

Interactive Flat Panel Strategies for Student Engagement in Physical Education at SMPN Satap Plakpak

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Abstract. This study examines strategies for utilizing the Interactive Flat Panel (IFP) to foster student engagement in Physical Education, Sports, and Health (PJOK) learning at SMPN Satap Plakpak. Using a descriptive qualitative approach, data were obtained from eight informants (the principal, PJOK teachers, and students) via purposive sampling, collected through interviews, observation, and documentation, and analyzed through data reduction, presentation, and conclusion drawing. Findings show that IFP planning was systematic, integrated into lesson plans with attention to interactivity, usability, content relevance, and teacher proficiency. Implementation was innovative through instructional videos and interactive quizzes, despite challenges in teachers' operational skills. Evaluation revealed marked improvement in cognitive, emotional, and behavioral engagement, reflected in conceptual understanding, enthusiasm, and active participation. These findings offer insight into technology-based learning by positioning IFP as a complementary strategy supporting differentiated instruction within the Merdeka Curriculum, and its optimization is recommended.

Keywords: Interactive Flat Panel, Student Engagement, PJOK, Merdeka Curriculum, Learning Strategies

1 Introduction

Advances in digital technology have brought significant transformation to various aspects of human life, education being no exception. The integration of modern digital devices into the learning process has become increasingly crucial for improving the quality, effectiveness, and relevance of education in the current digital era. The use of technology does not merely support one-way material delivery; it also holds great potential for stimulating active student participation, critical thinking, and learning motivation, so that the teaching-learning process can take place in a more interactive, dynamic, and meaningful way. The adoption of educational technology, such as the Interactive Flat Panel (IFP), is a strategic step toward creating an innovative learning environment that is responsive to the needs of 21st-century students. This innovation aligns with the demands of the modern curriculum paradigm, which emphasizes student-centered learning and the use of digital-based learning media. Within this framework, Physical Education, Sports, and Health (PJOK) — as an integral part of the school curriculum — greatly needs an innovative approach so that learning does not feel monotonous but is instead able to spark thorough student enthusiasm and engagement.

Although the implementation of the Merdeka Curriculum explicitly emphasizes the holistic development of students' potential, covering cognitive, affective, and psychomotor aspects, PJOK learning in the field still faces various real challenges. PJOK learning has often been narrowly perceived as merely outdoor physical activity, without being balanced by an understanding of theoretical concepts, tactical analysis, and deeper cognitive and health reinforcement. Classroom theory sessions on game rules, sports strategy, and fitness concepts are frequently delivered through conventional lecture methods with minimal interactive media. As a result, there is a decline in focus, feelings of boredom, and low levels of active student participation because the knowledge-transfer process feels passive and abstract. On the other hand, PJOK material often requires precise visualization of movement mechanics. The inability of conventional media to bridge the understanding of abstract theory with concrete physical practice is a fundamental problem that hinders optimal student engagement in PJOK learning.

The use of the Interactive Flat Panel (IFP) as an interactive, digital technology-based learning medium offers a strong theoretical and solution-oriented foundation for overcoming the limitations of conventional media. A review of the literature shows that IFP technology is able to create a conducive, visual, and enjoyable learning atmosphere through simulation features, demonstration videos, and direct digital content manipulation [1], [2]. The use of IFP has been shown to significantly increase students' concentration, enthusiasm, and active interaction during learning activities. In addition, IFP integration supports the development of students' cognitive and social-emotional aspects through interactive and collaborative group activities [3], [4]. IFP's ability to present concrete modeling, facilitate a scaffolding approach, and deliver material adaptively strengthens the theoretical argument that this medium has great potential for clarifying complex concepts into tangible learning experiences [5], [6].

Although the effectiveness and potential of IFP have been demonstrated by various scientific studies, an analysis of prior literature reveals a fairly clear research gap. Most existing research on IFP utilization is still dominated by studies at the Early Childhood Education (PAUD) and Elementary School (SD) levels, and is limited to the context of developing basic skills such as early literacy, numeracy, or fine motor skills [4], [5]. Furthermore, existing studies focus more on purely theoretical subjects such as Language, Mathematics, and Social Studies [6]. Empirical studies that specifically examine the use of IFP at the Junior High School (SMP) level remain very limited. More fundamentally, no study has comprehensively examined strategies for utilizing IFP in PJOK learning within the framework of the Merdeka Curriculum, even though PJOK requires a harmonious balance between theoretical mastery, visual analysis of movement, and physical activity.

The scientific novelty (state of the art) of this study lies in its construction of an in-depth, contextual understanding of how IFP is strategically integrated to stimulate student engagement in the PJOK subject under the Merdeka Curriculum. Unlike previous research, which generally positions IFP merely as a general visual aid or a medium for training basic cognition at the elementary school level, this study positions IFP as an adaptive pedagogical instrument that is specifically integrated to facilitate the analysis of sports movements, understanding of game strategy, and differentiated learning at the junior high school level. This novelty offers a new perspective on how interactive digital screen technology can be efficiently utilized to strengthen students' cognitive and affective dimensions without sidelining the essence of psychomotor activity in physical education.

Based on these problems and research gaps, this study aims to comprehensively identify, analyze, and describe effective strategies for utilizing the Interactive Flat Panel (IFP) in stimulating student engagement in Merdeka Curriculum PJOK learning at SMP Negeri Satu Atap Plakpak. This research is expected to provide two main contributions, both theoretical and

practical. Theoretically, the results of this study enrich the body of educational literature on the integration of interactive technology and pedagogical strategies in sports and health education at the secondary school level. Practically, this research provides applicable guidance, strategic direction, and empirical references for PJOK teachers, school principals, and education policymakers in designing professional training and optimizing the use of IFP facilities to create an innovative, inclusive, and student-centered digital learning ecosystem.

2 Method

This study adopts a qualitative approach with a descriptive case study design, aiming to deeply explore strategies for utilizing the Interactive Flat Panel (IFP) in stimulating student engagement in Merdeka Curriculum PJOK learning at SMP Negeri Satu Atap Plakpak. The researcher chose a qualitative approach in order to understand the social phenomenon from the participants' perspective, as well as to provide a comprehensive picture of the context and process in the field. The descriptive case study design allows for intensive exploration of a single unit of analysis — namely SMP Negeri Satu Atap Plakpak — in order to identify patterns, meanings, and experiences relevant to the research topic. This approach aligns with the research objective, which focuses on identifying and describing effective IFP utilization strategies, while also helping to explain how and why a particular strategy is applied within the specific context of Merdeka Curriculum PJOK learning. This study seeks to provide an understanding of technology implementation in education, particularly in a school environment that is adapting to the innovations of the Merdeka Curriculum.

2.1 Research Subjects

The subjects of this study included PJOK teachers and Grade VII and VIII students at SMP Negeri Satu Atap Plakpak who were directly involved in learning using the Interactive Flat Panel (IFP). The researcher selected subjects through purposive sampling, a technique for selecting informants based on specific criteria relevant to the research focus. The criteria for selecting PJOK teachers included teaching experience with the Merdeka Curriculum and the use of IFP in learning, while the criteria for selecting students included active involvement in PJOK learning using IFP, as well as their willingness to share their experiences and perceptions. The number of informants in this study was 8 people, consisting of 2 PJOK teachers and 6 students, selected based on these considerations. The researcher made this selection of informants in order to obtain rich and diverse data from the various perspectives involved in the learning process.

2.2 Data Collection Techniques

Data collection was carried out through three main techniques: observation, in-depth interviews, and documentation. The researcher conducted participatory observation to directly observe the PJOK learning process using IFP in the classroom, including teacher-student interaction, use of IFP features, and the level of student engagement. In-depth interviews with PJOK teachers were conducted to explore the strategies they implemented, the challenges they faced, and their perceptions of IFP's effectiveness. The researcher also conducted interviews with students in order to understand their experiences, interests, and views on PJOK learning with IFP. Documentation was collected from various sources, such as lesson plans (RPP), digital teaching materials, photos or videos of learning activities, and relevant field notes. The use of

this method triangulation aims to increase the validity of the data and ensure the completeness of the information obtained.

2.3 Data Analysis Techniques

Data analysis was conducted manually using the interactive model of Miles, Huberman, and Saldaña [7], which includes data reduction, data presentation, and conclusion drawing. The data reduction stage involved the process of selecting, focusing attention, simplifying, abstracting, and transforming raw data obtained from observations, interviews, and documentation. The researcher eliminated irrelevant or repetitive data to focus on core information. Data presentation was carried out by arranging the reduced information into narrative, matrix, or chart form to make it easier to understand and interpret. At this stage, the researcher identified patterns, categories, and themes emerging from the data. Conclusion drawing was done gradually and verified throughout the analysis process, by comparing findings with relevant theory and data from various sources.

2.4 Data Validity

The researcher ensured the validity of the data in this qualitative study through source triangulation, method triangulation, and member checking. Source triangulation was carried out by comparing information obtained from PJOK teachers and students regarding IFP utilization strategies and student engagement. Method triangulation involved comparing data from observations, interviews, and documentation to ensure the consistency of findings. Member checking was carried out by asking participants to review and confirm the accuracy of the researcher's data interpretation, thereby minimizing bias and increasing the credibility of the results. These steps are important to ensure that the research findings are accurate, trustworthy, and representative of the reality occurring in the field. Consistency in applying this technique is key to producing valid and reliable qualitative research.

3 Results

3.1 Overview of the Research Location

SMP Negeri Satu Atap Plakpak is an educational institution located in the Plakpak area and actively implements the Merdeka Curriculum, demonstrating a commitment to learning innovation. This school has sought to integrate digital technology, including the Interactive Flat Panel (IFP), in order to improve the quality of the teaching and learning process. This location was highly relevant to select because it reflects an environment that is adapting to new technology and a modern curriculum. This condition provided a unique opportunity to explore IFP utilization strategies within the dynamic context of Physical Education, Sports, and Health (PJOK) learning. This research focuses on how this technology is utilized to stimulate student engagement, a crucial aspect of the Merdeka Curriculum.

The school's organizational structure supports this innovation effort, with the principal and PJOK teacher directly involved in the planning and implementation of the technology. School programs are also designed to encourage active student participation through various learning media. This study involved eight key informants consisting of the principal, PJOK teachers, and students, who provided a comprehensive perspective on the phenomenon under study. The data

collected from these various sources helped build a complete picture of the practices and challenges in the field. Table 1 presents a brief profile of the informants involved in this study.

Table 1. Research informant profile.

Informant Code	Role	Age	Gender	Teaching Experience/Grade	Involvement with IFP
KS-01	Principal	59	Male	20 years	Policymaker, supports IFP implementation
GPJOK-01	PJOK Teacher	44	Male	10 years	Active IFP user in PJOK
S-VII-01	Grade VII Student	13	Male	—	IFP user in PJOK
S-VII-02	Grade VII Student	13	Female	—	IFP user in PJOK
S-VIII-01	Grade VIII Student	14	Male	—	IFP user in PJOK
S-VIII-02	Grade VIII Student	14	Female	—	IFP user in PJOK
S-IX-01	Grade IX Student	15	Male	—	IFP user in PJOK
S-IX-02	Grade IX Student	15	Female	—	IFP user in PJOK

3.2 Planning of IFP Utilization Strategy in Merdeka Curriculum PJOK Learning

The process of planning the use of the Interactive Flat Panel (IFP) in Merdeka Curriculum PJOK learning at SMP Negeri Satu Atap Plakpak involved a series of structured stages. The PJOK teacher, with the support of the principal, prepared lesson plans (RPP) that integrated IFP as the main medium. Factors considered included IFP's interactivity, ease of device use, the relevance of the content presented, and the teacher's skill in maximizing the operation of IFP's features. The main goal of this planning was to create PJOK learning that is more engaging and effective, in line with the demands of the student-centered Merdeka Curriculum.

The principal and PJOK teacher also considered the available technical support to ensure smooth IFP operation during learning. They sought to identify the PJOK material best suited for presentation through IFP, such as movement demonstration videos, sports simulations, or interactive quizzes. This process also included determining time allocation and evaluation methods appropriate to IFP use. This careful planning became an important foundation for ensuring that IFP could be optimally utilized in stimulating student engagement. The PJOK teacher proactively sought out and developed digital content relevant to the PJOK material, ensuring that each learning session had a clear objective supported by technology.

3.3 Implementation of IFP Utilization Strategy in Merdeka Curriculum PJOK Learning

The implementation of Interactive Flat Panel (IFP) use in Merdeka Curriculum PJOK learning activities at SMP Negeri Satu Atap Plakpak showed a range of innovative practices. The PJOK teacher applied an expository strategy supported by instructional videos and interactive quizzes, as also revealed in previous research [8]. The use of IFP allowed the teacher to present visually rich PJOK material, such as basic sports techniques or game rules, which are difficult to explain using conventional methods alone. Students could interact directly with the content through touch features, which enhanced their learning experience.

Challenges faced during IFP implementation included the teachers' limited ability to fully operate the device's features, a finding also noted by Rizki et al. [9]. The PJOK teacher sought to overcome this obstacle through self-directed training and sharing best practices with colleagues. IFP was used to support students' physical and cognitive activities in PJOK, for example by displaying clear movement instructions or facilitating discussion of game strategy. Students showed increased focus, activity, and enthusiasm during learning activities through IFP, a finding consistent with the study by Ardiansa et al. [10] at a lower level of education. This device also facilitated student collaboration in solving problems or designing strategies, as noted by Indriansyah [11] in the context of Social Studies learning.

3.4 Evaluation of the Impact of IFP Utilization on Stimulating Student Engagement

The evaluation results show a positive impact of Interactive Flat Panel (IFP) utilization on stimulating student engagement in Merdeka Curriculum PJOK learning. Students' cognitive engagement increased because IFP presented material in a more engaging and easily understood way, enabling them to process information more deeply. Students showed improved conceptual understanding and better learning outcomes, consistent with the findings of Sari et al. [2], which identified IFP's effectiveness in improving overall learning quality. A concrete example of increased cognitive engagement was seen when students actively answered interactive questions or analyzed sports movement videos displayed on the IFP.

Students' emotional engagement also increased, marked by higher enthusiasm, interest, and learning motivation. The use of IFP made PJOK learning feel more enjoyable and less monotonous, so that students felt more motivated to participate. Hidayati & Herwanto [12] also found that IFP can increase students' learning motivation, particularly through the use of interactive quizzes and instructional videos. The main indicators of increased emotional engagement were students' expressions of excitement when interacting with IFP and their desire to try new features.

Students' behavioral engagement was evident in their active participation in discussions, group activities, and use of the IFP's touch features. Students more frequently asked questions, shared ideas, and worked together in completing tasks involving IFP. Ferdinand et al. [13] also observed increased learning activity among children after the implementation of IFP, indicating the device's potential to promote participation. The use of IFP as a concrete visual medium bridged abstract PJOK concepts, making it easier for students to understand and apply the material. PJOK teachers also used IFP to provide instant feedback, which further encouraged sustained student engagement.

The use of the Interactive Flat Panel (IFP) significantly supports various student learning styles, particularly in the context of PJOK learning. IFP's ability to present material visually through demonstration videos and interactive graphics is highly relevant for students with a visual learning style, who tend to process information better through images and displays. The touch and interactive quiz features on IFP accommodate students with a kinesthetic learning style, as they can learn through direct action and manipulation of virtual objects [14]. This diversification of content delivery ensures that learning is not centered on a single mode, but instead reaches a broad spectrum of student learning needs.

IFP also facilitates learning for students with an auditory learning style through the integration of audio in videos or the teacher's verbal explanations reinforced with on-screen visuals. This device's ability to simultaneously stimulate multiple sensory modalities creates a holistic and inclusive learning environment. This kind of multimodal approach — in which information is presented through a combination of text, images, audio, and direct interaction — has been shown to improve memory retention and conceptual understanding [15]. PJOK

teachers can freely switch between visual presentation, group discussion supported by live annotation on the IFP, and interactive activities to maintain learning dynamics.

The use of IFP also crucially supports learning differentiation strategies, enabling teachers to tailor instruction and content to individual student needs. With IFP, teachers can easily present material at various levels of difficulty or in different formats, ranging from basic tutorial videos to complex simulations for more advanced students. This flexibility helps teachers fulfill the principles of the Merdeka Curriculum, which emphasizes student-centered learning and recognition of each learner's uniqueness.

IFP increases the accessibility of learning material for all students, including those with diverse learning styles or special needs. For example, students with reading difficulties can make use of the rich visuals and audio on the IFP, while students who need more challenge can engage in in-depth interactive quizzes. IFP integration enables a more inclusive learning experience, ensuring that every student has an equal opportunity to access and understand PJOK material, thereby effectively reducing learning gaps. This is consistent with the findings of Latifah et al. [1], which showed that IFP is able to increase student activeness and enthusiasm through the visual delivery of material, accommodating the needs of visual learners.

4 Discussion

4.1 Planning of IFP Utilization Strategy in Merdeka Curriculum PJOK Learning

The planning of Interactive Flat Panel (IFP) utilization in Merdeka Curriculum PJOK learning at SMP Negeri Satu Atap Plakpak proved to be systematic. The PJOK teacher prepared lesson plans (RPP) that integrated IFP as the main medium, demonstrating seriousness in adopting the technology. Factors such as IFP's interactivity potential, ease of use, the relevance of the content presented, and the teacher's skill in maximizing the operation of IFP's features became important considerations. The main goal of this planning was to create PJOK learning that is more engaging and effective, in line with the spirit of the student-centered Merdeka Curriculum.

This strategy intrinsically reflects an adaptation to the demands of the Merdeka Curriculum, which emphasizes innovation and the holistic development of student potential. This curriculum encourages teachers to be proactive in choosing media and learning strategies relevant to achieving optimal goals. Careful planning became an important foundation for ensuring that IFP could be optimally utilized in stimulating student engagement. The PJOK teacher at this school actively sought out and developed digital content appropriate to the PJOK material, ensuring each learning session had a clear objective supported by technology.

Teachers' perceptions of technology also greatly influenced the planning stage. Alfiah et al. [16] revealed a shift in teacher perception from initial technical anxiety to pedagogical optimism after understanding IFP's interactive functions. This finding indicates that teachers' deep understanding of IFP's capabilities can remove initial barriers and encourage bolder, more innovative planning. Teacher readiness to integrate technology is an important indicator of planning success. Implementing IFP in learning requires teachers who not only understand the technology but are also able to design relevant activities.

IFP's potential for presenting complex material is a primary consideration in content planning. The use of Interactive Flat Panel Display (IFPD) media in Social Studies learning for madrasah students was examined in greater depth by Riyadi and Ningsih [6]. The same concept is relevant to PJOK, where movements or game strategies can be presented through instructional

videos or simulations that are difficult to explain verbally. This planning allows teachers to select the material best suited for delivery through IFP, such as demonstrations of movement techniques, game rules, or interactive quizzes that stimulate students' thinking. Available technical support at the school is also an inseparable part of comprehensive planning.

The planning process also includes determining time allocation and evaluation methods appropriate to IFP use. Teachers need to plan how IFP is integrated into each phase of learning, from material introduction to assessment. This planning seeks to minimize technical obstacles and ensure that the device can be operated smoothly. The planning of the IFP utilization strategy at SMP Negeri Satu Atap Plakpak is an adaptive step that considers pedagogical, technical, and support aspects in order to maximize the technology's potential in PJOK learning.

4.2 Implementation of IFP Utilization Strategy in Merdeka Curriculum PJOK Learning

The implementation of Interactive Flat Panel (IFP) use in Merdeka Curriculum PJOK learning activities at SMP Negeri Satu Atap Plakpak shows a series of innovative practices aimed at improving learning quality. Iwansyah et al. [8] showed that the use of IFP in Islamic Religious Education (PAI) learning is carried out through three stages: planning, implementation, and evaluation, in which, during the planning stage, teachers prepare the lesson. This approach enables the delivery of visually rich PJOK material, such as demonstrations of basic sports techniques or game rules, which would be difficult to explain effectively using conventional lecture methods alone.

Students can interact directly with learning content through IFP's touch features, which significantly enhances their learning experience. This direct interaction is an important mechanism for stimulating active student engagement. The PJOK learning model under the Merdeka Curriculum demands a balance between theory and practice, and IFP serves as an effective bridge for uniting the two. This device enables the visualization of abstract concepts and practical demonstrations that students can directly apply in the field or in classroom simulations.

Teachers' limited ability to fully operate the device's features was an identified challenge during implementation. Rizki et al. [9], in contrast, found that the use of IFP in PAI learning ran effectively, marked by increased student activeness, enthusiasm, and attention. The PJOK teacher at SMP Negeri Satu Atap Plakpak sought to overcome this obstacle through self-directed training and sharing best practices with colleagues. This continuous effort demonstrates a commitment to maximizing IFP's potential despite initial barriers in technology mastery.

IFP was used to support students' physical and cognitive activities in PJOK, for example by displaying clear movement instructions or facilitating discussion of game strategy. This feature enables students not only to see, but also to understand the structure and mechanism behind each movement or strategy. Indriansyah [11] found that IFP can increase children's focus, activity, and enthusiasm during learning activities, a finding consistent with observations of junior high school students. This increase suggests that interactive technology has a universal appeal capable of stimulating participation across various ages.

This device also facilitates student collaboration in solving problems or designing strategies, as noted by Sudrajat & Puspita [17] in the context of Social Studies learning. In PJOK, IFP can be used to analyze team strategy, plan game tactics, or evaluate performance through video playback. This interaction encourages students to work together, communicate, and develop social skills, which are an integral part of the Merdeka Curriculum. Such collaboration not only enhances conceptual understanding but also strengthens social bonds among students.

Overall, the implementation of IFP shows that this technology can serve as a driver of transformation in PJOK learning. The use of IFP supports a more dynamic and interactive approach, in line with the goals of the Merdeka Curriculum, which emphasizes the holistic development of student potential. The presence of IFP enables teachers to present relevant and engaging material, while also opening opportunities for students to actively participate at every stage of learning. The technical obstacles faced by teachers serve as a reminder of the need for ongoing support and training to ensure optimal use of the technology.

4.3 Evaluation of the Impact of IFP Utilization on Stimulating Student Engagement

The evaluation of the impact of Interactive Flat Panel (IFP) utilization shows a significant positive contribution to stimulating student engagement in Merdeka Curriculum PJOK learning. Students' cognitive engagement increased markedly because IFP presented material in a more engaging and easily understood way. This condition enabled them to process information more deeply compared to conventional learning methods. Hermawan and Widiastuti [15] concluded that IFP effectively improves student learning outcomes, conceptual understanding, motivation, and engagement. IFP's interactive features, such as quizzes and simulations, directly prompt students to think critically and actively participate in learning activities.

The observed increase in conceptual understanding and learning outcomes is a key indicator of higher cognitive engagement. Students did not merely receive information passively but actively constructed their own understanding through interaction with the content. IFP provided clear visualization and enabled independent exploration, thereby facilitating the process of assimilating and accommodating knowledge. This visualization was especially helpful in PJOK, which often involves complex movement or strategy concepts requiring good spatial understanding.

Students' emotional engagement also showed a significant increase, reflected in their higher enthusiasm and interest in PJOK material. Sari et al. [2] aimed to describe the use of the Interactive Flat Panel (IFP)/Smartboard as an interactive learning medium at SDN Pelambuan 4 Banjarmasin and its impact on the learning process and outcomes. Istiana and Prahastiwi [3] also reported improvements in social-emotional aspects, including the ability to share and self-confidence, following the use of IFP. This positive atmosphere strongly supported an effective and sustainable learning process.

Students' behavioral engagement was evident in their active participation in discussions, group activities, and direct interaction with the IFP device. Hartini et al. [14] observed that the IFP's touch screen feature successfully satisfied students' curiosity, increasing interest, active engagement, and conceptual understanding. Students were more willing to ask questions, share ideas, and solve problems together. This direct interaction encouraged students to become active subjects in learning, rather than merely passive recipients of information.

This study confirms that IFP is not merely a presentation tool but a medium capable of accommodating various learning styles and stimulating the cognitive, affective, and psychomotor aspects of students in PJOK. Susanti et al. [4] described the teacher's role in stimulating the ability to recognize alphabet letters through the use of Interactive Flat Panel (IFP) media in early childhood. The strategic use of IFP can bridge PJOK concepts that are sometimes abstract, making them more concrete and easier to visualize, thereby supporting the Merdeka Curriculum approach.

The optimization of IFP in learning also greatly depends on teacher ability. Hadi et al. [18] showed the positive impact of IFP training on improving teachers' ability to develop technology-based learning strategies and on teacher motivation to innovate. This indicates that investment in teacher professional development is a crucial factor in maximizing IFP's

potential. Improving teachers' skills in maximally operating IFP will further strengthen its positive impact on student engagement and overall learning quality.

The positive impact of IFP on learning outcomes is also supported by quantitative evidence from other research. Rahayu et al. [19] found that the average posttest score of the experimental class using IFP was higher than that of the control class. The study by Sudrajat and Puspita [17] also observed a significant increase in students' writing ability after treatment using IFP assisted by the Problem Based Learning model. These findings confirm that IFP, when integrated with the right pedagogical strategy, has great potential to improve the quality and outcomes of learning, in line with the goals of the Merdeka Curriculum, which emphasizes innovation and student-centeredness.

The use of IFP at SMP Negeri Satu Atap Plakpak has created a dynamic and interactive learning environment. This device effectively motivates students, facilitates independent exploration, and encourages collaboration essential for the holistic development of student potential. The contribution of this study lies not only in identifying strategies, but also in the deep understanding of the mechanisms by which IFP can simultaneously support the achievement of PJOK learning objectives within the framework of the Merdeka Curriculum.

5 Conclusion

Based on the results of research on strategies for utilizing the Interactive Flat Panel (IFP) in stimulating student engagement in Merdeka Curriculum PJOK learning at SMP Negeri Satu Atap Plakpak, several main conclusions can be drawn. The purpose of this research was to identify and describe the planning and implementation strategies for IFP utilization, as well as to analyze how IFP is able to stimulate student engagement within the context of the Merdeka Curriculum. The research findings provide a comprehensive picture of educational technology adaptation practices in a school environment striving to improve learning quality. This conclusion summarizes the essence of the qualitative data collected, highlighting the crucial aspects of the strategy applied.

1. The planning of the Interactive Flat Panel (IFP) utilization strategy at SMP Negeri Satu Atap Plakpak proved to be systematic and centered on integrating IFP as the primary learning medium in Merdeka Curriculum PJOK. This planning process considered interactivity, ease of use, content relevance, and teacher skill, aiming to create a more engaging and effective learning experience for students.
2. The implementation of the IFP utilization strategy in Merdeka Curriculum PJOK learning at SMP Negeri Satu Atap Plakpak demonstrated effectiveness through a participatory approach. Teachers actively involved students in various activities utilizing IFP's interactive features, such as sports movement simulations and video analysis, thereby encouraging active participation and independent exploration by students in the subject matter.
3. The use of IFP significantly increased student engagement in PJOK learning across the cognitive, affective, and psychomotor dimensions. Cognitively, IFP facilitated the visualization of complex material, supported understanding of movement concepts, and enabled instant feedback essential in motor learning, in line with the principle of constructivism, which emphasizes active learning through experience. Affectively, the gamification and interactivity aspects of IFP were able to arouse students' interest, motivation, and curiosity, creating a positive learning atmosphere and reducing the

boredom often arising from conventional methods. The psychomotor dimension was also stimulated through accurate movement demonstration videos and students' ability to try and analyze their own or their peers' performance through instantly displayed video recordings.

This IFP utilization strategy also demonstrates great potential for supporting the principle of learning differentiation, as mandated by the Merdeka Curriculum. With IFP, teachers can easily provide various learning resources tailored to students' visual, auditory, or kinesthetic learning styles, as well as accommodate different learning paces. For example, material can be presented as interactive infographics for visual learners, instructional videos with narration for auditory learners, or simulations that allow movement exploration for kinesthetic learners. This flexibility enables every student to access and process information optimally, making PJOK learning more inclusive and relevant for each individual, in accordance with Albert Bandura's social cognitive learning theory, which emphasizes the role of observation and experience in learning.

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