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DEVELOPMENT OF INTERACTIVE LEARNING MEDIA BASED ON VIRTUAL REALITY TO IMPROVE STUDENT LEARNING OUTCOMES ON PARABOLIC MOTION MATERIAL

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ABSTRACT

The purpose of this research is to describe teachers' needs for web-based chemistry learning media to support the chemistry learning process in the classroom. Needs analysis is conducted based on the first stage of the ADDIE model, which is Analysis. The method used in this research is the survey method. There are 5 chemistry teacher volunteers from SMA Negeri 1 Sidamanik in Simalungun Regency. Data collection was carried out using questionnaires and interviews with qualitative data types. The questionnaire was distributed using Google Forms so that respondents could fill it out online. The research results were analyzed descriptively, and it was found that the media frequently used by teachers, such as projectors and PPT/LCD, had a percentage of 100%, while web-based chemistry learning media was never used. The obstacles faced by teachers include the creation, use, and development of media that are considered difficult, leading teachers to feel less motivated to create media for chemistry education. So they need a tutorial on how to create and use learning media.

***Keywords*: Learning Media, Reality, and Learning Outcomes**

A. INTRODUCTION

The term "learning outcomes" is composed of two distinct lexemes: "results" and "learning." Each of these words carries its own unique connotation and implications, thus necessitating a comprehensive examination of their individual meanings in order to fully grasp the concept of learning outcomes in an educational context. Learning, as a fundamental component, serves as the principal function underlying the entirety of educational processes that take place within the confines of formal schooling. The degree to which educational objectives are successfully attained is intricately intertwined with students' perceptions of their own learning activities and their roles as learners within the educational system.

Furthermore, the process of learning, characterized by active engagement and participation, constitutes a pivotal aspect of the execution of all forms and tiers of educational endeavors, indicating that the overall success in reaching educational milestones is, in fact, contingent upon the diverse learning experiences encountered by the students themselves. The concept of interest in learning encompasses a specific form of curiosity and motivation related to academic pursuits, which reflects students' intrinsic desire to engage with various tasks and practical applications. By fostering and enhancing students' interest in the learning process, one can anticipate a corresponding improvement in their academic outcomes, thereby establishing a direct relationship between engagement and achievement.

The growth and development of students' interest in learning can be effectively cultivated through the learning process itself, as the degree of engagement and excitement

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associated with educational activities plays a crucial role in shaping their overall academic experience. In this context, the more immersive and captivating the learning environment is for students, the more substantial their interest in academic pursuits will become. One particularly effective strategy for creating an engaging and enjoyable learning experience involves the strategic utilization of a learning environment that is specifically tailored to meet the diverse needs and preferences of students.

To this end, it is essential that the existing learning environment be designed to be as appealing and stimulating as possible, and one effective approach to achieving this goal is through the integration of supportive learning tools and resources. A pertinent example of such supportive learning tools can be found in the realm of learning media, which has been shown to play a significant role in enhancing educational experiences. In prior research studies, it has been demonstrated that Nearpod-based e-media learning activities have proven to be particularly effective in motivating students and improving their understanding of concepts such as Hooke's Law, achieving an impressive mastery percentage of 76.1%.

Moreover, the aforementioned study highlighted that the development of Nearpod-based learning activities was not only considered to be very feasible but also remarkably effective in bolstering students' learning outcomes related to Hooke's Law, as evidenced by the overwhelmingly positive feedback received from participants. In light of previous research findings, expert evaluations concerning the material being utilized were rated as highly feasible, garnering an impressive score of 93.5%, while the evaluation of the media itself received a similarly high feasibility rating of 89.5%. This data indicates that the learning media created based on expert validation results is widely recognized as appropriate and suitable for implementation within educational settings.

Additionally, in a separate study focusing on the Development of Nearpod-Based Science Learning Media aimed at enhancing both student learning activities and critical thinking skills among junior high school students, the results of the research indicated that the learning media was regarded as valid, achieving a notable percentage of 92.13%. Furthermore, the practical application results derived from the learning implementation sheet demonstrated an outstanding score of 93.23%, thereby categorizing it as exceptionally good in terms of practicality and effectiveness.

B. RESEARCH METHOD

This particular research methodology adopts a qualitative framework, employing literature study as the primary technique for data collection, which facilitates a deeper understanding of the subject matter at hand. A comprehensive literature study will be undertaken wherein an extensive array of sources and informational materials pertinent to the evolution and advancement of interactive learning media that is fundamentally grounded in Virtual Reality (VR) will be systematically gathered and meticulously analyzed

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to ascertain their potential influence on enhancing student learning outcomes specifically concerning the concept of projectile motion.

The critical dimensions that warrant investigation encompass: 1) the foundational concepts and theoretical underpinnings that govern the development of interactive learning media rooted in VR technology, 2) the measurable effects that VR may exert on student learning outcomes, particularly in the specialized area of projectile motion, 3) the various strategies and methodological approaches that can be employed to effectively integrate VR into educational practices, 4) the potential challenges and opportunities that present themselves in the course of developing and utilizing VR within the educational landscape, and 5) a thorough and critical examination of prior research studies that are relevant to this particular domain of inquiry. The data acquired from the literature study will subsequently undergo a detailed analysis employing both descriptive and interpretative techniques, which will ultimately yield a set of comprehensive conclusions regarding the significant role that VR plays in bolstering student learning outcomes, especially in relation to the intricate topic of projectile motion.

C. RESULTS AND DISCUSSION

A comprehensive literature examination focused on the evolution of interactive learning media that is fundamentally rooted in the principles of Virtual Reality (VR) technology, specifically designed to enhance the educational outcomes of students engaged with the subject matter pertaining to projectile motion, can encompass a multitude of significant facets that are pivotal to the overall effectiveness of the learning process. Furthermore, empirical findings have indicated that the effectiveness of such interactive media in facilitating learning activities, as measured by relevant academic metrics, stands at an impressive 84.47%. Consequently, this statistic can be interpreted to signify that the interactive media developed as part of this research initiative is not only valid and practical but also remarkably effective in augmenting both the learning experiences and critical thinking capabilities of students. Drawing from the synthesized results of the three distinct studies that have been meticulously reviewed in the preceding sections, we can assert with confidence that the implementation of interactive learning media utilizing platforms such as Nearpod has proven to be exceedingly effective in aiding student comprehension and mastery of the subject matter, particularly in relation to the enhancement of their overall learning outcomes.

The academic exploration of projectile motion constitutes a fundamental component of the physics education curriculum that is implemented across various educational tiers, ranging from secondary schools to higher education institutions. Nonetheless, it has been widely observed that students frequently encounter significant obstacles when attempting to grasp the intricate concepts and apply the foundational principles of projectile motion to tangible, real-world scenarios. The inherent limitations regarding the visualization of these concepts, as well as the lack of interactive engagement with the educational materials, can considerably impede the overall effectiveness of the learning experience. In the contemporary landscape characterized by the swift evolution of information and communication technology, the incorporation of interactive learning media founded on Virtual Reality (VR) represents a promising avenue for fostering a more engaging and efficacious pedagogical approach. The integration of VR technology facilitates a unique

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opportunity for students to directly interact with educational content, thereby cultivating a profound and immersive learning experience that transcends traditional methods of instruction.

The deliberate development of interactive learning media grounded in VR principles, specifically targeted at the subject of projectile motion, has the potential to emerge as an innovative remedy aimed at significantly enhancing student learning outcomes. By providing realistic visual representations and engaging simulations, it is anticipated that students will experience an increased capacity to comprehend the complex nuances of projectile motion, as well as the development of essential skills required to adeptly apply this understanding across a diverse array of situational contexts. Prior research endeavors have also highlighted the affirmative potential of VR technology in advancing students' grasp of physics concepts and further improving their academic performance. Thus, the primary objective of this study is to develop and refine interactive learning media based on VR technology that is specifically tailored for the instruction of projectile motion, while simultaneously evaluating its consequential impact on student learning outcomes. It is the aspiration of this research initiative that the findings will contribute meaningfully to the advancement of innovative and effective pedagogical methodologies within the realm of physics education.

The ongoing investigation into the progression of interactive learning media that utilizes Virtual Reality (VR) as a foundational element is poised to extend its focus towards the enhancement of student learning outcomes concerning the topic of parabolic motion. While it is true that projectile motion constitutes a significant subject within the domain of physics education, it has become increasingly evident that educational strategies relying exclusively on traditional teaching methodologies often fall short of adequately addressing the diverse needs of students in an optimal manner. Among the myriad challenges encountered during the instructional process related to parabolic motion are the evident lack of direct experiential learning opportunities that would allow students to observe parabolic trajectories in action, the difficulties that arise when attempting to visualize the intricate paths taken by objects in motion, and the inherent limitations that exist when it comes to conducting practical physical experiments that would otherwise facilitate a deeper understanding of these principles.

In the current academic discourse, it is imperative to recognize that the implementation of Virtual Reality (VR) technology holds substantial promise for effectively mitigating several educational challenges that students frequently encounter. Through the utilization of VR headsets, learners are afforded the remarkable opportunity to immerse themselves within a meticulously crafted three-dimensional simulation environment, which adeptly illustrates the principles of projectile motion in a manner that is not only visually engaging but also inherently realistic. Within this immersive space, students are able to meticulously observe the trajectories of various objects as they navigate through a three-dimensional framework, allowing them to monitor dynamic changes in various parameters, while also engaging in virtual experiments that would likely pose significant practical challenges if attempted in a conventional physical setting. Prior empirical studies have consistently demonstrated that the incorporation of VR-based learning media significantly enhances students' intrinsic interest and motivation towards the learning process, as well as bolstering their comprehension of complex scientific concepts. Nevertheless, it is crucial to

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acknowledge the existing gap in research that specifically targets the development of VR learning media tailored for the nuanced topic of projectile motion, particularly within the structured context of formal educational frameworks.

A comprehensive review of the extant literature concerning the advancements in VR technology is essential, which should encompass not only the innovative strides made in hardware, such as the evolution of VR headsets, but also the sophisticated software and platforms that facilitate the creation of immersive VR content. Furthermore, it is pertinent to investigate the burgeoning developments of VR applications within the realms of education and pedagogical practices. In addition, an exploration of the literature pertaining to the learning dynamics of parabolic motion is warranted, particularly with regard to the traditional pedagogical approaches that have historically been employed in educational settings. Identifying the myriad challenges and difficulties that students encounter while striving to comprehend and apply the intricate concepts associated with projectile motion is a critical endeavor that warrants further scholarly attention.

Additionally, it is vital to review the existing body of research that delves into the application of VR technology within the context of physics education, particularly as it pertains to the learning of various physics concepts. A thorough evaluation of the impacts that the utilization of VR technology has on students' conceptual understanding, their levels of learning motivation, and the overall learning outcomes achieved is essential for a comprehensive understanding of its educational efficacy. Furthermore, it is imperative to explore literature studies that rigorously assess the effectiveness of interactive learning media in enhancing the educational outcomes of students. A detailed review of the evaluation methodologies employed, alongside the principal findings related to the implementation of interactive media in educational contexts, will provide invaluable insights. Identifying specific studies or projects that have successfully developed VR learning content exclusively focused on the concept of projectile motion is also a necessary component of this exploration.

Such a review should encompass the intricate aspects of content design, interactivity, and user experience, particularly within the educational landscape concerning projectile motion. Moreover, an examination of the literature surrounding effective learning approaches in the context of VR technology is crucial, particularly in identifying learning strategies that can significantly enhance students' conceptual understanding and practical skills. By engaging in a thorough exploration and synthesis of findings from the existing literature studies in this specialized field, researchers can gain profound insights into the potential applications of interactive learning media grounded in VR technology, particularly in relation to improving student learning outcomes on the intricate topic of projectile motion. Ultimately, the literature study focusing on the development of interactive learning media based on Virtual Reality (VR) aims to enrich student learning outcomes in the domain of projectile motion by integrating interdisciplinary knowledge drawn from several critical areas, which include VR technology, physics education, and educational psychology, thus fostering a comprehensive understanding of this multifaceted subject.

Engaging in a thorough exploration of the existing academic literature surrounding the most recent advancements in virtual reality (VR) technology is essential, particularly focusing on the various hardware components and software applications that have been developed and utilized specifically within the educational sector. It is imperative to

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scrutinize the extensive capabilities that VR possesses in the creation of immersive, interactive learning environments that can significantly enhance the educational experience for students. Additionally, it is critical to conduct an exhaustive literature review concerning the predominant pedagogical approaches employed in the instruction of projectile motion, which is a fundamental concept in physics education. Furthermore, it is necessary to delve into the research findings that elucidate the challenges faced by students in grasping the complex notion of projectile motion, as well as identifying effective strategies that can be implemented to mitigate these obstacles and facilitate better understanding.

Moreover, it is vital to explore the burgeoning research surrounding the application of VR technology in the realm of physics education, as this innovative tool has the potential to revolutionize traditional teaching methodologies. A thorough review of the impact that VR technology has on students' motivation to learn, their conceptual understanding, and their problem-solving skills within the context of physics is required to fully comprehend its educational implications. In addition, it is important to examine literature studies that articulate the design principles behind interactive VR-based learning media specifically tailored for physics topics, with a particular emphasis on projectile motion, to ensure that the educational materials are both effective and engaging.

An analysis of design aspects such as the clarity of learning objectives, the user interface, and the level of interactivity offered by these VR educational tools is essential to ensure that they meet the learning needs of students. Furthermore, conducting a comprehensive literature review on the various evaluation methods that have been employed to assess the effectiveness of VR-based learning media in enhancing student learning outcomes on the subject of projectile motion is crucial for determining their overall efficacy. Additionally, it is important to review existing findings relating to the long-term impacts of incorporating VR technology into educational settings, as understanding these effects can inform future educational practices.

Finally, an examination of research pertaining to evidence-based learning methodologies, such as problem-based learning or cooperative learning strategies, is warranted to investigate how these approaches can be seamlessly integrated into VR learning environments, particularly for the topic of projectile motion. By synthesizing findings from diverse literature studies across various educational fields, the development of interactive VR-based learning media focused on parabolic motion can be grounded in a robust theoretical framework, thereby providing a comprehensive perspective on effective strategies aimed at enhancing student learning outcomes in physics education.

D. CONCLUSION

The advent of virtual reality (VR) technology has ushered in a plethora of significant opportunities that are instrumental in the formulation and delivery of profound and immersive learning experiences that resonate deeply with learners. Through the intricate amalgamation of highly realistic visualization techniques and interactive components, VR learning media possess the capability to facilitate a more dynamic and captivating educational journey for students, thereby enriching their overall learning process. A comprehensive review of existing literature indicates that the implementation of interactive VR-based learning media serves to significantly elevate students' conceptual

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understanding, enhance their motivation to learn, and improve their academic outcomes, particularly in complex subjects such as physics, which includes topics like projectile motion. Furthermore, research suggests that students exhibit a heightened level of engagement and enthusiasm when exposed to the interactive nature of VR technology, which fosters a more stimulating educational environment. This increased engagement not only enhances their learning experience but also encourages a deeper exploration of the subject matter at hand. Consequently, it is evident that the integration of VR technology within educational frameworks has the potential to transform traditional pedagogical approaches, offering a more effective means of instruction that aligns with the needs and preferences of modern learners.

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