives. The questions explored participants' perceptions of the effects of technology integration on student engagement and learning outcomes, the challenges encountered during implementation, and relevant instructional and management considerations. The open-ended format allowed respondents to describe their experiences and provide detailed explanations based on their actual involvement in technology-integrated Physical Education classes.

## Research Procedure

Before data collection, the researcher secured permission from the principals of the selected schools in Maryland, USA, through formal electronic communication. Upon obtaining approval, the researcher administered the interview guide through Google Forms. An informed consent form was incorporated into the instrument to explain the

study's purpose, the voluntary nature of participation, and the participants' right to withdraw. Responses were subsequently collected and organized for qualitative analysis.

### Data Analysis

The data were analyzed using thematic analysis to identify recurring patterns, experiences, and perspectives regarding technology integration in Physical Education. The researcher reviewed the participants' responses, extracted significant statements, assigned codes, and grouped related ideas into emerging themes. These themes were organized according to the study's research questions, particularly the perceived effects of technology integration on student engagement and learning outcomes, implementation challenges, and implications for educational leadership and management. The findings also provided the basis for formulating an enhanced technology integration program responsive to the identified needs and challenges.

## RESULTS

This section presents the findings of the study on the perceived effects of technology integration on student engagement and learning outcomes in Physical Education among selected middle and high schools in Maryland, USA, during the school year 2023–2024. Data gathered from Physical Education teachers and students were analyzed using thematic analysis and organized into clustered and emergent themes. The findings focused on four major areas: the effects of technology integration on student engagement, its effects on learning outcomes, the challenges encountered during implementation, and its implications for educational leadership and management. The identified themes also served as the basis for developing the proposed Enhanced Technology Integration Program.

**Table 1**
**Effect Of Integrating Technology on Students' Engagement**

| Clustered Themes | Emergent Themes |
|---|---|
| Encourages and increases participation; Boosts engagement effectively | Enhanced Participation |
| Enhances intrinsic motivation | Motivational Impact and Intrinsic Drive |
| Establishes meaningful connections; Fosters collaborative learning | Development of Collaborative Learning Environment |
| Caters to diverse learning styles | Accommodation of Diverse Learning Styles |
| Promotes lifelong commitment to physical activity | Encouragement of Lifelong Commitment |
| Creates a positive and enriching learning environment | Creation of a Positive and Enriching Learning Environment |

Table 1 presents the clustered and emergent themes describing the perceived effects of technology integration on student engagement in Physical Education. Six themes emerged: enhanced participation, motivational impact and intrinsic drive,

development of a collaborative learning environment, accommodation of diverse learning styles, encouragement of lifelong commitment, and creation of a positive and enriching learning environment.

### *Theme 1: Enhanced Participation*

The findings revealed that technology integration was perceived to encourage greater student participation and engagement in Physical Education activities. The participants indicated that technology-supported instruction provided opportunities for more interactive learning experiences, encouraging students to become actively involved in classroom activities. This finding was consistent with Jastrow et al. (2022), whose systematic review identified the potential of digital technologies to support student participation and learning in Physical Education. The findings suggested that appropriate technological applications could help teachers develop more engaging instructional activities.

### *Theme 2: Motivational Impact and Intrinsic Drive*

The findings indicated that technology integration was perceived to enhance students' intrinsic motivation to participate in Physical Education. Digital learning activities were associated with increased interest and willingness to engage in instructional tasks. Similarly, Knoke et al. (2024) reported that digital game-based approaches in Physical Education demonstrated positive results in improving students' motivation. These findings suggested that appropriately designed technological activities could encourage students to participate more actively and develop a positive attitude toward physical learning experiences.

### *Theme 3: Development of a Collaborative Learning Environment*

The findings revealed that technology integration was perceived to promote meaningful connections and collaborative learning among students. Participants indicated that technology-supported activities created opportunities for interaction, cooperation, and shared participation in Physical Education. Knoke et al. (2024) identified improvements in student–teacher interactions through certain digitally supported instructional approaches. Although their review did not establish that every technological intervention improved peer collaboration, the findings supported the potential of technology to facilitate educational interaction. This suggested that integrating collaborative digital activities could strengthen students' social engagement and learning experiences.

### *Theme 4: Accommodation of Diverse Learning Styles*

The findings indicated that technology integration was perceived to accommodate students' varied learning preferences and instructional needs. Participants recognized that digital resources provided alternative ways of presenting information and engaging students in Physical Education activities. Jastrow et al. (2022) documented the use of

various technologies, including video feedback, digital games, and other interactive applications, to support different instructional objectives in Physical Education. These findings suggested that providing varied learning resources could improve instructional flexibility and accessibility, although the effectiveness of such approaches should be evaluated according to learners' actual needs rather than fixed learning-style classifications.

### *Theme 5: Encouragement of Lifelong Commitment*

The findings suggested that technology integration encouraged students' interest in maintaining physical activity beyond classroom instruction. Participants perceived technological applications as useful for promoting motivation and sustained engagement in physical activities. Knoke et al. (2024) reported that certain digital applications and fitness technologies demonstrated favorable outcomes related to physical activity and motivation among schoolchildren. However, evidence regarding their long-term effectiveness remained inconclusive. Thus, the findings suggested that technology could support the development of positive attitudes toward physical activity, although lifelong commitment could not be established from the participants' perceptions alone.

### *Theme 6: Creation of a Positive and Enriching Learning Environment*

The findings revealed that technology integration was perceived to contribute to a positive and enriching learning environment in Physical Education. Participants associated technology-supported instruction with engaging activities, improved learning opportunities, and greater student involvement. This finding was supported by Jastrow et al. (2022), who identified instructional benefits associated with digital technologies in Physical Education, particularly in supporting motivation and skill development. The findings suggested that thoughtfully selected digital resources could help create a more engaging and supportive instructional environment.

**Table 2**
**Effect of Technology Integration on Learning Outcomes**

| Clustered Themes | Emergent Themes |
|---|---|
| Enhances performance | Performance Enhancement |
| Ensures provision of feedback; Cultivates a fair and constructive learning environment | Feedback Facilitation |
| Guides toward setting and achieving academic goals; Aids in goal-setting; Contributes to the accomplishment of objectives | Support for Goal Setting and Achievement |
| Enhances understanding; Nurtures better comprehension among students | Understanding and Comprehension Enhancement |

Table 2 presents the clustered and emergent themes describing the perceived effects of technology integration on students' learning outcomes in Physical Education. Four themes emerged: performance enhancement, feedback facilitation, support for goal setting and achievement, and understanding and comprehension enhancement.

### *Theme 1: Performance Enhancement*

The findings revealed that technology integration was perceived to enhance students' performance in Physical Education. Participants indicated that technology-supported instructional activities contributed to improving learning experiences and facilitating the acquisition of relevant skills. Jastrow et al. (2022) reported that digital technologies, particularly video feedback and interactive applications, demonstrated positive effects on motor skill development and performance in Physical Education. These findings suggested that integrating appropriate technological resources could support students' performance and facilitate the achievement of instructional objectives.

### *Theme 2: Feedback Facilitation*

The findings indicated that technology integration was perceived to facilitate the provision of constructive feedback and promote a supportive learning environment. Participants recognized that technology-assisted feedback could help students identify areas for improvement and monitor their progress in Physical Education. Zhou et al. (2021), in a systematic review of 23 studies, found strong evidence supporting the effectiveness of feedback in improving students' motor skill learning during Physical Education classes. Similarly, Mödinger et al. (2022) reported that video-based visual feedback could enhance motor learning and appeared more effective than verbal feedback alone in certain instructional contexts. These findings highlighted the potential of technology-supported feedback to strengthen instructional assessment and improve learning experiences.

### *Theme 3: Support for Goal Setting and Achievement*

The findings revealed that technology integration was perceived to support students in establishing learning goals and working toward the achievement of instructional objectives. Participants indicated that technological resources provided opportunities to monitor progress and encourage students to remain focused on their learning targets. Knoke et al. (2024) identified applications of digital fitness technologies and online learning resources that supported physical activity monitoring and instructional participation. Although their review did not directly establish improvements in academic goal-setting, its findings indicated that digital monitoring tools could provide opportunities for students to track their physical activities. This suggested that technology-supported monitoring could help students develop greater awareness of their progress toward learning objectives.

### *Theme 4: Understanding and Comprehension Enhancement*

The findings indicated that technology integration was perceived to improve students' understanding and comprehension of Physical Education lessons. Participants recognized that technology-supported instructional materials provided opportunities to clarify concepts and reinforce practical learning experiences. Jastrow et al. (2022) found that video-based demonstrations and digital feedback supported knowledge acquisition

and motor skill development in Physical Education. Similarly, Knoke et al. (2024) reported favorable outcomes in knowledge acquisition through certain digitally supported instructional approaches. These findings suggested that appropriately selected digital resources could facilitate students' understanding of instructional content and strengthen their learning experiences in Physical Education.

**Table 3**
**Challenges Encountered in the Integration of Technology**

| Clustered Themes | Emergent Themes |
|---|---|
| Limited connectivity; Insufficient technological infrastructure; Limited devices | Access and Resources |
| Cost and teacher training support; Budgeting and costs | Budgetary Concerns |
| Curriculum alignment; Time constraints; Resistance to change; Training and expertise; Perceived value of technology integration | Curriculum Alignment and Training |
| Errors in technology; Technical issues; Safety concerns | Technical Challenges |

Table 3 presents the challenges encountered by teachers and students in integrating technology into Physical Education. Four emergent themes were identified: access and resources, budgetary concerns, curriculum alignment and training, and technical challenges.

### *Theme 1: Access and Resources*

The findings revealed that limited internet connectivity, inadequate technological infrastructure, and insufficient digital devices were among the challenges encountered in integrating technology into Physical Education. These limitations restricted opportunities for teachers and students to utilize technology-supported instructional activities effectively. Jastrow et al. (2022) similarly identified inadequate access to digital resources and institutional support as barriers to technology integration in Physical Education. The findings suggested that improving technological infrastructure and ensuring equitable access to digital resources were necessary to support effective technology integration.

### *Theme 2: Budgetary Concerns*

The findings indicated that financial constraints affected the acquisition, maintenance, and utilization of technological resources in Physical Education. Participants identified technology-related expenses and insufficient financial support for teacher training as challenges to implementation. Wallace et al. (2023) likewise reported that inadequate funding and limited institutional resources constrained teachers' ability to integrate digital technologies into Physical Education instruction. These findings highlighted the importance of strategic budgeting and adequate financial allocation for technological resources, maintenance, and professional development.

### *Theme 3: Curriculum Alignment and Training*

The findings revealed that curriculum alignment, limited preparation time, resistance to change, and insufficient technological expertise presented challenges to technology integration. Participants recognized the need for appropriate training and instructional planning to ensure that digital applications supported the objectives of Physical Education. Wallace et al. (2023) found that teachers' limited digital competencies and inadequate professional development hindered technology integration in Physical Education. Similarly, Jastrow et al. (2022) emphasized the importance of teacher preparation and pedagogical training in maximizing the instructional benefits of digital technologies. These findings suggested that continuous professional development and curriculum-based technology planning were essential for effective implementation.

### *Theme 4: Technical Challenges*

The findings indicated that technological errors, operational difficulties, and safety concerns affected the implementation of technology-supported Physical Education activities. Participants identified these challenges as potential disruptions to instruction and student participation. Jastrow et al. (2022) identified limitations associated with digital technology implementation, particularly regarding technological resources and instructional conditions. Wallace et al. (2023) also emphasized that technology integration required appropriate pedagogical support and consideration of classroom-related challenges. These findings suggested the need for technical assistance, equipment maintenance, and appropriate safety measures to ensure reliable and responsible technology use in Physical Education.

**Table 4**
**Implications of Technology Integration for Educational Leadership and Management Theory**

| Clustered Themes | Emergent Themes |
|---|---|
| Proactive change management; Evolving leadership theories; Addressing ethical and equity concerns | Leadership Adaptability and Change Management |
| Continuous professional development; Strategic planning for technology integration; Evaluation and assessment of digital initiatives | Professional Development and Continuous Learning |
| Collaborative decision-making; Fostering partnerships with stakeholders; Championing a vision aligned with educational goals | Collaborative Leadership and Visionary Practices |
| Cybersecurity measures; Digital pedagogy frameworks; Advocating for digital citizenship; Promoting responsible use of technology | Digital Transformation and Responsible Use |

Table 4 presents the implications of technology integration for educational leadership and management based on the perspectives of participating teachers. Four emergent themes were identified: leadership adaptability and change management,

professional development and continuous learning, collaborative leadership and visionary practices, and digital transformation and responsible use.

### *Theme 1: Leadership Adaptability and Change Management*

The findings revealed that technology integration highlighted the need for adaptive educational leadership and effective change management. Participants emphasized proactive decision-making, responsiveness to technological advancements, and consideration of ethical and equity concerns in implementing digital initiatives. AlAjmi (2022) found that school principals' digital leadership positively influenced teachers' technology integration, emphasizing the importance of visionary leadership in supporting technological change. Similarly, Kaya-Kasikci et al. (2023) found that technology leadership contributed to a supportive school climate through organizational trust and enabling structures. These findings suggested that educational leadership and management practices needed to incorporate adaptability, strategic decision-making, and equitable technology implementation.

### *Theme 2: Professional Development and Continuous Learning*

The findings indicated that continuous professional development, strategic planning, and evaluation were important considerations for educational leadership in technology integration. Participants recognized that teachers required ongoing opportunities to strengthen their technological competencies and improve instructional practices. Kaya-Kasikci et al. (2023) found that information and communication technology training contributed to teachers' computer self-efficacy, which supported their technology integration practices. Likewise, AlAjmi (2022) emphasized the importance of digital leadership in facilitating technology utilization among teachers. These findings suggested that educational leaders needed to prioritize sustained professional development, instructional support, and regular evaluation of digital initiatives.

### *Theme 3: Collaborative Leadership and Visionary Practices*

The findings revealed that collaborative decision-making, stakeholder partnerships, and a shared institutional vision were considered essential for effective technology integration. Participants emphasized the importance of involving teachers and relevant stakeholders in planning and implementing technology-supported instructional initiatives. Kaya-Kasikci et al. (2023) found that educational leadership contributed to technology integration by establishing supportive organizational conditions, particularly through trust and enabling structures. Similarly, AlAjmi (2022) identified visionary digital leadership as an important factor in strengthening teachers' technology integration. These findings suggested that collaborative leadership and clearly established institutional goals could facilitate coordinated and sustainable technology implementation.

### *Theme 4: Digital Transformation and Responsible Use*

The findings indicated that technology integration raised important considerations regarding cybersecurity, digital pedagogy, digital citizenship, and responsible technology use. Participants recognized the need for educational leaders to establish appropriate practices that supported safe, ethical, and effective utilization of digital resources. Jastrow et al. (2022) highlighted the importance of addressing data protection and critical engagement with digital media in Physical Education. Moreover, Wallace et al. (2023) emphasized the need to align technological applications with appropriate pedagogical practices while considering potential classroom distractions and digital risks. These findings suggested that educational leadership and management practices needed to incorporate digital responsibility, data protection, and instructional guidance to support sustainable technology integration.

## DISCUSSION

The study examined the perceived effects of technology integration on student engagement and learning outcomes in Physical Education among selected middle and high schools in Maryland, USA, during the school year 2023–2024. Using a descriptive-qualitative approach, the study gathered teachers' and students' perspectives through open-ended questions administered via Google Forms. Thematic analysis identified patterns concerning student engagement, learning outcomes, implementation challenges, and implications for educational leadership and management.

### Findings

The following findings emerged from the thematic analysis of participants' responses:

**1. Effects of Technology Integration on Student Engagement.** Six emergent themes were identified: enhanced participation, motivational impact and intrinsic drive, development of a collaborative learning environment, accommodation of diverse learning styles, encouragement of lifelong commitment, and creation of a positive and enriching learning environment. These themes indicated that participants perceived technology integration as beneficial to students' engagement, motivation, and participation in Physical Education activities.

**2. Effects of Technology Integration on Learning Outcomes.** Four emergent themes emerged: performance enhancement, feedback facilitation, support for goal setting and achievement, and understanding and comprehension enhancement. The findings suggested that participants associated technology-supported instruction with improved learning experiences, constructive feedback, progress monitoring, and better comprehension of Physical Education lessons.

**3. Challenges Encountered in Technology Integration.** Four emergent themes were identified: access and resources, budgetary concerns, curriculum alignment and training, and technical challenges. These findings indicated that limited connectivity, inadequate devices, financial constraints, insufficient technological expertise, and operational difficulties affected the implementation of technology-supported Physical Education instruction.

**4. Implications for Educational Leadership and Management Theory.** Four emergent themes were identified: leadership adaptability and change management, professional development and continuous learning, collaborative leadership and visionary practices, and digital transformation and responsible use. These themes highlighted the importance of adaptive leadership, strategic planning, stakeholder collaboration, continuous professional development, and responsible technological practices in supporting effective technology integration.

## Conclusions

The study concluded that technology integration was perceived to contribute positively to student engagement and learning experiences in Physical Education. Participants associated technology-supported instruction with increased participation, motivation, collaboration, improved comprehension, and opportunities for constructive feedback and goal achievement. However, the effective implementation of technology was constrained by inadequate technological resources, financial limitations, insufficient teacher preparation, and technical difficulties.

The findings further highlighted the importance of educational leadership and management in facilitating technology integration through strategic resource allocation, professional development, collaborative decision-making, and responsible technology use. Addressing these instructional and organizational challenges was essential to strengthening technology-supported Physical Education programs. Consequently, the findings provided a basis for proposing an enhanced technology integration program intended to promote accessible, inclusive, and effective instructional practices.

## Recommendations

Based on the findings and conclusions, the following recommendations were proposed:

**1. Improve Technological Infrastructure and Accessibility.** Schools should strengthen internet connectivity, provide adequate digital devices, and improve technological facilities to ensure reliable access to technology-supported Physical Education instruction.

**2. Strengthen Budget Allocation and Teacher Development.** Educational administrators should allocate sufficient financial resources for acquiring and maintaining technological equipment while implementing continuous professional development

programs focused on digital competencies and technology-supported instructional strategies.

**3. Enhance Technical Support and Curriculum Integration.** Schools should establish accessible technical assistance, implement regular equipment maintenance, and ensure that technological applications align with Physical Education curriculum objectives and student safety requirements.

**4. Promote Collaborative Leadership and Continuous Evaluation.** Educational leaders should encourage stakeholder participation in technology-related decisions, strengthen partnerships, and conduct periodic evaluations of technology integration practices to identify implementation gaps and areas for improvement.

**5. Develop and Implement an Enhanced Technology Integration Program.** Schools should consider adopting a structured program that addresses identified challenges through improved technological resources, teacher training, instructional planning, technical support, and continuous monitoring to strengthen student engagement and learning experiences in Physical Education.

**6. Conduct Further Research.** Future researchers may investigate the long-term effects of technology integration on student engagement, physical activity participation, and measurable learning outcomes using quantitative, mixed-methods, or longitudinal research designs.

## Compliance with Ethical Standards

The study observed ethical principles in conducting research involving Physical Education teachers and students from selected middle and high schools in Maryland, USA. Prior to data collection, permission was secured from the school principals to conduct the study. Participants were informed of the research objectives, procedures, and voluntary nature of their participation through an informed consent form incorporated into the Google Forms questionnaire. They were also informed of their right to withdraw from the study without adverse consequences.

The researcher sought to protect participants' privacy and confidentiality by ensuring that the information gathered was used solely for research purposes. Participants' responses were treated with confidentiality, and the reporting of findings was intended to prevent the identification of individual respondents. The study also upheld the principles of respect, voluntary participation, and responsible handling of research information throughout the research process.

## PROPOSED ENHANCED TECHNOLOGY INTEGRATION PROGRAM

### Rationale

The findings of the study revealed that technology integration was perceived to enhance student engagement, motivation, participation, and learning outcomes in Physical Education (PE). However, challenges involving limited technological resources, budgetary constraints, insufficient teacher training, curriculum alignment, and technical difficulties affected its implementation. These findings served as the basis for developing the proposed Enhanced Technology Integration Program for selected public middle and high schools in Maryland, USA. The program was designed to strengthen technology-supported Physical Education instruction through improved infrastructure, inclusive instructional practices, continuous professional development, stakeholder collaboration, and systematic evaluation. It also emphasized educational leadership, responsible technology use, and the integration of digital resources that complemented physical activities and supported meaningful student participation.

### Objectives

The proposed program aimed to strengthen technology integration in Physical Education by improving technological accessibility, enhancing teachers' digital competencies, promoting inclusive and interactive learning experiences, addressing implementation challenges, and establishing sustainable monitoring and evaluation mechanisms.

### Program Implementation Matrix

| Key Components | Objectives | Proposed Strategies |
|---|---|---|
| 1. Technology Access Initiative | Improve access to digital learning resources. | Secure funding and partnerships for technological equipment; establish maintenance and upgrading plans. |
| 2. Inclusive Curriculum Development | Promote accessible and inclusive PE instruction. | Integrate adaptive technologies and instructional resources responsive to students' diverse abilities and needs. |
| 3. Teacher Training Program | Strengthen teachers' technological and pedagogical competencies. | Conduct professional development activities, practical workshops, and continuous training on technology-supported PE instruction. |
| 4. Infrastructure Enhancement | Address connectivity and technical limitations. | Improve internet connectivity, maintain equipment, and establish accessible technical support services. |
| 5. Gamification Integration | Enhance student motivation and participation. | Incorporate interactive challenges, digital activities, and progress-monitoring systems into PE lessons. |
| 6. Community Engagement and Fundraising | Strengthen stakeholder participation and financial support. | Establish partnerships with local organizations, businesses, and community stakeholders for resource mobilization. |

| | | |
|---|---|---|
| 7. Policy Advocacy | Strengthen institutional support for technology integration. | Develop policies on resource allocation, responsible technology use, student safety, and curriculum integration. |
| 8. Research and Feedback Mechanism | Evaluate instructional effectiveness and identify areas for improvement. | Collect teacher and student feedback; assess engagement, learning outcomes, and implementation challenges. |
| 9. Collaborative Projects | Promote teamwork and meaningful student interaction. | Implement technology-supported group activities, collaborative challenges, and instructional projects. |
| 10. Regular Review and Update | Ensure program relevance and sustainability. | Conduct periodic program reviews and update instructional resources based on evaluation findings and technological developments. |

## Schedule of Implementation

The proposed program followed a phased six-year implementation framework to allow gradual development, institutional preparation, and continuous evaluation.

| Implementation Period | Priority Activities |
|---|---|
| Years 1–2 | Technology acquisition, infrastructure enhancement, and establishment of technical support. |
| Years 3–4 | Inclusive curriculum development and implementation of teacher training programs. |
| Years 5–6 | Integration of gamified learning activities, collaborative projects, and community engagement initiatives. |
| Throughout implementation | Continuous monitoring, feedback collection, research, and program improvement. |

## Monitoring and Evaluation

The proposed program would be evaluated through regular assessments of student engagement, learning outcomes, technological accessibility, teacher readiness, and instructional effectiveness. School administrators and Physical Education teachers would gather feedback from students and relevant stakeholders to identify implementation challenges and determine areas requiring improvement. Evaluation activities would include monitoring student participation, reviewing instructional practices, assessing technological resources, and documenting progress toward program objectives. Findings from these assessments would guide necessary adjustments and support the program's continued relevance and sustainability.

## Expected Outcomes

The proposed program was expected to improve access to technological resources, strengthen teachers' digital competencies, support inclusive and interactive Physical Education instruction, and enhance opportunities for student participation and learning. It was also intended to strengthen educational leadership practices through strategic planning, stakeholder collaboration, responsible technology use, and continuous

evaluation. Successful implementation would depend on adequate institutional support, available resources, and sustained commitment from school administrators, teachers, and relevant stakeholders.

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