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Science, Technology and Mathematics Education: A roadmap to Economic growth and Sustainable Development of the Developing Nations

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ABSTRACT

The entire globe is shifting rapidly, so in this fast-paced setting, education is essential for directing and propelling national growth. Education in science, technology, and math stands out in this environment as a beacon that might point the way toward economical and sustainable growth. To succeed in the modern inventive period, one has to be able to extract and apply relevant knowledge, recognize important patterns, and understand the foundations of a range of difficulties. The development of the requisite abilities and knowledge may be aided by science, technology, and math education by highlighting the creation of captivating notions about science, the nature of scientific investigation, and its applications. Science is an approach that focuses on various research methods and tasks related to the development, acquisition, and management of knowledge, skills, aptitudes, and attitudes about the natural factors in the environment. The importance of education, economic growth and sustainability, obstacles to and strategies for achieving economic growth and sustainable development in developing countries, and the connection between STEM education and sustainable economic growth were all examined in this study.

Keywords: Science, Technology, mathematics Education, Sustainable Development

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1. INTRODUCTION

The world is changing quickly, and education plays a crucial role in guiding and accelerating national development in this dynamic environment. In this context, science, technology and mathematics education stands out as a lighthouse that may show the way to socioeconomic and sustainable advancement (Olofin et al, 2023). The most powerful tool available for enacting change is education. It is the greatest investment a nation can make to quickly develop its political, social, economic, and human resources. Education is a method by which people are formally aided via appropriate direction and supervision in enhancing their skills for both their personal and society's benefit (Orikpe, 2013, Bello, 2020). Developing Nation such as Nigeria adopted a National Policy on Education in this regard (Bello, 2020).The policy placed a strong emphasis on developing an individual's physical and mental competency as well as skills in order to give him the means to exist in society and support its advancement (FRN, 2004, Bello, 2020). In order to thrive in the current innovative era, one must possess the ability to extract and apply pertinent knowledge, identify significant patterns, and comprehend the fundamentals of a variety of challenges (The InterAcademy Partnership (IAP), 2021). By emphasizing the formation of compelling concepts about science and the nature of scientific inquiry and its uses, science, technology and mathematics education might potentially aid in the development of the necessary skills and knowledge (The InterAcademy Partnership(IAP), 2021, Onoshakpokaiye, 2021).

Science is a method of undertaking, and it is primarily concerned with different types of investigation procedures and tasks in relation to the growing, obtaining, and managing of information, abilities, capacities, and attitudes about the environmental natural variables (Okoli, Obiajulu & Ella, 2013, Bello, 2020, Avwiri, 2016). According to Bello (2015), technology can be additionally defined as the practical use of scientific knowledge and research to social problems, improving human comfort levels. Using precise, logical, and exact thought processes, mathematics aims to enhance human experience of oneself and the surrounding world, according to Ezenweani (2006). A vital component of human existence is mathematics. In our daily actions, humans use it whether directly or indirectly

(Onoshakpokaiye, 2011, Onoshakpokaiye, 2021). Mathematics is a discipline of science that has to do with numbers and how they operate as well as calculation, computation, and problem solving, according to Roohi (2012). Onoshakpokaiye (2021) and Roohi (2012) posited that mathematics involves the study of amount, space, and structure. It also reveals concealed trends to us, allowing us to make sense of what is happening around us. In order to assess the effects of technological and scientific progress, students will therefore acquire scientific knowledge and abilities through the inquiry process. The term "scientific literacy" describes a person's use of scientific information. It facilitates comprehension of the scientific method and enables the application of evidence-based knowledge to a wide range of problems requiring both individual and group solutions (The InterAcademy Partnership (IAP), 2021)

Science, technology and mathematics are taught in schools as an all-encompassing idea that is utilized to improve sustainable growth and create riches for everyone through industrialization, particularly now that globalization has increased competition. Innocent (2016) reports that a number of nations, including France, Norway, Japan, Finland, Germany, the United Kingdom, China, and the United States, have established distinctive educational programs specifically aimed at young people via science, technology and mathematics training. We must discover ways to increase their competence in science, technology and mathematics education since these fields play such important roles in the growth and prosperity of nations today (Bello, 2020). Hence, as part of a larger framework of the enabling environment, developing nations should think about making capacity-building in science, technology and mathematics education a priority for national socioeconomic growth sustainability.

According to Bello (2015), a variety of obstacles, including insufficient teaching and learning facilities and ineffective delivery of high-quality, sustainable education, particularly in the areas of science, technology and mathematics, impede the expansion of education and social development in developing nations. He went on to say that some of these elements may be the outcome of specific difficulties that curricular problems encountered in classrooms. The problems with the curriculum have been largely ignored while being closely related to global concerns and changes in education.

2. RESEARCH METHOD

This study adopted a descriptive qualitative research design to explore the role of science, technology, and mathematics (STM) education in fostering economic growth and sustainable development in developing nations. The qualitative approach was chosen to enable an in-depth examination of conceptual frameworks, policies, educational practices, and the interrelation between STM education and socioeconomic advancement.

The data used in this research were obtained from secondary sources, including peer-reviewed journal articles, official policy documents such as the National Policy on Education (FRN, 2004), and reports from global institutions like the InterAcademy Partnership (IAP). These sources were analyzed to identify recurring themes, patterns, and arguments related to the impact of STM education on national development.

The method of document analysis was employed to critically evaluate relevant literature. This included thematic coding of content to categorize data under core themes such as the significance of STM education, its challenges in the context of developing nations, and proposed strategic interventions. The validity of the study was ensured by triangulating data across multiple credible sources, thereby providing a holistic view of the subject matter.

Through this approach, the study highlighted the crucial role that STM education plays in developing human capital, stimulating innovation, promoting technological advancement, and driving sustainable economic growth. The research further examined the barriers to effective implementation and offered evidence-based recommendations to enhance the impact of STM education in resource-constrained settings.

3. RESULTS AND DISCUSSION

Education and its significance

Education, in the words of Hornby (2012), is a field of social science that involves teaching and acquiring particular knowledge, beliefs, and abilities. The goal of education is to help individuals become more knowledgeable, physically fit, and morally upright so that they can eventually live happy lives and contribute to the betterment of society as a whole (Herman, 2013). A person is assisted in

realizing his or her potential through the carefully thought-out process of education. Education affects deep knowledge and comprehension in today's environment in order to propel society's citizens toward new knowledge frontiers across a range of domains (Ofordum & Onyekwena, 2019**)**. An individual's personal and societal well-being is greatly impacted by education, which is a basic human right. It has become recognized as a tool for economic, societal, and political growth and transformation, and it is fundamental to encouraging behavioural change in people (Ofordum & Onyekwena, 2019**)**.

The economy must be significantly reorganized, new technologies must be adopted, sustainable patterns of production and consumption must be promoted, and effective management of both people and material resources must be safeguarded (Enrico and Lngeborg, 2015). An individual gains the information and abilities required for long-term sustainability and the advancement of their community or country via education. According to Maclean (2008), education is still seen as the primary key to both economic and social growth, even if there are many other keys to development, such as better infrastructure like ports, highways, telecommunications centers, dams, and the like.

Science, Technology and Mathematics Education

The word science is from the term "scientia" in Latin means "knowledge." It is an organized process that creates and structures knowledge in the form of universe-related explanations and predictions that can be put to the test. According to Ofordum & Onyekwena(2019) science is defined as the area of knowledge or study that deals with a body of information that has been presented in a methodical way to demonstrate how universal laws work. It is the study of natural events by observation, classification, description, experimentation, analysis, and theoretical justification. It is the methodical understanding of the material or physical world that comes from experimentation and observation. According to Uza (2014), applied science is the use of pure science to address real-world issues for people, whereas pure science is the study of nature to satiate curiosity. According to the definition given above, science is the study of how to get proven information by closely observing and evaluating natural phenomena. Science is a practical discipline. Important characteristics like curiosity, perseverance, hard work, objectivity, logic, suspended judgment, open-mindedness, and honesty are linked to the scientific process (Okafor, 2012, Avwiri, 2020). The ultimate purpose of science is to solve scientific problems or to meet human needs.

The goal of science, technology and mathematics education is to communicate science concepts and methods to people who aren't often thought of as belonging to the scientific community. These people could be students, farmers, market vendors, or even an entire community (Aina, 2013). Education in science, technology and mathematics acts as a stimulant to encourage people to think like entrepreneurs. Science, technology and mathematics education provides students with the critical thinking, problem-solving, and creative abilities necessary to recognize market gaps and create novel solutions. Education in science, technology and mathematics also fills in the gaps between theory and practice in real-world situations. Students' learning is enhanced by practical laboratory experiences and group projects, which also challenge them to consider how scientific ideas may be applied to real-world inventions (Olofin *et al*, 2023). Science, technology and mathematics education equips people to adapt to and succeed in a technology-driven labour market at a time when economies are being drastically transformed by fast technological advancements. Aspiring entrepreneurs may create science-based start-ups that fulfill market expectations and handle local difficulties by combining this mindset with a solid foundation in scientific concepts (Ofordum & Onyekwenba, 2019).

The National Policy on Education (Federal Republic of Nigeria - FRN, 2004) defines science and technology education as a part of the educational process that includes, in conjunction with broad education, the study of technologies as well as associated sciences and the gaining of knowledge, understanding, and practical abilities that pertain to careers in various social, economic, and other sectors. Science is the input and technology is the product in the relationship between the two while mathematics is the basis for all sciences without which science and technology cannot exist (Bello, 2015, Onoshakpokaiye, 2021). Hence, science, technology and mathematics education is a type of education that seeks to generate citizens who are knowledgeable about science and who are also prospective scientists and technologists. Technology education facilitates the gaining of both fundamental scientific knowledge and practical, applied skills (Ige, 2013). A sustainable scientific advancement is extremely hard perhaps even impossible, without a solid basis in fundamental mathematical and scientific knowledge (Linda, 2000). Science, technology and mathematics education

offers fundamental and integrated process abilities, which include: assisting in the development of collaborations between the public and private sectors to promote and support general education; encouraging information and communication technology (ICT) at all levels; and acting as an instrument for the gaining of practical abilities and a creation of jobs(Okafor, 2012). The scientific endeavour is an inventive and demanding one. It integrates with technology, which emphasizes innovation and troubleshooting. Thus, sustainable development begins with the harmonious interaction of science, technology, mathematics and society

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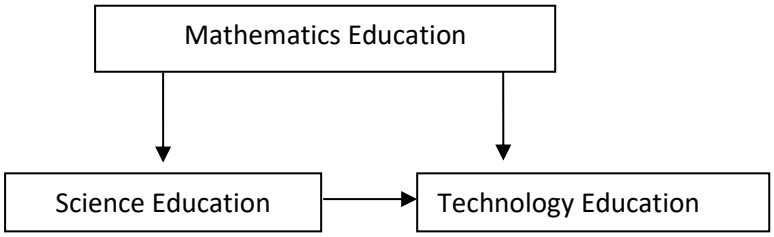


Fig 1.The schematic diagram showing the relationship between mathematics, science and technology education.

Science, technology and mathematics education is a process of teaching or training especially in school to improve one's knowledge about the environment and to develop one's skill of systematic inquiry as well as national attitudinal characteristics (Pember & Humbe, 2009). Gaining the information, abilities, attitudes, and values required to create a sustainable future is made possible via science, technology and mathematics education (Ofordum & Onyekwena, 2019**)**. A variety of important sustainable development issues are incorporated into teaching and learning in this context when we talk about scientific education for sustainable growth, such as reducing the risk of disasters, lowering poverty rates, and climate change.

Science, technology and mathematics education plays a crucial role in determining the direction of the developing countries' economic and sustainable development. This fundamental feature includes a number of important elements that work together to foster the development of a population that is scientifically literate, which promotes creativity, technical advancement, and general socioeconomic growth (Olofin *et al*. 2023). The educational techniques and curriculum serve as the fundamental building blocks of scientific education. The subjects, ideas, and abilities taught to pupils at different educational levels are outlined in the curriculum, which acts as a guide. Students are exposed to the fundamentals of mathematics, physics, chemistry, biology, and other scientific subjects through this program. The curriculum's congruence with national development goals is essential because it guarantees that scientific instruction provides students with the information and skills necessary to meet developing nation's socioeconomic difficulties and ambitions.

In scientific education, pedagogical strategies have a transforming effect. They direct the way in which educators communicate knowledge and motivate learners to interact with scientific ideas (Olofin *et al.*2023). Two essential components of the foundation of scientific education as a vehicle for socioeconomic development requires making sure that it is available to everyone, regardless of gender, socioeconomic status, or geographic location. The developing countries can harness its people resources and create an atmosphere of equal opportunity by resolving inequities and encouraging inclusion. The broad framework that directs the course of scientific education is made up of government initiatives and policies.

Economic growth and Sustainable development

According to Bello (2020) sustainable growth is defined as the progress that satisfies current demands without jeopardizing the potential of future generations to satisfy their own. As a result, growth that could be maintained throughout time is referred to as sustainable growth. Keeping these concepts in mind, development that is sustainable may also be defined as development that builds upon the current while creating an environment that allows generations to come to grow and satisfy their requirements (Bello, 2020). Sustainable development is described as meeting existing demands without

compromising the potential of future generations to satisfy their own needs (Brundtland Commission, 2011, Ofordum & Onyekwena, 2019).

All people will live better lives today and in future generations, to put it another way. Economic, social, and environmental advancements are recognized as essential elements of human progress (Ofordum & Onyekwena, 2019**)**. The goal of sustainable development is to fulfill human needs while protecting the environment so that they may be addressed for future generations as well as the present. It is a pattern of economic growth. Ahuja (2012) emphasizes that economic growth may be measured in the following ways: enhanced human capital improvement; increased food supply and agricultural output; increased income. The initiative, ingenuity, inventiveness, and self-control of those in charge of developmental initiatives are essential to achieving sustainable development. But according to Michael (2012), sustainable development is the capacity to address both the requirements of the present and those of the coming generations. Therefore, sustainability is a process that describes how all facets of human existence are developing and how that is influencing substance. As a result, science, technology and mathematics education for sustainable development fosters skills like critical thinking, envisioning the future, and cooperative decision-making. In the developing nations, Science, technology and mathematics education can help achieve sustainable growth if taking seriously. Science, technology and mathematics Education changes the world both intellectually and physically and is a surefire tool for national progress. Cantner & Pyka (2001) stated that Science, technology and mathematics Education has been identified as a major factor in raising productivity and a crucial long-term lever for prosperity and economic progress.

Sustainable development and the function of science, technology and mathematics education coexistence in peace. Peaceful surroundings are necessary for both sustainable development and economic progress (Ofordum & Onyekwena, 2019**)**. Learning science instills in students some fundamental values, such as respect for others' opinions, cooperation, and open-mindedness. In order to foster peaceful coexistence in society, these good habits formed in school will probably be implemented in later life. Apart from improving citizens and neighbors, high-quality education also contributes to the well-being and significance of social and political life (Ofordum & Onyekwena, 2019**)**. The universe of inquiry and discovery is introduced to pupils through the study of science as a subject. This methodology is expected to foster scientific inquiry among future science graduates. This will result in increased productivity enhancement and technical advancements that will impact the economy.

Relationship between Science, Technology, Mathematics Education and sustainable economic growth

Science, technology, mathematics and innovation policies are not feasible unless they are supported by well-crafted policies that tackle problems like learning, research, and development (R&D) (Orkaa & Kwaghbo, 2011). For this reason, education in developing nations such as Nigeria ought to be focused on preparing students for the industrial, scientific, and technological era in order to promote sustainable development and global competitiveness. Science, Technology and Mathematics Education promote and advances economic and technical advancement both nationally as well as between its citizens. As stated by Linda (2000), this awareness is the result of global movements for mathematics, technology and science literacy, which aims to give the developing nation's future citizens a grasp of technological as well as scientific methods and proof so they are able to make knowledgeable choices on scientific and technological problems, as well as to guarantee that young people going into the country's workforce have the expertise and abilities necessary for fostering economical, scientific, and technological growth.

The focus of science, technology and mathematics education is on developing students' problem-solving and decision-making abilities, which are essential for success in the twenty-first century. There is hardly a facet of everyday existence that science, technology and mathematics have not touched, making scientific and mathematics education especially crucial. Through discoveries, it creates knowledge and gives students the necessary abilities to live a simpler life than they have ever had. According to Juma & Yee-Cheong (2005), a nation’s ability to solve problems and initiate sustainable economic growth is strictly dependent on its capabilities in science, technology and mathematics. Science, technology and mathematics linked to economic growth determine the ability to provide social amenities and adequate infrastructure. Science, technology and mathematics have potentials in

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addressing the challenges associated with poverty and hunger elimination by creating job opportunity, empowering youth with vocational or entrepreneurship skills (Orkaa & kwaghbo, 2011).

Science, technology and Mathematics literacy is essential to the developing nations' economy since they are included in the nation's plan for growth. Industrial development and science, technology and mathematics are so closely related that it is difficult to draw clear boundaries between them. Thus, rather than emphasizing a theoretical approach to instruction or fact memorization, the overwhelming demand for the training of a citizenry who are capable of participating in an increasingly globalized world strongly impacted by technological advances highlights the necessity for qualitative science, technology and mathematics education. Omer (2011) argues that scientific advancements are driving the globalization agenda and the emerging world order of the twenty-first century. Though each country's ability to expand industrially is heavily reliant on its degree of sophisticated science, technology and mathematics, it is important to remember that these fields are essential to the extraction of resources for human consumption. Education in science, technology and mathematics will make the developing nations' current state of technological progress possible.

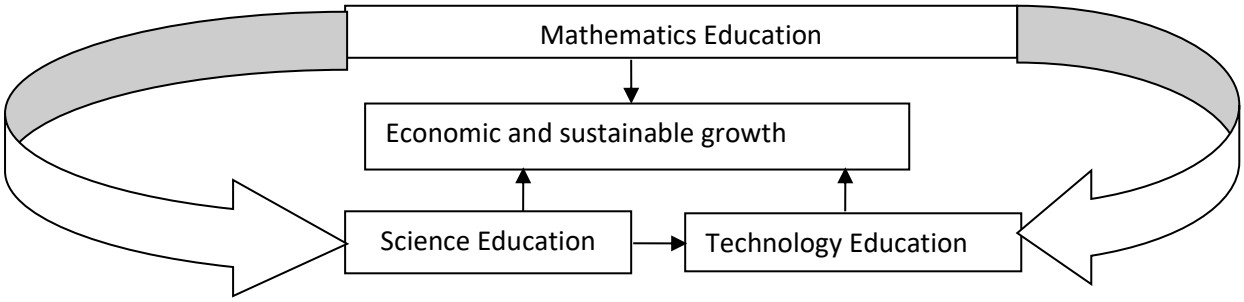


Fig 2. Schematic diagram showing the relationship between science, technology, mathematics, economic and sustainable growth.

Science, technology and mathematics education equips people to adapt to and succeed in a technology-driven labour market at a time when economies are being drastically transformed by fast technological advancements. Developing nation can attract investments from tech-centric companies and position itself to be successful on a global scale by developing a workforce with a solid foundation in science, critical thinking, and flexibility. In a nutshell a key component of the developing countries socioeconomic growth and sustainability is the promotion of innovation and technical improvement through science, technology and mathematics education. It produces a generation of creative thinkers capable of using scientific understanding to produce game-changing ideas. The developing nations can unlock the potential of its young to propel technical advancement, boost economic productivity, and establish the country as a leader in the global innovation scene by fostering this innovative culture. Science, technology and mathematics education has enabled many industrialized nations to make great strides in science and technology (Aina, 2013). Any country's progress depends heavily on science, technology and mathematics education in many different ways (Aina, 2013).

Through research, science education opens up new job options. Farming an ecologically friendly agricultural practice that permits the production of crops and animals without endangering human or natural systems is known as sustainable agriculture. Agriculture may modernize and develop technologically as a result of scientific knowledge and abilities. Increased food production, job possibilities, and a decrease in poverty are all results of improved agriculture. Decrease in Poverty One of the main tenets of sustainable development is the decrease of poverty. It is evident that education level affects earned income level (Ahuja, 2012, Ofordum & Onyekwena, 2019).

One fundamental component that has the power to influence the developing nation's socioeconomic growth trajectory is science, technology and mathematics education. Its domain has the capacity to stimulate creativity, enhance technical progress, and develop a workforce competent in navigating the intricacies of a world changing quickly. Economic growth is fueled by innovation, which comes from a population that is knowledgeable about science and capable of critical thought. Developing nations may improve its competitiveness internationally by finding innovative answers to urgent problems and fostering a culture of inquiry and exploration via scientific and mathematical

education (Olojo et al., 2022). A flourishing economy's ability to advance technologically depends on the basis that scientific and mathematical education provides. Giving people the skills to understand and use science opens opportunities to breakthroughs in a variety of fields, including agriculture and healthcare.

Using scientific education as a strategy to achieve socioeconomic development in developing nations is centered on promoting innovation and technological improvement. In a period of fast technological development, this symbiotic link between scientific and mathematics education and innovation has the potential to move the country ahead. A culture of invention is constructed on the foundation of science, technology and mathematics education. A strong grasp of scientific concepts, critical thinking ability, and problem-solving skills are all provided by science, technology and mathematics education, which fosters the kind of thinking required for creative inquiry. It promotes experimentation, curiosity, and the guts to defy accepted wisdom—all essential elements of an inventive environment. It is impossible to overstate the value of mathematics in daily life. Nobody on the planet could survive without mathematics; it has become a need for daily existence. Today, it is a vital instrument for the advancement and sustainable growth of the entire planet (Roohi, 2012, Onoshakpokaiye, 2021)). The majority of occupations rely heavily on mathematics skills and expertise, particularly in science as well as other disciplines involving calculations. Amarjeet et al. (2016) states that mathematics is crucial for the organization and dissemination of knowledge. It offers a strong, concise, and generally clear approach in this area. Many parts of the physical cosmos may be predicted and explained by mathematics. It is an activity that involves solving problems and is backed by a wealth of information. Every fruitful future is unlocked by mathematical proficiency, while doors are closed by a deficiency in the subject (Onoshakpokaiye, 2021).

Innovation with a foundation in science, technology and mathematics education has the power to revolutionize a number of industries. Students who are raised with an innovative mindset are more equipped to question established norms and come up with novel solutions. For example, a science-savvy student may come up with creative solutions to problems in energy, agriculture, healthcare, or environmental sustainability. Another direct result of strong science, technology and mathematics education is technological innovation, which makes a significant contribution to developing nations economic expansion. Students gain useful abilities that have real-world implications when they interact with science and technology and mathematics in the classroom. These abilities might include everything from biology and engineering to data analysis and programming. With these skills, graduates may make a significant contribution to the advancement and use of cutting-edge technology (Yabugbe, 2009).

The growth of human capital via science, technology and mathematics education is seen as essential to creating a workforce that is capable and empowered and can successfully negotiate the challenges of developing nations evolving socioeconomic environment. In addition to imparting information, this essential component fosters the practical skills, flexibility, and creative thinking that people need in order to effectively contribute to the growth and development of their country. A broad range of abilities that go beyond the study of science, technology and mathematics are acquired via scientific and mathematics education. Among the cognitive skills developed during science, technology and mathematics education include interpreting information, logical problem-solving, and the ability to think critically. These abilities serve as the cornerstone of a skilled workforce that can handle complex problems in a variety of sectors. People who are educated in science, technology and mathematics are more equipped to interact with and adjust to the swift advancements in technology that characterize the current period.

A solid foundation in science, technology and mathematics enables people to embrace lifelong learning and stay relevant in a changing labour market and as industries change and new disciplines develop. Additionally, scientific and mathematics education fills in the gaps between information gained theoretically and its practical application. Practical experiences in the lab, real-world projects, and group research foster a feeling of pragmatism while simultaneously enhancing comprehension. Employers significantly evaluate graduates' capacity to apply what they have learned to real-world circumstances in addition to their academic achievements (Olojo et al., 2022). The problem of unemployment is also addressed by developing a trained labour force. Graduates from strong scientific programs are highly skilled in industries that are in demand, including engineering, technology, medical care, and others. As a result, unemployment rates are lowered as the demands of the labour market are

met and a pool of qualified candidates is assembled. It is essential that science, technology and mathematics education be integrated with business demands (Amaka & Uju 2019)

Hindrances and way forward towards Economic growth and sustainable growth of the developing nations

There are several difficulties in the developing nations' socioeconomic structure. One major obstacle is the lack of appropriate access to high-quality education, especially in rural and underprivileged regions. A lack of modern tools and scientific labs makes it difficult to offer science, technology and mathematics instruction in an efficient manner. Inequalities are made worse by gender differences in educational attainment, which limits the potential contributions of a sizeable section of the population. Additionally, there is a clear disparity in opportunities and access to education due to economic inequality. The practical relevance of scientific information is limited by a lack of strong integration between academics and industry, which impedes the creation of novel solutions suited to regional problems. Insufficient funding for research and development also hinders the growth of domestic innovations and solutions. Notwithstanding these obstacles, scientific and mathematics education has the potential to unlock a wealth of opportunities in developing countries socioeconomic environment.

Nevertheless, despite the efforts of several governments and institutions, the benefits of Science, technology and mathematics Education are still not widely felt in many developing countries. However, many developing countries' science and mathematics teacher unemployment rate hasn't produced the innovative experts and trained human capital needed to turn the country's condition around (Ofordum & Onyekwena, 2019). Various obstacles have been identified as impeding Science, technology and mathematics Education. These include ongoing labour disputes, insufficient financial resources, and issues with curriculum and examination malpractice, low teacher quality, instructional strategies, inadequate assessment of physical facilities, and the attitudes of educators (Asuquo, 2002; Nwachukwu, 2012, Akpan, 2008, Ofordum & Onyekwena, 2019). These and several other issues demonstrate how inadequate the developing countries educational system is. Thus, for the country to undergo the required change, all parties involved must work together in harmony. The federal government's transformation plan and brain awards program are positive moves, but meaningful advancements won't come unless such initiatives are supported by efficient and pertinent education. After that is finished, scientific and mathematics education may be employed as a tool to accomplish sustainable development in areas such as research, agriculture, rural development, peaceful coexistence, poverty reduction, health, and nutrition (Obi & Obiadazie, 2014).

In order to handle the developing nations enormous natural resources responsibly, a thorough comprehension of scientific concepts is required. Future leaders and politicians can be better prepared to find a harmonious equilibrium between environmental sustainability and economic growth by obtaining an education in science, technology and mathematics. One of the main pillars of society well-being, healthcare, greatly benefits from a scientifically educated population. Science, technology and mathematics education is the foundation for innovations that improve public health, lower mortality rates, and increase worker productivity, ranging from medical research to the creation of novel remedies (Omotayo, 2010, Olofin, Ogunjobi, Falemu & Akinwumi,2023)).

Developing nations needs a strong science technology and mathematics education environment in order to make its mark on the world arena. A population with a strong scientific and mathematics literacy promotes economic growth through international collaborations, research alliances, as well as access to worldwide marketplaces in a connected globe. Many developing nations want to end poverty, while science technology and mathematics education appears to be a key component of that transition. This educational paradigm opens doors to socioeconomic mobility and breaks the cycles of poverty by providing underprivileged groups with scientific knowledge and skills. Cooperation is necessary if scientific and mathematics education is to reach its full potential. Sufficient allocation of resources towards educational infrastructure, curriculum modifications that emphasize experiential learning and critical thinking, continuous professional development for the science and mathematics educators, and public advocacy are essential in steering developing countries in the direction of a future where science technology and mathematics education serves as a fundamental component of the country's socio-economic progress rather than merely an aid (Rising, 2009, Olofin *et al*, 2023)).

A dedication to fostering the next generation of scientists, innovators, and leaders who will propel developing nation's socioeconomic progress and change is demonstrated by investments made in education, especially in the sciences, technology and mathematics. To put it briefly, the basis of scientific, technological and mathematics education in developing countries is a complex system that includes infrastructure, pedagogy, curriculum, teacher development, inclusion, and government assistance. In addition to providing people with scientific information, laying a solid foundation enables people to actively participate in socioeconomic development through creativity, technical advancement, and the development of solutions specifically suited to developing nation's particular problems (Amaka & Uju 2019). In light of these circumstances, scientific education function as a vehicle for attaining socioeconomic development has more relevance as it works to address current issues while seizing future prospects.

By collaborating with businesses, academic institutions, and international networks, scientific and mathematics education may become more relevant to the real world and better meet the demands of the changing labour market. These kinds of relationships also pave the way for the sharing of best practices, research collaborations, and information exchange. Science technology and mathematics education shows promise as a powerful tool for solving these issues and taking advantage of the numerous opportunities. Science technology and mathematics education has the power to spark a revolutionary path towards sustainability socioeconomic growth by expanding access, encouraging innovation, connecting academics and industry, and utilizing collaborative networks.

The younger generation offers a large pool of potential employees that are ready to interact with research and support economic expansion. Technological and communication innovations provide new channels for sharing educational materials, overcoming distances, and democratizing knowledge access. The nation's wealth of natural resources, which include minerals and agriculture, provide an ideal environment for scientific research and development (National Institute of Open Schooling, 2023). Education in science, technology and mathematics may encourage sustainable behaviours, guaranteeing prudent resource management that promotes long-term growth.

4. CONCLUSION

In conclusion, scientific education fosters the growth of human capital and the creation of a workforce that is informed, adaptable, and progressive. This workforce possesses the skills necessary for creativity, problem-solving, and major contributions in a range of sectors in addition to their understanding of science, technology, and mathematics. Science, technology, and math education need to be given higher priority if sustainable growth is to take place. By investing in science education, the developing country may secure a more bright and prosperous future for its citizens and contribute to their socioeconomic progress.

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Development of Practical Learning Videos Based onScience, Technology, Engineering, and Machthematics (STEM) Assisted by KineMaster Application on Acid Base Material

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ABSTRACT

This study aims to develop a STEM-based practical learning video to help students achieve learning objectives. Where in the research location, practical activities on acid-base material were not carried out due to the lack of tools and materials used in the laboratory. The development model used is the Lee & Owens model, with five stages: analysis, design, implementation, and evaluation. The implementation of the research used was a teacher interview sheet, a student needs analysis questionnaire, a media expert validation questionnaire, a material expert validation questionnaire, teacher assessments and student response questionnaires. The trial was conducted on a small group of 10 students in grade XI Phase F2. The results of this development research were declared valid and suitable for use in learning. The material expert validator, the media expert validator gave a value that was suitable for testing by validating each 2 times. The teacher's assessment stated that it was suitable for testing with one validation. Students gave a good response with a value of 87.07% with the category "very suitable". Practical learning video based onscience, technology, engineering, and mathematicsThis has been proven to be valid, feasible and effective for use in acid-base learning and can help students achieve learning objectives even if they do not carry out practical activities directly in the laboratory.

Keywords: Practical Learning Videos, STEM, Acid Bases

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1. INTRODUCTION

Learning Learning is a process by which a person acquires knowledge, skills, attitudes, and understanding through experience, training, and education. This process involves interaction between students and learning resources (teachers, books, technology, environment, etc.). The purpose of learning is to change a person's behavior and understanding to a better and deeper level and be able to apply the knowledge and skills in everyday life. The process of learning is called learning, in learning in high school according to the curriculum used there is a chemistry subject.

Chemistry studies the composition, structure, properties, changes, and energy that accompany them,(Redhana 2019). One of the materials in chemistry learning is acid-base material. Some of the learning objectives in this acid-base material are measuring the pH acidity level and analyzing the pH change trajectory of several indicators. So to achieve these learning objectives, practical activities are needed. In practical activities, students can measure and analyze pH changes directly based on several indicators.In chemistry learning, understanding one of the materials, namely acids and bases, cannot only be learned through theory, but also requires practical activities (Khairunnufus et al. 2019)

According to Chandra and Dian (2020)Practical activities are an inseparable part of chemistry learning, because with the existence of practicals, students' skills will be trained, starting from the skills of observing a problem to the skills of communicating research results in the form of work reports and with the existence of practicals, students will be more skilled in using practical equipment in the laboratory. Practicals are important and cannot be separated from theory, but many obstacles are found in their implementation,(Jumrodah et al. 2023). These obstacles include, the lack of standardized tools and materials for practical work, the high cost of tools and materials for practical work, the limited time for practical work, and the lack of facilities for processing practical waste in schools. In addition, other obstacles faced are the low level of teacher motivation in planning, preparing and implementing chemical practical work due to the high workload while the time teachers have to carry out practical

work is limited, (Alifani et al. 2022). Practical activitiesprovide unexpected experiences to students,(Yudianto 2017).

In the learning objectives and learning objectives flow, students are required to be able to measure pH and analyze the pH change trajectory of several indicators, where to achieve this, practical activities are needed. If practical activities are not carried out, the learning objectives have not been achieved. One alternative that can overcome the problem of not implementing practical work in schools is the creation of substitute media for practical work. Learning media functions as a channel for messages from the sender to the recipient so that it can stimulate students' thoughts, attention and interest in the learning process, (Ardiman, Tukan, and Baunsele 2021). Media that can replace the role of practicums is practicum learning videos. Practical video learning media can help students understand practical material, (Putri et al., 2020). Students prefer learning video media because they are easier to understand and can be played repeatedly, (Putri and Dewi 2020). Student activity and responses to chemistry practicum learning video media are classified as very good, (Maulida and Nazar 2016)

One of the applications that can be used in making learning media videos for practical work is the KineMaster application. KineMaster is a full-featured and professional video editing application for iOS and Android devices. It supports multiple layers of video, audio, images, text, and effects equipped with various tools that allow teachers to create high-quality videos. The learning materials are designed to be as attractive as possible, can display videos, and animated images related to the learning materials so that students can focus more on what is conveyed by the teacher,(Hafizatul 2020)

One of the learning strategies that is suitable for application in acid-base learning is learning with a STEM approach.(Marpaung et al. 2022).STEM is a learning model that integrates aspects of science, technology, engineering and mathematics in developing student creativity through learning activities that prioritize problem solving in everyday life.(Munandar, Izzani, and Yulian 2020). The implementation of STEM-based learning models has been declared successful in improving chemistry learning outcomes (Suriti 2021). VideoSTEM-based learning can increase students' interest in learning and the use of STEM-based learning videos has a significant effect on increasing students' interest and learning outcomes (Devi and Subali 2021)

2. RESEARCH METHOD

This development research applies qualitative and quantitative methods with the type of researchresearch and development(R&D). The development model used is the Lee and Owens development model as a foundation in product development. The Lee & Owens development model is one of the multimedia development models whose series of steps in the development process are arranged systematically and clearly (Lee & Owens, 2004). In the Lee & Owens development model there are five stages of development, namelyAssessment/analysis, design, development, implementation, Andevaluation

A. Analysis stage

The analysis stage is the initial stage for identifying and determining needs. learning needs by collecting various information related to videos practical learning that will be developed. In this analysis stage, it is carried out several stages, namely, needs analysis, student characteristics analysis, objectives analysis, Educational technology materials and analysis.

B. Design Stage

The next stage carried out after conducting the analysis is the design stage. product. The product design stage will then be developed into a media learning in the form of STEM-based practical videos assisted by the Kinemaster application on acid base material.

C. Development Stage

The development stage is the stage of completing the product manufacturing process. Where what has been conceived in the design stage is then implemented into a finished product. The product to be developed is a video of practical learning STEM based. After the initial product is finished, it is continued to the next stage where The product must first be validated by material experts and media experts. The product that is made assessed by media experts and material experts in terms of material suitability and media suitability. So that researchers can then identify the product's deficiencies and weaknesses. Then This product will be revised according to input and suggestions from the expert team until the product is ready. declared worthy to be tested on students at the next stage.

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D. Implementation Stage

The implementation stage is a step to implement learning video products. STEM-based practicum on acid-base material. At the implementation stage, the product is tested try to find out the quality and feasibility of the product. After getting the feasibility test try from material experts and media experts the product is implemented to students, implementation is done in small groups

E. Evaluation Stage

Evaluation is conducted to see whether the developed practical learning video is feasible or not. At the evaluation stage it is called formative evaluation because it aims for revision needs, formative evaluation is conducted by media experts and material experts. The revised product is in accordance with input from media experts and material experts so that the product is declared feasible to be tested.

3. RESULTS AND DISCUSSION

A. Analysis stage

The results of the analysis obtained data as many as 57.1% of students agreed that practicums in chemistry learning were needed. And as many as 60.7% of students agreed that practicum activities helped the chemistry learning process. The results of an interview with one of the chemistry teachers at SMA N 10 Muaro Jambi, it was found that practicum activities were not carried out. The practicum activities were not carried out because there were several obstacles. The obstacles found were inadequate tools and materials in the laboratory. The results of the distribution of student characteristic questionnaires obtained data as many as 53.6% stated that they were less interested in acid-base material. And as many as 57.1% stated that acid-base material was difficult to understand. Based on teacher interviews in the chemistry learning process in class XI F2 only used book media as teaching materials. However, in the results of the questionnaire distribution, as many as 57.1% of students did not like the learning media used. This made 64.3% of students feel bored in the learning process. As many as 60.7% of students stated that they were interested in learning video media and as many as 67.9% of students agreed to use learning video media on acid-base material. From the data obtained, it can be concluded that learning media is needed to replace the role of practicums in learning and help students' learning process to better understand acid-base material.

B. Design Stage

The design process at the design stage begins with the creation of a flowchart to visualize the product development flow. After that, a storyboard is created containing the initial design which will then be developed into a media in the form of a practical learning video. In this stage, a team is also formed, a research schedule is determined so that the results of the developed learning videos are of high quality and can be used by students. At this stage, the material is arranged in line with the learning objectives set out in the independent curriculum. The material and content in the practical learning video are designed to be more interesting so that it is easier for students to understand.

C. Development Stage

In the development stage, the researcher implemented the Storyboard design that had been compiled into a STEM-based practical learning video product. The development stage includes two main processes, namely product development and validation.



Fig 1. Video cover view



Fig 2. Explanation of the Definition of Acids and Bases

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Fig 3. Characteristics of acids and bases **Fig 4. Practical Activities**

Video development is carried out using the KineMaster application for editing and combining elements such as text, animation of the practical process into a practical learning video.

Subject matter expert validation

Validation of material experts is done quantitatively by asking for advice and input from experts until the media is declared worthy of being tested. In the first stage of validation of material experts, there were several improvements from material experts.

Table 1. Material expert validation

No	Aspect Evaluation	Question	Correct	Improvements/Suggestions
1	Format	Is the acid-base material presented in the STEM-based practical video appropriate? Independence curriculum module?	It's all right	-
		Is the topic of the acid-base material in the STEM-based practical video appropriate? with TP and ATP?	Already appropriate	-
2	Contents	Is the arrangement of acid-base material in the practical learning video STEM-based?	Not yet suitable	• In the example section, the application of STEM is not yet appropriate • In the practical activities, STEM is not yet depicted
		Is the arrangement of acid-base material in STEM-based practical learning videos complete? regular?	Already appropriate	-
		Is the acid-base material in the STEM-based practical learning video easy to understand?	Yes, it is easy to understand	-
		Can the material in the STEM-based practical learning video achieve the practical objectives contained in the flow? learning objectives?	Yes it is achieved	-

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		Can the elements in the practical learning video visualize the material concept? acid base	Yes, it is appropriate	-
		Whether component contextual in the learning video is appropriate	Yes, it is appropriate	-
3	Language	Is the use of language in the practical learning videos clear, simple and easy? understood?	Yes, it is simple and easy to understand	-
		Is the use of language in Is the learning video standard?	Not yet suitable	• In the explanation of STEM there are non-standard words

From the results of the first validation, the researcher then revised the parts that were not appropriate. Then the second stage of validation was carried out again, the results of the second stage of validation obtained the conclusion that the product developed was "Eligible for Field Trials with Revisions".

Media Expert Validation

Media expert validation is also done quantitatively by asking for advice and input from experts until the media is declared worthy of being tested. In the first stage of media expert validation, there were several improvements from media experts.

Table 2. Media expert validation

No	Aspect Evaluation	Question	Correct	Improvements/suggestions
1	Simplicity	What is a learning video?STEM-based practicums easy to understand?	Yes, it is easy to understand	-
		Are the images and text in the STEM-based practical learning videos easy to understand?	Yes, it is easy to understand	-
		Is the quality of the STEM-based practical learning videos good?	Yes, good quality	-
		Can the supporting elements of the video clarify the concept you want to convey?	Not yet	Some supporting elements are not related to the material presented, such as the characteristics of acid-base solutions stating the pH measurement, but the element is a universal indicator.
2	Integration	WhetherIs the video layout correct?	Yes, it is appropriate	-

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		Is the arrangement of fonts and audio clear and appropriate?	Not yet	There are several font sizes that are not appropriate
3	Emphasis	Do the elements, images and fonts in the video provide emphasis to the material being explained?	Not yet	There are images that do not match the concept that is being conveyed, such as a teacher explaining but the image of the teacher is younger than the student.
4	Balance	Is the layout of text, images and elements in the video appropriate?	Not yet	In the practical activities there is a section where the narrator covers the practical tools and materials.

From the results of the first validation, the researcher then revised the parts that were not appropriate. Then the second stage of validation was carried out again, the results of the second stage of validation obtained the conclusion that the product developed was "Eligible for Field Trials with Revisions".

Teacher Assessment

This teacher assessment is used as a consideration for improving the teaching material product being developed. This assessment sheet is filled in by the Chemistry teacher. And this assessment sheet is in the form of questions containing comments and suggestions as improvements to perfect the product. Based on the results of the teacher's assessment, overall the teaching material developed is very good and worthy of being tested.

D. Implementation Stage

The trial was only conducted as a small group trial consisting of 10 students in class XI F2. In the implementation of the trial, students watched and listened to the learning video displayed through a projector. Furthermore, students were given a student response questionnaire to be filled in and to provide an assessment of the STEM-based learning video product that was developed. And the results obtained from the student response questionnaire regarding the STEM-based practical learning video are as follows:

Table 3. Student response questionnaire results

No Questions	Respondents										Score
	1	2	3	4	5	6	7	8	9	10	
1	4	4	4	5	4	4	4	4	4	4	41
2	5	4	4	4	5	4	5	4	4	5	44
3	5	4	4	4	4	4	5	4	4	5	43
4	5	4	4	5	4	4	4	4	4	5	43
5	5	5	4	4	5	4	4	5	5	4	45
6	5	4	5	4	5	4	5	4	4	4	44
7	5	4	4	4	4	4	4	4	5	5	43
8	5	4	5	4	4	4	4	5	4	4	43
9	5	4	5	4	4	4	5	4	4	4	43
10	5	4	4	4	4	4	5	4	4	5	43
11	5	5	4	4	4	4	4	5	4	5	44
12	5	4	4	4	5	4	4	4	4	4	42
13	5	5	5	4	5	5	4	5	5	5	48
Total number											**566**

According to Riduwan, (2014) to determine the classification of student responses, the percentage of eligibility is used with the formula:

$$\boldsymbol{K = \frac{F}{N \times I \times R} \times 100\%}$$

Information:
K = Percentage of eligibility value
F = Total number of respondents' answers
N = Highest score in the questionnaire
I = Number of questions in the questionnaire
R = Number of Respondents
The interpretation of the scores can be stated as follows:

Table 4. Student Questionnaire Assessment Categories

Number of Item	Average Answer Score	**Description of Criteria**
1	81%-100%	Very Good
2	61%-80%	Good
3	41%-60%	Not Good
4	21%-40%	Bad
5	0%-20%	Very Bad

$$\boldsymbol{K = \frac{566}{5 \times 13 \times 10} \times 100\%}$$

$$\boldsymbol{K = 87,07\%}$$

E. Evaluation Stage

The evaluation in this study is formative in nature, which is carried out at every stage, both at the analysis, design, development and implementation stages. Evaluation is carried out for the need for revision and improvement to obtain a feasible product.

4. CONCLUSION

Based on the results of the research on the development of practical learning videos based on Science, Technology Engineering and Mathematics (STEM) assisted by the KineMaster application on acid-base material, the following conclusions can be drawn:

1. The process of developing a video product for learning practical work based on Science, Technology Engineering and Mathematics (STEM) assisted by the KineMaster application on acid-base material, was designed using the KineMaster application and this video product for learning practical work was developed using the Lee and Owens (2004) development model.
2. A practical learning video based on Science, Technology Engineering and Mathematics (STEM) assisted by the KineMaster application on acid-base material that was developed is conceptually feasible based on the validation results of material experts and media experts.
3. The video product of practical learning based on Science, Technology Engineering and Mathematics (STEM) assisted by the KineMaster application that was developed received a decent response from chemistry subject teachers and obtained a percentage of answers from all student respondents of 87.07% with the category of student responses "Very Good".

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Development of FUNCHEM Educational Game Based on Integrated Chemo Edutainment Ability Critical Thinking Skills of High School Students on Colloid Material

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ABSTRACT

The research aims to develop the funchem educational game based on a chemo-edutainment approach integrated with critical thinking skills as an instructional medium for the topic of colloids. The research was driven by the low level of students critical understanding of colloidal concepts and the prevalent use of conventional teaching methods that tend to be monotonous. The chemo-edutainment approach, which merges educational content with entertaining elements, is considered to have the potential to create a more engaging and enjoyable learning experience. The research employed a Research and Development (R&D) design, adopting the Lee and Owens model, which encompasses five systematic phases: Analysis, Design, Development, Implementation, and Evaluation. The findings of this study indicate that: (1) the development process of the educational game involved a series of steps including needs analysis, media design, product development, and classroom implementation; (2) expert validation results from both content and media reviewers categorized the game as "Excellent" and highly appropriate for use in the classroom; and (3) teacher assessments and student responses demonstrated high levels of enthusiasm, with the majority of students reporting that the game significantly supported their understanding of colloidal concepts. In conclusion, the chemo-edutainment-based educational game integrated with critical thinking skills has proven to be effective in enhancing students' critical thinking abilities within the context of colloid instruction.

Keywords: Chemo-edutaiment, Colloid, Educational Game

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1. INTRODUCTION

Education is important for every individual to develop knowledge and skills. In accordance with Law No. 20 of 2003, education aims to develop the potential of students actively. The success of learning is highly dependent on the role of the teacher who is able to create a learning atmosphere that motivates and encourages students to think critically. One of the supporting factors is learning media.

Learning media is a tool that is able to channel information and stimulate students' thoughts and attention, so that it can improve the teaching and learning process (Miharti, 2022). Students are presented with learning problems, where the main focus is not on the answers but on how they arrive at those answers (Sudiantini & Shinta, 2018). In the Merdeka Curriculum, learning emphasizes the process, encouraging students to think critically, creatively, and independently. High school chemistry is considered difficult because of its abstract nature (Ristiyani & Bahriah, 2016). However it can be contextualized through material that is close to life, such as colloids. This material is relevant because it is found in everyday life and can be used to develop students' critical thinking skills through experimentation and data analysis.

Critical thinking is an intellectual process involving the formulation, application, synthesis, and evaluation of information from observation, experience, or communication as a basis for action (Lismaya, 2020). According to Piaget, elementary students are in the concrete operational stage, where they think using real objects or problems (Rosidah, 2018). Thus, highly motivated students tend to think more critically. Therefore, critical thinking skills should be fostered in learning to help students solve problems effectively.Critical thinking is part of the 21st century skills (4C) formulated by the Framework Partnership of 21st Century Skills, namely: 1) Communication, 2) Collaboration, 3) Critical Thinking and Problem Solving, and 4) Creative and Innovative or inventiveness and innovation (Mardhiyah, 2021). which is important to be familiarized with in learning. Based on the results of the analysis of student needs in class XII SMA 1 Muaro Jambi, the students who filled in the respondents,

totaling 26 students, stated that around 99% of students had smartphones. As many as 96.2% of students like digital learning media such as PPT, learning videos, learning websites and others. As many as 84.6% of students have problems in understanding chemistry material, and as many as 77% of students agree that colloidal material is quite difficult to understand. And 88.4% of students are interested in understanding colloidal material by understanding the learning concepts applied in using educational games.

Based on the results of observations made by researchers with one of the chemistry teachers at one of the SMA 1 Muaro Jambi schools, it was stated that the curriculum used in a class X, XI, and XII learning was the independent curriculum. Then the learning process on certain chemistry materials many teachers still use traditional learning methods such as lectures or group discussions without involving activities that stimulate creativity. This method often lacks challenging students to think outside standard boundaries or explore new ideas. On the other hand for learning media, school learning relies on conventional learning media, such as LKS or LKPD, and some interactive media but not too often so it tends not to stimulate students to think critically enough. According to the Chemistry Teacher of SMA 1 Muaro Jambi, the use of interactive multimedia in the form of educational games on colloidal material has never been done before. In this school, the Criteria for Achieving Learning Objectives (KKTP) that students must achieve in this chemistry subject is 80. During the learning process, the researcher analyzed that in colloidal material, most students were able to achieve quite good test scores, where around 70% of students could answer the questions correctly. However, although the test results showed adequate understanding of the colloid concept, students critical thinking skills were still low.

According to the Chemistry Teacher of SMA 1 Muaro Jambi, students tend to have difficulty when faced with problems that require in-depth analysis, application of concepts in new situations, or solving more complex problems. Students have not been able to connect colloid concepts with everyday phenomena critically or solve problems that require them to think outside the context that has been taught. This shows a gap between the understanding of basic concepts and students' critical thinking skills but during the colloid learning process in the classroom, the activities carried out by students have not encouraged their creativity or only focus on memorization and direct understanding of concepts. Students only repeat information without being given the opportunity for creative exploration, this indicates a lack of development of creative thinking skills. And school facilities such as laboratories and computer rooms are available but have not been optimally utilized in learning.

Considering some of these problems, the most appropriate solution to overcome students difficulties in understanding and improving critical thinking skills in studying colloids is to use learning media in the form of educational games that can be accessed by users, so they can continue the learning process as needed. Therefore, the use of educational games is very important to facilitate students in understanding learning materials, because this media combines audiovisuals that can influence thinking skills through active interaction. Educational games also support teachers in creating interesting learning, according to the demands of the Industrial Age 4.0 and Society 5.0 (Zurweni, 2024). According to Widiastuti (2012), educational games are digital games designed to support teaching by utilizing interactive multimedia technology. This game not only makes learning more interesting, but also improves students' critical thinking skills. As technology develops, learning media are increasingly diverse, helping teachers teach more effectively and encouraging students to think critically. Chemo-edutainment-based games can support students' learning both independently and in the classroom (Narestifuri & Hidayah, 2022).

Previous research Rasyid (2019) shows that educational game-based learning media effectively improves students' critical thinking skills. Based on these problems, it is necessary to conduct a study entitled **"Development of Chemo-edutainment Based FunChem Educational Game Integrated with Critical Thinking Ability of High School Students on Colloid Material".**

2. RESEARCH METHOD

The type of research conducted is development research or Research and Development (R&D) which produces products in the form of Chemo-edutainment based funchem educational games integrated with students critical thinking skills on colloidal material. The development model used in this research is the Lee & Owens (2004) development model. This model has five stages, namely analysis, design, development, implementation, and evaluation.

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1. Analysis: At this stage the researchers analyzed the learning problems at SMA 1 Muaro Jambi. There are five analyzes carried out, namely (a) needs analysis, (b) analysis of student characteristics, (c) analysis of objectives, (d) analysis of materials, (e) analysis of educational technology.
students, (c) goal analysis, (d) material analysis, (e) educational technology analysis.
2. Design: After the analysis stage is completed, the next step is product design. In planning this research, the next step is to make a product design that will be developed into learning media in the form of a chemo-edutaiment-based funchem educational game product integrated with critical thinking, which will be applied to colloid material. Product design design
development of this media is described as follows. (a) Team Formation, (b) Research Schedule, (c) Media Specifications (d) Material Structure, (e) Flowchart Making (f) Storyboard Making (g) Evaluation.
3. Development: At the development stage, including: (a) Product manufacturing, (b) Material expert validation, (c) Media expert validation, (d) Teacher assessment.
4. Implementation: At this stage, the product that has been improved and declared feasible by the expert team will be tested on a small group of 10 participants and will be tested on a one to one of 3 participants to obtain data on the quality of learning media. The sample selection is based on the recommendation of the chemistry teacher.
5. Evaluation: The evaluation stage was conducted to assess the extent to which the chemo-edutainment-based funchem educational game developed successfully achieved the objectives and met expectations.

After the data is collected, the next step is to analyze the assessment results from the initial analysis questionnaire, material expert validation questionnaire, media expert validation questionnaire, teacher assessment questionnaire, and student response questionnaire.

1. Validation questionnaire for media experts, material experts, and teacher assessments

Data analysis conducted for the validation questionnaire for media experts, material experts, and teacher assessments includes quantitative data, and qualitative data in the form of suggestions or comments. The determination of the validation classification by experts and teacher assessments uses interval distances on a Likert scale using the following formula.

$$\% \text{ Score} = \frac{\text{Number of Scores Obtained}}{\text{Total Score}} \times 100\%$$

Table 1. Assessment Criteria of Experts and Teachers

Number of Item	Average Answer Score	**Description of Criteria**
1	81%-100%	Very Good
2	61%-80%	Good
3	41%-60%	Not Good
4	21%-40%	Bad
5	0%-20%	Very Bad

2. Student questionnaire

The data analysis technique used for the student questionnaire instrument is by using the percentage of media feasibility. The instrument data that has been collected is then analyzed to calculate the percentage that provides responses according to certain criteria. Ridwan (2015) states that the following formula can be used to categorize student responses.

$$\text{K} = \frac{\text{F}}{\text{N x I x R}} \text{ x } 100\%$$

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Description:
K = Percentage of eligibility value
F = Number of respondents' answers
N = Highest score in the questionnaire
I = Number of questions in the questionnaire
R = Number of respondents

Table 2. Student Questionnaire Assessment Categories

Number of Item	Average Answer Score	**Description of Criteria**
1	81%-100%	Very Good
2	61%-80%	Good
3	41%-60%	Not Good
4	21%-40%	Bad
5	0%-20%	Very Bad

3. RESULTS AND DISCUSSION

Research Result

The first validation from the material expert resulted in a total score of 35 with an average of 2.9, corresponding to a feasibility percentage of 58.3%, classified as "Not Feasible." The expert suggested adding more detailed material, especially on the properties of colloids and their practical uses, as well as improving the clarity of critical thinking questions. Based on this, the first validation was deemed unfit for testing. The second validation received a score of 45, with an average of 3.7 and a feasibility percentage of 75%, classified as "Good." The expert confirmed the material clarity was improved, and the second validation was deemed suitable for testing without further revisions.

Table 3. Result of Material Expert Validation

Validation Stages	Validation 1	Validation 2
Total score	35	45
Average score	2,9	3,7
Percentage	58,3%	75%
Category	Less Worthy	Worthy

The first media validation resulted in a score of 43 with an average of 2.86 and a feasibility percentage of 57.3%, falling into the "Not Feasible" category. Suggestions included improving the template colors, buttons, and the alignment of learning outcomes and objectives. Therefore, the first validation was deemed not ready for testing. In the second validation, a score of 55 with an average of 3.67 and a feasibility percentage of 73.3% was obtained, falling into the "Feasible" category. Additional suggestions included adding icons to the game and checking the alignment of questions with learning outcomes. The second validation was considered ready for testing.

Table 4. Result of Media Expert Validation

Validation Stages	Validation 1	Validation 2
Total score	43	55
Average score	2,86	3,67
Percentage	57,3%	73,3%
Category	Less Worthy	Worthy

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Based on the teacher's assessment, the game-based educational media scored 39 with an average of 3.54 and a feasibility percentage of 70.9%, placing it in the "Feasible" category. The teacher found the media engaging, challenging, and effective in encouraging critical thinking. The teacher approved the product for testing with students at SMAN 1 Muaro Jambi.

Table 5. Result of Teacher Assesment

Validation Stages	Result
Total score	39
Average score	3,54
Percentage	70,9%
Category	Worthy

Based on the student response data, the percentage of correct answers from all students is 86.6%, which falls into the "Very Good" category (range 81%-100%). There were 3 respondents with a total of 260 answers from 10 questions.

Table 6. Result of Small Group Trial

Validation Stages	Result
Total score	260
Average score	86,6
Percentage	86,6%
Category	Very Good

Based on the small group trial data, the average percentage is 92.6%, falling in the "Very Good" category (81%-100%), indicating that the game is engaging and effective for learning colloid material and is practically feasible.

Table 7. Result of One to One Trial

Validation Stages	Result
Total score	463
Average score	92,6
Percentage	92,6%
Category	Very Good

Based on the results of the development of the Funchem educational game product, the following is a description of the game product that has been developed.



Fig 1. Funchem Colloid Educational Game Layout

The final stage is evaluation, which aims to assess whether the product meets the initial expectations. In this research, the evaluation is formative, conducted at each stage, including analysis, design, development, and implementation. This evaluation helps address any shortcomings identified

in the FunChem educational game based on chemo-edutainment, ensuring it becomes more effective and appropriate.

Discuccion

This research aims to develop a chemistry educational game based on chemo-edutainment integrated with critical thinking skills on colloid material. This research was conducted because colloid learning is still theoretical and lacks stimulation of students' critical thinking, even though most students already understand the basic concepts. The learning media used are also not yet interactive, so innovation in the form of an educational game is needed to increase student engagement and enhance higher-order thinking skills. One of the media that can be used to hone brain skills is games. In this case, by overcoming conflicts or problems within the game, the brain becomes accustomed to actively thinking to solve problems in the game. Problems become more interesting to solve when taken from real life and combined with elements of imagination (Martono Kurniawan, 2011).

A research conducted by Devi et al. (2022) titled "Development of Kolopoli Educational Game Media Based on Android on Colloid System Material" showed that the developed educational game was categorized as very good and deemed theoretically feasible. Rasyid et al. (2019) developed an Educational Game rated very good and feasible, effectively enhancing students critical thinking similar to this study's focus. The research conducted by Damarjati & Miatun (2021) titled “Development of Android-Based Educational Game as a Learning Media Oriented Towards Critical Thinking Skills” showed that the developed educational game was categorized as very good, deemed theoretically feasible, and capable of enhancing critical thinking skills. This reason strengthens the researcher's decision to use educational game media. The use of educational games is the right solution to support a more interactive and enjoyable learning process, as well as being effective in improving understanding of colloid system material.

4. CONCLUSION

The results of the research indicate that the development of the FunChem educational game based on chemo-edutainment, integrated with critical thinking skills on colloid material, has successfully enhanced students critical thinking abilities. Validation by subject matter and media experts showed an improvement in feasibility from "not feasible" to "feasible to use." Teacher assessments stated that the media is engaging and effective in promoting students' independent learning. The one-to-one trial resulted in a satisfaction score of 86.6%, while the small group trial obtained a score of 90.46%, both categorized as "excellent." Therefore, FunChem has been proven to be feasible for use and effective in improving students' understanding of concepts and critical thinking skills in colloid material.

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Implementation of Problem Based Learning (PBL) Learning Model to Improve Mathematical Critical Thinking Skills and Learning Motivation of Grade 5 Students at UPT SD Negeri Kutorejo 3 Tuban

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ABSTRACT

This study aims to improve the mathematical critical thinking skills and learning motivation of 5th grade students of UPT SDN Kutorejo 3 Tuban through the application of the Problem Based Learning (PBL) learning model with material comparing and sorting fractions. This study uses a Classroom Action Research (CAR) approach consisting of two cycles. The subject of the study was grade 5 students with a total of 29 students. The instruments used in this study include tests to assess mathematical critical thinking skills, learning motivation questionnaires, and observation sheets of the learning process. The results showed a significant increase in students' mathematical critical thinking skills and learning motivation after the application of the PBL model. In the first cycle, 69% of students achieved completeness in the critical thinking test, while 31% of students did not complete it. Based on the results of the questionnaire, 40% of students showed low motivation to learn. In the second cycle, the percentage of completeness increased to 75.8%, with 22 students achieving completeness. In addition, students' motivation to learn also increased, with 87.84% of students showing higher motivation compared to the first cycle. Thus, it can be concluded that the application of the PBL model is able to encourage the improvement of mathematical critical thinking skills and learning motivation of 5th grade students at UPT SDN Kutorejo 3 Tuban.

Keywords: ***Problem Based Learning, Mathematical Critical Thinking Skills, Learning Motivation***

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1. INTRODUCTION

In elementary schools, mathematics education plays a crucial role in shaping students' foundational understanding of mathematical concepts. Enhancing students' critical thinking skills is one of the significant challenges in mathematics learning. Facione (2015) states that critical thinking is a purposeful and directed thinking process used to justify statements, interpret information, and solve problems. One topic that requires critical thinking is comparing and ordering fractions. However, many students struggle with this topic, leading to low learning motivation.

At UPT SDN Kutorejo 3 Tuban, initial observations revealed that many fifth-grade students faced difficulties in understanding the topic of comparing and ordering fractions, coupled with low motivation, which hindered their learning outcomes. To address this, teachers need to implement learning models that encourage active participation and stimulate students' thinking to develop their critical thinking skills and motivation. Mathematical critical thinking involves analyzing and evaluating mathematical problems using logical principles and learned concepts. This skill is essential for solving complex mathematical problems, such as comparing and ordering fractions.

According to Hadi (2015), critical thinking is an individual's capacity to construct logical arguments and evaluate their validity through a systematic approach to form beliefs. Furthermore, this process includes analyzing and assessing information, enabling students to actively participate in decision-making (Umam, 2018). Learning motivation, on the other hand, is a driving force, either internal or external, that encourages students to engage enthusiastically in learning, leading to optimal outcomes (Afriansyah, 2022). This motivation must be continuously nurtured during classroom learning (Fadjriyah Hapsari, 2021), especially in challenging subjects like mathematics (Fauzan, 2023).

One learning strategy to address these issues is the Problem-Based Learning (PBL) model. PBL emphasizes solving real-world problems relevant to students' lives. Widiasworo (2018) explains that PBL is an instructional approach that presents authentic problems as stimuli to motivate learning. PBL

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also fosters collaboration, communication, and creative problem-solving. This study aims to identify improvements in mathematical critical thinking skills and learning motivation among fifth-grade students at UPT SDN Kutorejo 3 Tuban through the implementation of PBL in the topic of comparing and ordering fractions.

2. RESEARCH METHOD

This research is classified as a type of Classroom Action Research (CAR), which is a research method carried out by individuals and groups in their own classroom environment This research aims to improve and improve the quality of the implementation of the learning process in the classroom. The main objective of this study is to develop critical thinking skills in mathematics and increase students' learning motivation through the application of the Problem Based Learning (PBL) learning model. The subjects of this study are 29 5th grade students of UPT SDN Kutorejo 3 Tuban. Data collection techniques include critical thinking ability tests, learning motivation questionnaires, and observation of student activities during the learning process. The data obtained were analyzed using a qualitative descriptive approach to describe the changes that occurred during the study. This research was carried out in two cycles, with each cycle consisting of 2 hours of lessons (1 meeting). Each cycle in this study consists of four stages, namely planning, action, observation, and reflection. The flow of stages in each cycle of this research is presented in Figure 1 below.

Fig 1. Flow of Stages in Classroom Action Research

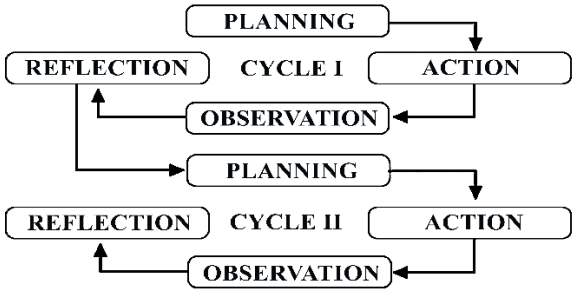


Figure 1 shows the Flow of Stages in Classroom Action Research (CAR). The instruments used in this study include tests to measure mathematical critical thinking skills, questionnaires to assess learning motivation, and observation of student activities during the learning process. The data obtained was then analyzed by reflecting on the improvement of the results of the mathematical critical thinking ability test and the results of the learning motivation questionnaire during the two learning cycles. The success criteria in this study include the achievement of classical completeness in critical thinking skills through the PBL model, namely at least 75% of the total students obtained a score of ≥ 70, the percentage of students with low learning motivation did not exceed 25%, and there was an increase in mathematical critical thinking skills and learning motivation in each learning cycle.

3. RESULTS AND DISCUSSION

The Problem Based Learning (PBL*)* learning model has been applied in the learning activities of grade 5 students at UPT SDN Kutorejo 3 Tuban as an effort to evaluate the extent to which the model is able to improve students' mathematical critical thinking skills. The application of this model is based on the assumption that problem-based learning can encourage students to be more active, independent, and engaged in higher-level thinking processes, including the ability to analyze, evaluate, and infer information from the problems presented.

Before the research activity is carried out, the researcher first coordinates and discusses intensively with the teacher who understands the characteristics of the students in the school, as well as the supervisor who has a role as a director in the preparation of the research design. This discussion aims to formulate learning tools that are in accordance with the needs of students and relevant to the research objectives. The learning tools that are prepared include various important components, such as teaching modules that contain PBL-based learning steps, teaching materials that support students'

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understanding of the mathematics material being taught, and interactive learning tools and media to support the process of delivering material visually and contextually.

In the implementation of the research, the researcher also prepared a number of instruments to collect relevant data. The instrument includes test questions designed to measure students' critical thinking skills based on certain indicators, questionnaires to explore information about students' learning motivation levels before and after the application of the PBL model, and observation sheets used to record and analyze student activities during the learning process. All of these instruments are used to support the analysis of the effectiveness of the PBL model in improving the quality of mathematics learning in the classroom.

A. Cycle I

Cycle I was carried out in one meeting session with a total of 2 hours of lessons. The evaluation of the Problem Based Learning (PBL) learning process is carried out using observation sheets filled in by teachers during learning activities. The research at this stage involved 29 students as research subjects. At the end of the first cycle, a test was carried out to measure students' mathematical critical thinking skills as a form of evaluation of the application of the PBL model. Based on the results of the test, it is known that as many as 9 students have not reached the expected level of completeness, so it is necessary to make improvements through the implementation of cycle II. The percentage of student completeness in the mathematical critical thinking test reached 69%, or a total of 20 students, while the other 31% or as many as 9 students have not succeeded in reaching the completeness criteria. This achievement shows that the percentage of student completeness is still below the set success standard, which is at least 75% of the total number of students. The results of the evaluation of students in this cycle can be detailed as follows.

Table 1. Analysis of Mathematical Critical Thinking Ability Test Results in Cycle 1

Score (Percentage)	Category	Many Students
$1\% \leq x < 25\%$	Not Good	0
$25\% \leq x < 50\%$	Pretty Good	4
$50\% \leq x < 75\%$	Good	5
$75\% \leq x < 100\%$	Excellent	20

Based on the results of the analysis presented in Table 1 regarding the mathematical critical thinking ability test of grade 5 students, it can be seen that there are no students who are classified as poor. A total of 4 students were recorded in the fairly good category, while 5 students showed results in the good category. The majority of students, namely 20 people, managed to achieve the excellent category in the measurement of mathematical critical thinking skills. These findings indicate that most students have demonstrated high mastery of concepts and critical thinking skills after participating in learning with the Problem Based Learning (PBL) model.

Meanwhile, based on the results of a questionnaire that aims to measure the level of student learning motivation, data was obtained that 40% of students still show a low level of learning motivation. On the other hand, the other 60% of students are classified as having high motivation to learn. This data was collected through a questionnaire that was filled out directly by the students after following the learning process, with results showing variations in their levels of enthusiasm and internal drive to learn. The details of the data are presented in the following section as a basis for consideration in designing strategies to increase learning motivation in the next cycle.

Table 2. Analysis of the Results of the Level of Learning Motivation in Cycle I

Category	Many Students
Tall	6
Keep	15
Low	8

The factors influencing these results were revealed through a series of observations made during the implementation of classroom learning. This observation process is carried out by researchers together with pamong teachers, who observe each stage of learning from beginning to end. Before learning begins, the atmosphere in the classroom shows a high level of interest and enthusiasm from the students. This is evident when students welcome the teacher into the classroom, especially when they see the teacher bringing the tools and learning materials used in the activity. The existence of

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interesting and relevant learning media can affect students' motivation to actively engage in the learning process, which is a positive indication of their attitude towards the learning to be carried out. However, the implementation of learning did not go as planned because there were several students who seemed sleepy. This condition is most likely caused by a lack of rest time the night before, as well as the student's lack of attention to the material being taught. Some students also seem to be not focused on the material being discussed, so teachers need to implement a more interactive and innovative approach to retract their attention and optimize the learning process. Nonetheless, students complete the assignments given by the teacher well through group discussions. However, there are still several groups who come to the teacher to ask how to do the task. During the discussion activities, most of the students have already shown good cooperation in their groups.

B. Cycle II

Cycle II was carried out in one meeting with a total duration of 2 hours of lessons. Learning assessment using the PBL model is carried out through observation sheets filled out by teachers during the learning process. A total of 29 students were subjects in the research in this second cycle. The activity in the second cycle ended with a critical thinking ability test to evaluate the success of learning using the PBL model. Based on the results of the mathematical critical thinking ability test in Cycle II, there was an increase even though there were still 7 students who had not completed it. The percentage of students who managed to achieve completeness in mathematical critical thinking skills was 75.8%, or as many as 22 students. Meanwhile, 24.2% of students, namely 7 students, are still incomplete. This indicates that the number of students who have achieved completeness has met the specified success standard, which is at least 75% of the total number of students. This achievement was obtained based on the results of the evaluation of students with the following details.

Table 3. Analysis of Mathematical Critical Thinking Ability Test Results in Cycle II

Score Presentation	Category	Many Students
1%≤x<25%	Not Good	0
25%≤x<50%	Pretty Good	2
50%≤x<75%	Good	5
75%≤x<100%	Excellent	22

Based on the analysis contained in Table 3 regarding the results of the mathematical critical thinking ability test for grade 5 students, it can be concluded that no students are in the poor category. A total of 2 students were recorded in the fairly good category, 5 students were included in the good category, and the majority of students, namely 22 people, managed to reach the very good category. This achievement shows a significant improvement in students' mathematical critical thinking skills after participating in learning.

In addition, the results of the questionnaire used to measure the level of student learning motivation revealed that 22.16% of students had relatively low learning motivation. On the other hand, another 87.84% of students showed a higher level of motivation. These results reflect an increase in student learning motivation compared to the previous cycle, demonstrating the effectiveness of the learning model in increasing student engagement and drive to learn. Thus, the results of this study have met the success indicators that have been set, namely a significant increase in both aspects, namely mathematical critical thinking skills and student learning motivation.

Table 4. Analysis of the Results of the Level of Learning Motivation in Cycle II

Category	Many Students
Tall	6
Keep	19
Low	4

The results obtained in this study are influenced by a number of factors identified through observation of the implementation of learning in the classroom. The observation was carried out by the researcher together with the pamong teacher, who monitored each stage of learning from the beginning to the end of the session. Before learning begins, students are seen showing high enthusiasm and interest

in learning activities. This can be seen when they welcome the arrival of teachers who enter the classroom while bringing various tools and learning materials that will be used in the learning process. In cycle II, there was a significant increase where no students looked sleepy or lost focus during the lessons. To raise the students' enthusiasm before starting learning, the teacher provides ice breaking activities that successfully increase students' energy and readiness to follow the lesson with attention. In addition, learning activities run smoothly in accordance with the plan that has been prepared in the implementation of learning. The available facilities and infrastructure are also quite supportive, without any significant disruptions, such as power outages that can interfere with the learning process. The facilities used in learning, such as comfortable classrooms, projectors, laptops, speakers, and smooth internet access, all play an important role in creating a conducive learning atmosphere. With this condition, students become more focused and able to actively participate in group discussions. Students who have understood the material before also play a role in explaining to their group friends, so that the discussion process runs two-way and is more dynamic. This makes students rarely ask questions directly to the teacher because they feel that they understand enough of the material being discussed. In addition, students also show an active attitude in providing responses or questions when other groups present the results of their discussions, which indicates an increase in their involvement in learning.

4. CONCLUSION

The application of *the Problem Based Learning* (PBL) model has been proven to be effective in improving the mathematical critical thinking skills and learning motivation of 5th grade students at UPT SDN Kutorejo 3 Tuban. The increase in critical thinking skills can be seen from the percentage of student completeness which was originally 69% in the first cycle increased to 75.8% in the second cycle. In addition, an increase also occurred in the aspect of learning motivation, where in the first cycle as many as 40% of students had low learning motivation, while in the second cycle the figure decreased to 22.16%. Problem-based learning provides students with the opportunity to be more active, independent, and involved in the learning process, so that they are able to analyze, evaluate, and infer information more critically. The learning atmosphere also becomes more conducive and fun because of the interesting learning media*, ice breaking* activities, and adequate supporting facilities. Students not only actively engage in group discussions, but also show increased participation in presentations and questions and answers between groups. Thus, the PBL model can be used as an alternative to innovative and effective learning strategies to improve the quality of mathematics learning in elementary schools.

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Influence of the Type Think Pair Share Cooperative Model Aided by Wordwall-Based Media on Mathematics Study Results of Class IV in Elementary School

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ABSTRACT

This research is motivated by the low learning outcomes in mathematics learning of fourth grade elementary school students. The purpose of this study was to determine the effect of the cooperative model of think pair share type assisted by wordwall-based media on student learning outcomes. The method used was quasi experimental type non-equivalent control group design. Data collection techniques are done through test and non-test techniques. Hypothesis testing using simple liner regression with the results showed that the application of the cooperative model of think pair share type assisted by wordwall-based media was able to increase students' active participation, understanding of mathematical concepts and learning outcomes significantly, so it can be concluded that there is a significant effect of using the cooperative model of think pair share type assisted by wordwall-based media on the learning outcomes of mathematics class IV elementary school.

Keyword : Learning outcomes, Mathematics, Wordwall media, Cooperative model of think pair share type

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1. INTRODUCTION

The learning process is one of the most important activities in learning activities in schools, effective learning will have a positive impact on the development of student learning outcomes, One of the lessons in school that can train students' deductive reasoning is in mathematics, (Mubarok, 2022), Mathematics is an important science that is learned from elementary level learning, The reality in the field, most students have different views on mathematics lessons, Most of the students ignore mathematics because they think that the mathematics lessons they learn have no impact and connection between the usefulness of the material and real life everyday (Kamarullah, 2017), students experience tension in the mathematics learning process, as a result of low interest in students asking about material they don't understand or expressing opinions, so that students prefer to sit still, take notes and listen during learning, the negative impact on students views that mathematics is a lesson that is less interesting, confusing, difficult to learn, boring so that it becomes a factor that causes students to dislike mathematics lessons (Masana, 2022).

Based on the results of a survey conducted by the OECD organization (2019), it states that 72% of Indonesian students have mathematics skills that are classified as low Based on the above, about 72% of Indonesian students are at level 1 and below. Based on this, most students are below level 1 (around 41%), while the rest are at level 1 (around 31%). The mathematical ability of Indonesian students is below level 1 by 41%, according to PISA states that mathematical ability in Indonesia has never been significantly improved in 2022 to become the value with the lowest score in mathematical literacy since 2006, Indonesia occupies position 7 from the bottom with an average score of only 379. Another survey from data from the Ministry of Education and Culture of Lampung province stated that it shows that almost all elementary schools in Bandar Lampung the quality of learners in 2024 has decreased compared to 2023, the quality of learning that has not been optimal can be one of the factors causing low learning outcomes, meaning that the learning process in the classroom has not been maximized in learning.

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Low learning outcomes according to educators' statements, apart from being caused by not optimal educators in varying models, media and forms of learning in every lesson, especially learning mathematics, educators in the learning process have not used team learning forms too often and have an impact on the ability to think logically on their environment, students will be more active and like learning, especially learning mathematics if the form of learning varies in models, media and forms of learning that are carried out not in the same form in each lesson. Learning mathematics requires the right model, media, form of learning, so that the learning outcomes of students are maximized, defining the learning model as a conceptual framework that educators use as a guide in carrying out the learning process in the classroom (Tabrani and Amin, 2023).

There are various types of cooperative learning models, one of which is the Think Pair Share (TPS) type cooperative model, research on the Think Pair Share (TPS) type cooperative model has a positive view, one of which gives students time to be able to (think) in solving questions and problems given by educators related to the problem statement (Arumasharroh, 2023). Cooperative learning models, one of the cooperative learning models is Think Pair Share (TPS), to maximize the learning process, learning media is needed, audio-visual-based learning media is an alternative for educators with various advantages compared to using real media, one of the media that can be used is wordwall, a technology-based media that can help the mathematics learning process to improve learning outcomes at SD Negeri 1 Bumi Waras.

2. RESEARCH METHOD

According to the research, quantitative research is a research approach that uses data in the form of numbers and exact science to answer research hypotheses, in the research process focuses on the process of finding knowledge that uses numerical data as a tool in analyzing research data (Waruwu, 2023). The research design, in this study is a quasi experimental type non-equivalent control group design, the experimental group is the group that is given treatment with the Think Pair Share type cooperative learning model assisted by wordwall-based media and the control group is treated with the conventional learning model Numbered Heads Together type.

This research was conducted at SD Negeri 1 Bumi Waras, the sample used in the study in class IV SD N 1 Bumi Waras was a saturated sample, there were 48 students consisting of 24 experimental class students and 24. Data collection techniques use test and non-test data, for test tests using instrument tests then research, data processing using validity tests, reliability, differentiation and likeness of questions for instrument tests then test data using normality tests, homogeneity, analysis of learning outcomes, N-Gain, hypothesis pretest and posttest data. For non-test tests using observation data on the use of the Think Pair Share type cooperative model assisted by wordwall-based media in the experimental class.

3. RESULTS AND DISCUSSION

This study includes data on the ability of learning outcomes by applying the learning model of the cooperative model type think pair share assisted by wordwall-based media and giving different treatments to the experimental class and control class for 6 meetings, the experimental class was conducted as many as 3 by delivering fraction material and applying the think pair share model and applying wordwall media, while the control class was conducted 3 times a meeting by delivering fraction material using the numbered heads together model. The implementation of the instrument trial was carried out on March 6, 2025 Furthermore, researchers conducted research on March 10-15, 2025 by implementing a series of learning activities. The first research implementation on March 10, 2025 was to take the experimental class prestest data which was carried out before learning activities, on March 10-12, 2025 carrying out learning activities by applying the cooperative model of think pair share type assisted by wordwall media on fraction mathematics material, on March 12 taking posttest data in the experimental class, then on March 13-15, 2025, research on March 13, 2025 carried out prestest data collection activities followed by the learning process of fraction mathematics material by applying the numbered heads together model and on March 15 after the learning process took posttest data.

The results of the research data were obtained from the pretest and posttest scores in the experimental and control classes. The question items given were 20 questions that had been tested for

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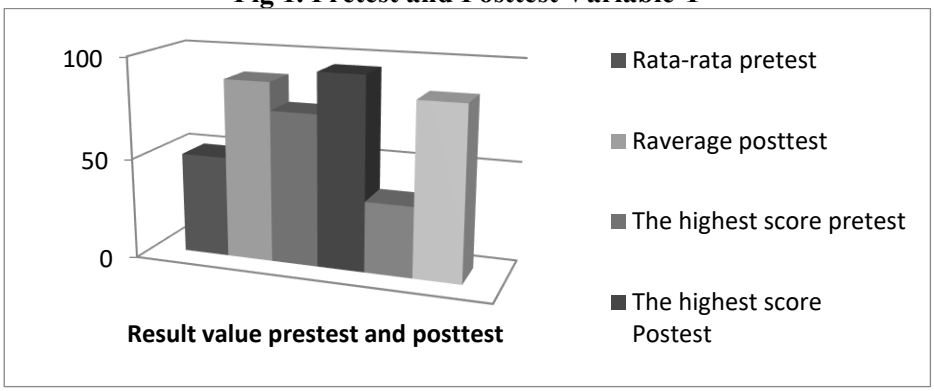
validity, reliability, difficulty of the questions and the differential power of the questions. . Data on the posttest value of student learning outcomes can be seen in the following data;

Table 1.
Pretest and Posttest Score

No	Research data	Result value *prestest* and *posttest*					
		Average		The highest score		Lowest value	
1	Eksperimental	***Prestest***	***Posttest***	***prestest***	***posttest***	***prestest***	***posttest***
	class	50	88,75	75	95	35	80
2	Control class	***Prestest***	***Posttest***	***prestest***	***posttest***	***prestest***	***Posttest***
		44,375	79, 375	65	85	25	70

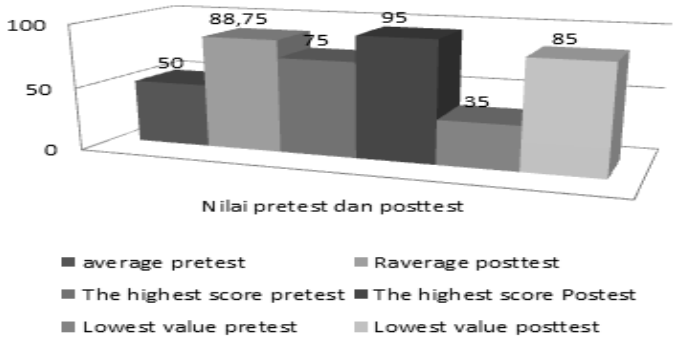
For the results of the pretest and posttest of the experimental class for variable Y, it can be seen in the following diagram;

Fig 1. Pretest and Posttest Variable Y



The results of the observation calculation of the use of the cooperative model of think pair share type assisted by wordwall-based media for variable X:

Fig 2. Observation Calculation of the Cooperative Model of Think-Pair-Share Type



The average N-Gain for the experimental class (cooperative method of think pair share type assisted by wordwall media) is 76.8052 or 76.8% including in the effective category with a minimum N-Gain value of 50% and a maximum of 91.67%, so it can be concluded that the cooperative method of think pair share type assisted by wordwall-based media is effective in improving mathematics learning outcomes in grade IV elementary school.

This hypothesis was tested using simple regression test analysis using the help of SPSS version 25 using the posttest value of the experimental class and the observation value of the learning model used, the following test results Based on table 31 above, it can be seen that Fhitung < Ftabel, namely Fhitung = 15.532 and Ftabel = 4.30, then Fhitung < Ftabel, namely 15.532 < 4.30 with a significant level of 0.001 < 0.05, it can be concluded that Ha is accepted and HO is rejected, which means that

there is a significant effect of the cooperative model of think pair share type assisted by wordwall-based media (X) to improve student learning outcomes (Y).

This means that the influence of the cooperative model of think pair share type assisted by wordwall-based media (X) on improving mathematics learning outcomes (Y) is 41.4%, while 58.6% is influenced by other factors. % while 58.6% is influenced by other factors

4. CONCLUSION

Based on the results of research and discussion, the conclusion of this study is that there is a significant influence on the cooperative model of think pair share type assisted by wordwall-based media variable (X) on the learning outcomes of mathematics class IV elementary school variable (Y), this can be proven in the results of simple linear regression hypothesis testing that there is a significant influence on variable X on variable Y, meaning that there is an increase in grade IV math learning outcomes through the use of cooperative model of think pair share type assisted by wordwall-based media. It can be concluded that Ha is accepted and Ho is rejected. Average N-Gain for the experimental class (cooperative method of think pair share type assisted by wordwall media) is 76.8052 or 76.8% included in the effective category with a minimum N-Gain value of 50% and a maximum of 91.67%, so it can be concluded that the cooperative method of think pair share type assisted by wordwall-based media is effective in improving the learning outcomes of mathematics class IV elementary school. This study successfully showed a significant effect on learning models and media on student learning outcomes. These findings provide a positive contribution to the world of education, especially in the development of learning methods, increasing learning motivation, utilizing educational technology, so that it is expected to support the creation of educational practices that are more effective, innovative, and according to the needs of students in the future. In addition, the results of this study can be a reference for future researchers to develop further studies, either by expanding the variables studied, using different methods, or applying this research to other contexts or populations, so as to enrich knowledge and provide real solutions to educational problems.

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The Impact of Family Environment and Learning Independence on Learning Outcomes through Learning Motivation

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ABSTRACT

This study aims to analyze the impact of family environment and learning independence on student learning outcomes through learning motivation at SMKN 1 Tombariri using path analysis. A quantitative approach was used in this study with a survey method to collect data from 66 students through a questionnaire consisting of family environment variables, learning independence, learning motivation, and learning outcomes. Data were analyzed using path analysis techniques to identify direct and indirect relationships between the variables studied. The results showed that the family environment had a significant effect on student learning outcomes through learning motivation. Parental support in the form of attention, the formation of good learning habits, and the provision of learning facilities at home increased student motivation which ultimately had an impact on achieving better learning outcomes. In addition, learning independence also had a significant effect on student learning outcomes through learning motivation. Students who have the ability to learn independently, manage time, and develop learning strategies, show higher motivation, which leads to more optimal learning outcomes. Overall, path analysis shows that the family environment, learning independence, and learning motivation are interrelated and have a direct and indirect effect on student learning outcomes. This finding confirms the importance of synergy between these factors in improving student learning outcomes at SMKN 1 Tombariri.

Keywords: Family Environment, Learning Independence and Learning Outcomes

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1. INTRODUCTION

Education is the main pillar in building quality human resources in the challenging era of globalization. In the national education system, learning success is determined by the extent to which students achieve optimal learning outcomes as a reflection of the process of mastering predetermined competencies. Learning outcomes according to Sudjana (2017) are the abilities possessed by students after receiving learning experiences. Therefore, various factors that influence learning outcomes need special attention.

In general, factors that influence learning outcomes are divided into two groups, namely internal factors and external factors. Internal factors include psychological aspects of students such as learning motivation and learning independence, while external factors include the surrounding environment, especially the family environment. The family environment plays an important role as the first and main place for children to obtain learning and basic life values. Parents who care, provide moral support, and provide learning facilities at home can increase children's enthusiasm for learning (Wahyuni & Rachmawati, 2021). Conversely, family conditions that are not conducive, lack attention, or have economic limitations can reduce students' academic achievement (Yusuf, 2020).

Learning independence is also an important element in supporting student learning outcomes. Students who have learning independence are able to set learning goals, manage time, and evaluate their learning process and outcomes independently (Suryani & Hidayat, 2020). In this case, students do not only depend on teachers, but actively build their own knowledge. However, neither the family environment nor learning independence always have a direct impact on learning outcomes. Learning motivation acts as a mediating factor that strengthens the influence of both variables on students' academic achievement (Uno, 2020).

Learning motivation is an internal or external drive within students that fosters a desire to learn. According to Ryan and Deci (2000), students who have high learning motivation will show consistent effort, high interest, and perseverance in completing tasks. In the context of education in Indonesia,

learning motivation is often a problem, especially at the Vocational High School (SMK) level, which tends to face additional challenges such as work readiness and limited learning facilities.

This condition is also seen in SMKN 1 Tombariri, where most students have not achieved the Minimum Completion Criteria (KKM) in various subjects, especially productive subjects. Based on academic data for 2024/2025, around 45% of grade XI students did not achieve the KKM score in the odd semester exam. Based on the results of initial observations, it was found that this low achievement was related to minimal learning motivation, lack of family involvement in the child's education process, and weak student independence in managing the learning process.

Several previous studies have highlighted the relationship between family environment, learning independence, learning motivation, and learning outcomes. Fitriani (2022) found that family environment has a positive effect on motivation and learning achievement of high school students. Research by Rahmat and Putra (2021) revealed that learning independence has a significant relationship with learning outcomes of junior high school students. Meanwhile, Wulandari and Ningsih (2022) showed that learning motivation is a strong mediating variable in the relationship between social environment and learning outcomes of vocational high school students. However, these studies are generally separate and have not combined the four variables in one model.

This study has novelty by testing a structural model involving family environment and learning independence as independent variables, learning motivation as a mediating variable, and learning outcomes as dependent variables, in the context of vocational high school students in rural areas. There are not many studies that specifically examine this complex relationship in the vocational high school environment, especially in areas such as Tombariri which have their own social and geographical characteristics. Therefore, this study is important to contribute to strengthening theoretical models and educational practices in an effort to improve the quality of student learning outcomes.

2. RESEARCH METHOD

This study uses a quantitative approach with the explanatory research method because it aims to explain the causal relationship between independent variables (family environment and learning independence), mediating variables (learning motivation), and attachment variables (learning outcomes) in students of SMKN 1 Tombariri. The quantitative approach was chosen because it is appropriate for testing hypotheses that have been formulated based on theories and previous research results and allows statistical data processing (Sugiyono, 2022).

The population in this study was all 11th grade students at SMKN 1 Tombariri in the 2024/2025 academic year totaling 120 students. The sampling technique used proportional random sampling to ensure balanced representation from each department. Based on the Isaac and Michael table for a population of 92 people at a 5% error rate, a minimum sample size of 65 students was obtained. This sample is considered representative enough to draw statistically valid conclusions (Creswell & Creswell, 2018).

The data collection technique was carried out by distributing a previously validated closed questionnaire. The instrument was compiled using a five-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree". The family environment variable was measured based on indicators of communication, parental attention, and the availability of learning facilities at home (Wahyuni & Rachmawati, 2021). The learning independence variable was measured through indicators of learning planning, learning initiative, and self-evaluation (Suryani & Hidayat, 2020). Learning motivation was assessed based on self-determination theory which includes intrinsic and extrinsic motivation (Ryan & Deci, 2000), while learning outcomes were taken from students' semester grade data obtained from homeroom teachers. Before being used for data collection, validity and reliability tests were carried out first. The validity test of the instrument was carried out using the Pearson Product Moment correlation technique, and was declared valid if the calculated r value > r table. The reliability test was carried out using Cronbach Alpha, with an α value ≥ 0.7 as the limit of reliable instrument provisions (Arikunto, 2019).

The data analysis technique used in this study is path analysis which allows researchers to analyze the direct and indirect effects between variables. The analysis process was carried out using Mplus software version 8, which is known to be effective in testing structural relationship models. To test the mediation effect of learning motivation, a bootstrapping approach of 5000 samples was used at a 95%

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confidence interval. The mediation effect is said to be significant if the confidence interval does not cross zero (Hayes, 2013). This procedure was chosen because it is more accurate in estimating indirect effects than conventional methods such as the Sobel test. Before conducting path analysis, a classical assumption test was first conducted to ensure the feasibility of the data. The normality test was conducted using Kolmogorov-Smirnov, multicollinearity was assessed based on the VIF value <10, and the heteroscedasticity test was conducted using the Glejser method. All of these assumption tests are important to ensure that the data analyzed meets the requirements of linear regression and does not produce bias (Gujarati & Porter, 2009).

3. RESULTS AND DISCUSSION

A. Results

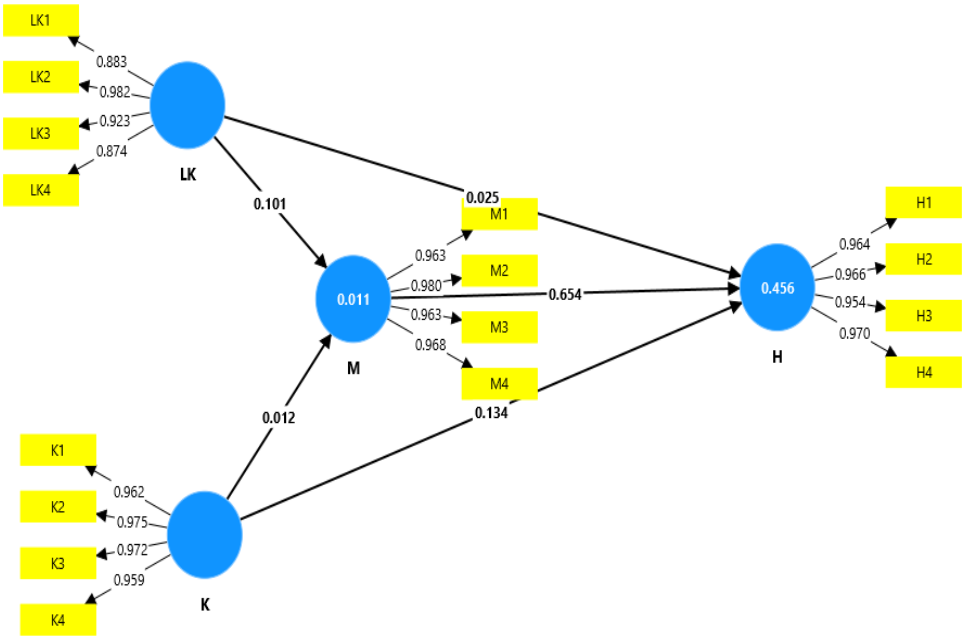
1. Outer Model Evaluation (Measurement Model)

a. Convergent Validity

Convergent validity is part of the measurement model (measurement model) which in SEM-PLS is usually referred to as the outer model while in covariance-based SEM it is called confirmatory factor analysis (CFA). There are two criteria for assessing whether the outer model (measurement model) meets the convergent validity requirements for reflective constructs, namely (1) the loading must be above 0.7 and (2) the p value is significant (<0.05). However, in some cases, the loading requirement above 0.7 is often not met, especially for newly developed questionnaires. Therefore, loadings between 0.40-0.70 must still be considered to be maintained**.**

Indicators with loadings below 0.40 should be removed from the model. However, for indicators with loadings between 0.40 and 0.70, we should analyze the impact of the decision to remove the indicator on the average variance extracted (AVE) and composite reliability. We can remove indicators with loadings between 0.40 and 0.70 if the indicator can increase the average variance extracted (AVE) and composite reliability above its threshold. The threshold value for AVE is 0.50 and composite reliability is 0.7. Another consideration in removing indicators is the impact on the content validity of the construct. Indicators with small loadings are sometimes retained because they contribute to the content validity of the construct. Figure 4.1 presents the outer loading values for each indicator.

Fig 1. Outer Loading Values



From the table above, it can be seen that the loading factor value of all statement items is >0.70, so it is concluded that all statement items are convergently valid. Furthermore, validity testing is carried out based on the average variance extracted (AVE) value, reliability based on composite reliability (CR) and Cronbach's alpha (CA).

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b. Discriminant Validity

Table 1.
Discriminant Validity Test: Fornell & Larcker

	Learning outcomes	Learning Independence	Family Environment	Motivation to learn
Learning outcomes	0.963			
Learning Independence	0.155	0.967		
Family Environment	0.110	0.133	0.916	
Motivation to learn	0.060	0.026	0.103	0.969

Based on the table above, the AVE root value for each variable is > correlation between constructs with other constructs, so it can be concluded that all variables are declared valid discriminants.

c. Reliability Test

Composite Reliability is used in the Structural Equation Modeling (SEM) model, especially in the Partial Least Squares (PLS) method. CR assesses the overall construct reliability by considering the indicator weights on the latent variables. While Cronbach's Alpha measures the internal reliability of an instrument based on the correlation between items in one variable. The higher the alpha value, the more consistent the items in the measurement instrument.

Table 2.
Reliability Testing based on Composite Reliability (CR) and Cronbach's Alpha (CA)

	Cronbach's alpha	Composite reliability (rho_c)
Learning outcomes	0.974	0.981
Learning Independence	0.977	0.983
Family Environment	0.955	0.954
Motivation to learn	0.978	0.984

CR and CA ≥ 0.70, the instrument has good reliability. From the table above, the Cronbach's alpha and Composite reliability values of all variables are > 0.70, so all variables are reliable.

2. Structural Model Evaluation Results (Inner Model)

In Structural Equation Modeling (SEM), structural models are used to test causal relationships between latent variables. One important measure in evaluating a structural model is R-Square (R^2), which shows how much the independent variables can explain the dependent variable.

Table 3.
Coefficient of Determination Test

	R-square	R-square adjusted
Learning outcomes	0.456	0.429
Motivation to learn	0.611	0.721

The adjusted R-square value of the learning motivation variable is 0.721, indicating that the family environment and learning independence variables are able to explain motivation by 72.1%. So it can be concluded that the model is considered moderate. While the adjusted R-square value of teacher innovative behavior is 0.429, indicating that the family environment, learning independence and learning motivation variables are able to explain learning outcomes by 42.9%.

3. Hypothesis Testing

Table 4.
Path Coefficient Test & Significance of Influence

Path	Path Koefisien	T statistics	P values
Family Environment -> Motivation to learn	0.457	4.644	0.019

Learning Independence -> Motivation to learn	0.234	3.092	0.026
Motivation to learn -> Learning outcomes	0.525	5.217	0.000
Family Environment -> Learning outcomes	0.113	6.218	0.028
Learning Independence -> Learning outcomes	0.390	5.492	0.036
Family Environment -> Motivation to learn -> Learning outcomes	0.406	7.623	0.033
Learning Independence -> Motivation to learn -> Learning outcomes	0.291	6.089	0.029

Based on the results in Table 4 the following results were obtained:

1) Family environment has a positive effect on learning motivation, with a coefficient value = 0.157, and is significant, with T-Statistics = 4.644 > 2.00 and P-Values = 0.019 < 0.05 (Hypothesis Accepted).
2) Learning independence has a positive effect on learning motivation, with a coefficient value = 0.234, and is significant, with T-Statistics = 3.092 > 2.00 and P-Values = 0.026 < 0.05 (Hypothesis Accepted).
3) Learning motivation has a positive effect on learning outcomes, with a coefficient value = 0.525, and is significant, with T-Statistics = 5.217 > 2.00 and P-Values = 0.000 < 0.05 (Hypothesis Accepted).
4) Family environment has a positive effect on learning outcomes, with a coefficient value = 0.113, and is significant, with T-Statistics = 6.218 > 2.00 and P-Values = 0.028 < 0.05 (Hypothesis Accepted).
5) Learning independence has a positive effect on learning outcomes, with a coefficient value = 0.390, and is significant, with T-Statistics = 5.492 > 2.00 and P-Values = 0.036 < 0.05 (Hypothesis Accepted).
6) Family environment has a positive effect on learning outcomes through learning motivation, with a coefficient value = 0.406, and is significant, with T-Statistics = 7.623 > 2.00 and P-Values = 0.033 < 0.05 (Hypothesis Accepted).
7) Learning independence has a positive effect on learning outcomes through learning motivation, with a coefficient value = 0.291, and is significant, with T-Statistics = 6.089 > 2.00 and P-Values = 0.029 < 0.05 (Hypothesis Accepted).

B. Discussion

1) The Influence of Family Environment on Student Learning Motivation

This study found that the family environment has a significant influence on students' learning motivation at SMKN 1 Tombariri. A supportive family environment, such as parental attention, involvement in learning activities, open communication, and the provision of adequate learning facilities, has been proven to be able to encourage increased enthusiasm and willingness of students to learn. Students who come from families with a positive atmosphere generally show higher enthusiasm in participating in the learning process. They are more confident, have clear learning goals, and show perseverance in completing school assignments. This finding strengthens the view that the family is the first and foremost environment in shaping the character and motivation of students to develop academically.

Based on observations and interviews conducted at SMKN 1 Tombariri, it was found that the family environment plays an important role in shaping students' learning motivation. Students who come from families with supportive and caring parenting patterns generally show a high enthusiasm for learning. They are more organized in doing assignments, actively participate in learning activities, and have clear academic goals. On the other hand, students who come from families with less supportive conditions such as minimal parental attention, disharmony in the household, or low parental involvement in education tend to show weak learning motivation. This can be seen from the low attendance of students in class, lack of participation in discussions, and lack of initiative to complete assignments independently.

The results of this study are supported by research conducted Nurbayan, et al. (2024), relationships or relationships between family members are also needed for children to support the learning process, if parents do not have a good relationship with their children, such as parents who are too strict in educating and indifferent to children's learning, then it will cause children's enthusiasm and motivation to learn to decrease. Agustina & Kurniawan (2020) stated that students' learning motivation

is influenced by the family environment. Students will be more motivated to learn when they get positive support from their families because students will feel appreciated and cared for.

2) The Influence of Learning Independence on Learning Motivation

The results of the study showed that learning independence has a significant influence on students' learning motivation. Students who have independence in learning tend to show a strong internal drive to achieve their academic goals. They are better able to manage their study time, take the initiative in understanding the material, and set learning targets without having to always rely on external encouragement, such as teachers or parents**.**

Facts on the ground support this finding. The results of interviews with teachers at SMKN 1 Tombariri show that students who are able to manage their own study time and do not wait for instructions continuously are generally more enthusiastic in participating in learning. They not only complete assignments on time, but also look for additional references outside the material given in class. Several teachers stated that independent students tend to be more proactive in asking questions and discussing, which indicates a high motivation to learn from within themselves. On the other hand, students who do not yet have independence in learning often show a passive attitude. They only learn when asked, rarely ask questions, and show a high dependence on the presence of teachers or friends. This condition makes their learning motivation low, because it does not grow from self-awareness, but rather because of external factors.

This finding is in line with previous research by Yuliana and Wibowo (2021), which showed that students with a high level of learning independence have stronger learning motivation compared to students who tend to rely on others. This study also emphasizes that strengthening the independence aspect can be an important strategy in increasing learning motivation in a sustainable manner. Learning independence is said to have an influence on learning motivation and the coefficient has a positive value, resulting in the better learning independence, the better learning motivation will be (Khotimah & Eko, 2021). Setiaji et al (2021) stated that independent learning can influence learning motivation.

3) The Influence of Learning Motivation on Learning Outcomes

Learning motivation is one of the internal factors that has a strong influence on student learning outcomes. Based on the results of research conducted at SMKN 1 Tombariri, it was found that students with high levels of learning motivation tend to have better learning outcomes compared to students who are less motivated. High motivation makes students more focused, consistent in learning, and better prepared to face academic challenges. Theoretically, learning motivation encourages students to set goals, direct attention and effort to learning activities, and maintain learning behavior over a certain period of time (Uno, 2019). With strong motivation, students will be more active in understanding the material, doing assignments optimally, and showing tenacity in facing learning difficulties. This certainly has a positive impact on their academic achievement.

Based on the observation results, students who show high learning enthusiasm are usually more disciplined in doing assignments, are active in the learning process, and have a strong interest in the subject matter. They also tend to have regular study habits at home and do not delay schoolwork. This can be seen from the consistency of the academic grades they achieve, which are generally in the satisfactory category or exceed the Minimum Completion Criteria (KKM). On the other hand, students who lack learning motivation show the opposite behavior. They are more often late in submitting assignments, are less enthusiastic in following lessons, and rarely show initiative to understand difficult material. When asked about their academic ideals or goals, these students also appear to not have a clear direction, which reflects a weak internal drive to learn. As a result, their learning outcomes often do not meet the KKM.

The results of this study are supported by research conducted by Saragih et al. (2023), learning motivation significantly affects social studies learning outcomes. Students who have high motivation in learning social studies will produce better learning outcomes and understand social studies concepts more completely. This study shows that learning motivation is an important factor in determining social studies learning outcomes, and this strategy can be used to describe learning motivation in the field of social studies.

4) The Influence of Family Environment on Learning Outcomes

The results of this study indicate that the family environment has a significant effect on student learning outcomes. This is shown through the results of quantitative data analysis which reveal a positive

correlation between family environment variables and learning outcomes. In other words, the more conducive a student's family environment is, the higher the tendency for their learning outcomes. The family environment includes several aspects such as parental support, family interactions, socio-economic conditions, and learning habits at home. In this study, it was found that students who received emotional support and motivation from their parents tended to have a higher enthusiasm for learning. Parents who are involved in their children's learning activities, such as helping with homework or providing special time for discussion, contribute to improving students' understanding of the lessons.

The level of education and occupation of parents also contribute to student learning outcomes. Parents with a higher educational background tend to understand the importance of education better and are able to provide adequate tutoring. They also tend to have higher academic expectations for their children, which indirectly motivates students to study harder. This study is also in line with several previous studies. For example, research by Susanti & Haryanto (2022) found that direct parental involvement in the child's educational process is closely related to academic achievement. Likewise, Putra (2021) revealed that more stable family economic factors allow students to have access to better learning resources, such as books, the internet, and additional tutoring. The results of this research are in accordance with Chulsum (2017) who stated that there is a significant positive impact of the family environment on learning outcomes.

5) The Influence of Learning Independence on Learning Outcomes

The results of the study show that learning independence has a significant influence on student learning outcomes. Students who have a high level of learning independence tend to get better academic grades compared to students who tend to rely on help from teachers or peers. This shows that students who are able to plan, manage time, and complete assignments independently have an advantage in mastering the subject matter. Facts in the field show that students who actively make their own study schedules and consistently work on practice questions independently succeed in achieving exam scores above the class average. In addition, the results of observations in the field strengthen the quantitative data, where students who demonstrate independent learning habits, such as looking for additional references, taking notes on important material, and reflecting on previous exam results, appear more prepared to face learning evaluations. Conversely, students who have a high dependence on teachers, are not used to studying without guidance, and are less disciplined in managing study time show less than optimal results.

Although most of the data supports a positive relationship between learning independence and learning outcomes, there were some respondents in this study who had a high level of learning independence but their learning outcomes were not optimal. This shows that in addition to independence, other factors such as cognitive ability, environmental support, psychological conditions, and learning methods also influence students' academic achievement.

The results of this study are supported by the results of research conducted by Hidayat (2019) that learning independence is very necessary for students' needs for their learning achievements because with learning independence students are able to have a sense of responsibility in their learning and an attitude of initiative, creativity and activeness in learning will emerge without depending on others. Handayani & Hidayat, (2018) that there is a significant positive influence of learning independence on mathematics learning outcomes. Independence is something that plays an important role in learning, especially mathematics learning. This is because learning independence is the ability of students to carry out learning activities with their own motivation and without coercion.

6) The Influence of Family Environment on Learning Outcomes Through Learning Motivation

The results of the study showed that the family environment indirectly influences student learning outcomes through learning motivation. This means that a conducive family environment characterized by emotional support, attention to education, and positive communication can increase students' learning motivation, which then has an impact on their academic achievement. Quantitative data shows that students who come from families with high attention to the learning process tend to have strong intrinsic learning motivation, such as the desire to excel and a sense of responsibility for school assignments.

Facts on the ground support these results. In interviews with several students, it was found that those who have parents who are actively involved in education (for example by reminding them of

study time, asking about their grades, or providing learning facilities) feel more enthusiastic about learning. In contrast, students who come from families with low involvement show a lack of motivation to learn, feel that learning is only a school obligation, and do not have clear academic targets. This shows that the role of the family is not only in physical aspects such as providing learning needs, but also in shaping attitudes and learning motivation.

The results of this study are in line with the results of Prabasari & Subowo's research (2017) which explains that there is a significant positive influence between parenting patterns of parents to students on learning achievement through learning motivation as an intervening variable. And Tirtiana (2013) states that there is an impact between the family environment on learning outcomes through learning motivation.

7) The Influence of Learning Independence on Learning Outcomes Through Learning Motivation

The results of the study indicate that learning independence has an indirect effect on student learning outcomes through learning motivation as a mediating variable. This means that students who are independent in learning tend to have higher learning motivation, and this motivation then drives them to achieve better learning outcomes. Statistical data supports that students with a high level of independence also show high motivation scores, and ultimately have significantly better academic achievements compared to students who are not independent.

Facts in the field strengthen these findings. In observations and interviews, it was found that students who are accustomed to designing their own study schedules, looking for additional learning resources without being asked by teachers, and evaluating their learning outcomes independently, feel more confident and motivated to continue to improve their achievements. They tend to set personal learning targets and feel satisfied if they succeed in achieving them. Conversely, students who are still dependent on teachers or friends in the learning process often show a lack of initiative and low motivation, which has an impact on less than optimal learning outcomes.

The results of this study are supported by the results of research Kharisma Hidayat (2014) The results of this study are supported by the results of Kharisma Hidayat's research (2014) which states that the variable of learning independence has an indirect influence on learning outcomes through learning motivation.

4. CONCLUSION

Based on the research results, it can be concluded:

1) This study shows that the family environment has a positive effect on students' learning motivation at SMKN 1 Tombariri. A supportive family, with a parenting pattern that cares about children's education, has a positive impact on students' learning motivation. An environment that pays attention to students' academic needs and provides adequate learning facilities will create a conducive atmosphere, which in turn increases students' enthusiasm and drive to learn better.
2) Students' learning independence also plays an important role in increasing their learning motivation. Students who can manage their own study time, plan academic activities, and find additional learning resources without relying on others tend to have higher motivation. This independence encourages students to feel more responsible for their learning process, which has an impact on strengthening their internal motivation to achieve higher achievements.
3) Student learning motivation has been shown to have a direct influence on their learning outcomes. Students who have high learning motivation, both intrinsic and extrinsic motivation, show better learning outcomes. Motivation is the main driving force that directs students to be active in the learning process, more committed to completing tasks, and trying to achieve their academic goals.
4) This study shows that the family environment has a significant influence on student learning outcomes. A supportive family environment, whether in the form of parental attention to education, the formation of good learning habits, or the provision of adequate learning facilities, can improve student learning outcomes. Students who receive strong support from their families tend to have higher motivation and enthusiasm for learning, which leads to better academic achievement.

5) Learning independence has a positive influence on student learning outcomes. Students who are able to organize and manage their learning time independently, plan learning activities, and find solutions to problems faced during learning tend to achieve better results. Learning independence allows students to be more responsible for their learning process, which in turn encourages them to try harder and achieve optimal academic results.
6) The family environment plays an important role in indirectly influencing student learning outcomes, through learning motivation. When the family environment supports by providing attention and encouragement to learn, students become more motivated. This high motivation then contributes directly to achieving optimal learning outcomes.
7) Learning independence also has an indirect effect on learning outcomes through learning motivation. Students who are able to learn independently will develop the motivation to continue to progress, and feel more confident in achieving academic goals. This learning independence encourages students to try harder in learning, which ultimately results in better academic achievement.

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Enhancing Students' Critical Thinking through an Ethnophysics Module with a Scaffolding Approach

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ABSTRACT

Contextual learning resources that follow the characteristics of students are still needed. Meanwhile, learning resources are still general and have not been adjusted to students' characteristics and learning environments. In addition, the Indonesian curriculum aims to strengthen the profile of Pancasila students. Critical thinking is one of the six main characteristics of the Pancasila student profile. The ethnophysics module with a scaffolding approach can be a learning resource that provides information in the form of physics material combined with local wisdom to contextualise it with a scaffolding approach. The scaffolding approach is used for students to achieve their potential abilities, namely critical thinking. The study aimed to determine the effect of implementing the ethnophysics module with a scaffolding approach on students' critical thinking skills. This study used an experimental method with a pretest-posttest control group design. The research subjects comprised 23 students from the experimental class and 29 from the control class. The test instrument consisted of pretest and post-test critical thinking questions. The study found a significant effect of the ethnophysics module with a scaffolding approach on students' critical thinking skills, as seen from the n-gain score and effectiveness test using Mann-Whitney U on students' critical thinking skills as seen from the n-gain score and effectiveness test using Mann-Whitney U.

Keywords: Critical thinking, ethnophysics, scaffolding approach

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1. INTRODUCTION

Learning resources available in schools are generally textbooks. The evidence came from interviews with physics teachers at Permata Kasih High School, who reported relying on textbooks during classroom instruction, especially physics instruction. However, these textbooks are only used during class learning and must be returned once the physics instruction ends. As a result, students only access learning resources during class hours. Furthermore, this textbook contains minimal integration of local culture or wisdom. It presents examples within global or national contexts, which may not be appropriate for Indonesian students due to their significantly different cultural backgrounds. Textbooks often ignore the cultural background and local conditions in which students live. Consequently, the content of this book is irrelevant and lacks contextual meaning for students (Makhmudah et al., 2019; Safitri et al., 2018; Widyaningrum et al., 2013). For instance, using industrial or urban contexts is unfamiliar to students from rural or culturally distinct areas.

Non-contextual material makes it difficult for students to understand the material because the content feels far from their everyday lives. It was also identified in the study by Sari et al. (2018), which found that students experienced difficulty comprehending material due to the lack of contextual relevance in the textbooks. Implementing contextual learning significantly enhances students' ability to understand and apply concepts in real-life situations (Rutumalessy et al., 2023). When the material is not linked to the environment around the students, they become less motivated to learn, as they struggle to perceive the practical benefits of what is being learned. Conversely, Rutumalessy et al. (2023) said that students feel more motivated to learn when they see the connection between the material and their daily lives. Consequently, students' engagement in learning will also be affected. Students may be unable to participate actively because they are not encouraged to relate new knowledge to their personal experiences or local culture. It leads to surface-level learning, where students tend to memorize content rather than develop meaningful conceptual understanding.

Meanwhile, Education in Indonesia is guided by the Indonesian Curriculum, which sets specific learning outcomes for students, including the Pancasila Student Profile. This profile encompasses a set of competencies that students are expected to acquire, including critical thinking skills (Satria et al., 2022) Critical thinking, defined as the systematic analysis and evaluation of problems based on reasoned judgment and personal perspective, is a crucial skill for students to develop (Firdaus et al., 2019). Students with good critical thinking skills will find it easier to make decisions or conclusions from a problem. However, students' critical thinking skills remain relatively low. Several studies have reported students struggling to solve problems that require higher-order thinking. Therefore, it is essential for teachers to continuously innovate instructional practices by integrating subject materials with cultural contexts (ethnophysics) and adopting effective learning strategies that promote the development of students' critical thinking skills.

Ethnophysics modules offer an alternative solution for providing contextual and relevant learning resources to the students' environments. This module offers materials related to the local wisdom of the region where students reside. The module can also improve learning outcomes and student skills, and support independent learning with or without teacher guidance (Lestari & Apsari, 2022; Puspitasari, 2019; Utami et al., 2018). In addition, it helps students become more familiar with local culture and contribute to its preservation (Hidayanto et al., 2016). The module is designed systematically and engagingly as a student learning guide. Generally, module formats include a title, table of contents, information map, competency objective, an overview of the material, connection to other topics, material descriptions, assignments, summaries, glossary, final task, and index (Mudzakir, 2010). Some more specific formats incorporate learning content, methods, objectives, self-learning instructions, and practice questions. Modules are made to provide learning resources according to the characteristics, settings, and backgrounds of students' social environment and the characteristics of the teaching materials (Hamdani, 2011).

Teaching module with contextual learning material content allows students to learn according to their characteristics. However, there also needs to be a strategy that can help teacher trains students to think critically. Thus, this study aims to implement instruction through an ethnophysics module with a scaffolding approach. Scaffolding is the assistance given by a more knowledgeable individual to Help a learner complete tasks that are difficult or that the learner finds challenging. This support is provided so that the individual can achieve their potential abilities. Scaffolding can take various forms, such as structured tasks, identifying meaningful contexts, simplifying the problem, making connections, and parallel modelling (Anghileri, 2006)**.** Scaffolding has the potential to enhance student's skills, such as developing higher-order thinking skills when applied in the classroom (Eveline et al., 2019)

Integrating ethnophysics in the module aims to facilitate students' understanding of physics by linking physics concepts with local wisdom. This integration may enhance the relevance of learning. This approach is implemented by gradually training students' thinking skills. Hence, this combination of learning strategies is expected to support students in promoting their critical thinking skills. Therefore, this study aims to investigate the impact of implementing a physics module based on the local wisdom of the Dayak Keninjal tribe in Malawi Regency, West Kalimantan, and a scaffolding approach to students' critical thinking skills. The findings of this research are expected to support contextual learning and the implementation of the Indonesian Curriculum. Indonesian curriculum emphasizes designing instruction that considers the characteristics and needs of students to foster meaningful student learning experiences (Anggaena et al., 2022)

2. RESEARCH METHOD

This study is an experimental study with a pretest-posttest control group design. Two classes are the experimental and control classes (Table 1).

Table 1. Research Design

Kelompok	Pretest	Perlakuan	Posttest
E	O1	X1	O2
K	O3	X2	O4

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Where E is the experimental class, K is the control class, O1 is the pretest in the experimental class, O2 is the posttest in the experimental class, O3 is the pretest in the control class, and O4 is the posttest in the control class. X1 is learning using the ethnophysics module with a scaffolding approach, and X2 is learning using the lecture method without using learning media.

This design compares the initial (pretest) and the final (posttest) tests in the experimental and control classes. The test in each class is carried out twice, namely the test before treatment (pretest) and the test after treatment (posttest) (Sugiyono, 2016)**.** Experts first validated the items. The validation results indicated that the items were appropriate for assessing students' critical thinking skills. The experts evaluated the items based on content, construction, and language (Table 2). According to Aiken's V table for seven raters with four rating categories and a 1% chance of error, the minimum acceptable V value is 0,86. When compared with the V values of each test item, it was found that all items met or exceeded the minimum V value, indicating that the questions are valid for measuring students' critical thinking skills (Aiken, 1985)**.**

Table 2. Results of Expert Validation of the Critical Thinking Test Instrument

Question's Number	V's Aiken	Keterangan
1	0,95	Valid
2	0,95	Valid
3	0,90	Valid
4	0,95	Valid
5	0,90	Valid

The population was students from four 10th-grade classes at Permata Kasih High School. The sample consisted of students from Class X Alpha and Class X Beta, designated as the experimental and control groups. The experimental group comprised 23, while the control group comprised 29.

The experimental class learned using modules, while the control class learned using the lecture method with a whiteboard as the media. Teachers at the school often use the lecture method for the 10th-grade Science subject. The module used contains material that integrates the local wisdom of the Dayak *Keninjal* tribe, namely the concept of energy in the Dayak *sipet* (Dayak blowgun), where the blowgun bullet, commonly called *damak* when blown, will fly. The flying *damak* has energy in it. In addition, the concept of energy is also included in the activities of *nutuk* padi (pounding rice) and the *peloper* (catapult) game. Learning activities are designed as many as three: learning activities about energy, forms of energy, and the law of energy conservation. The module is also made by integrating the scaffolding approach. The scaffolding approach in the module is in the form of assistance in solving practice questions, namely instructions for solving questions (helpful tips). In addition to the module, the scaffolding approach is also applied to learning activities in the classroom. The module used can be seen in Figure 1.

After the learning process had been done in both classes, we analyzed students' critical thinking skills using the n-gain test and t-test. N-gain was used to determine the increase in students' critical thinking skills. In contrast, the t-test was used to evaluate learning effectiveness using the ethnophysics module with a scaffolding approach. The research data obtained were scores from critical thinking skill test questions with aspects of critical thinking skills measured, taken from Polya, namely interpretation, analysis, evaluation, and inference. The data were then analyzed using N-Gain. The N-Gain score was used to determine the extent to which students' critical thinking skills and learning independence had increased. The following equation was used to calculate N-Gain (Hake, 1998).

$$N - Gain = \frac{posttest\ score - \ pretest\ score}{maximum\ score\ - \ minimum\ score}$$

The N-Gain categories can be seen in Table 3.

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Table 3. N-Gain Score Categories

Score	Pretest
0.70-1.00	High
0.31-0.69	Medium
0-0.30	Low

Nonparametric statistics were used to analyze the data because the research results did not meet some of the requirements for using parametric tests. Therefore, this study conducted a nonparametric statistical test using the Mann-Whitney U Test. The Mann-Whitney U Test was used to see the effectiveness or difference between the control class and the experimental class in terms of each dependent variable (critical thinking skills and student learning independence).

Mann-Whitney Test Hypothesis

H0 There is no significant effect of the ethnophysics module with a scaffolding approach on students' critical thinking skills.

H1 There is a significant effect of the ethnophysics module with a scaffolding approach on students' critical thinking skills.

The basis for decision-making in the Mann-Whitney Test: 1. If the Asymp. Significance value (2-tailed) < 0.05, then Ho is rejected, and Ha is accepted; 2. If the Asympt. The significance value (2-tailed) is> 0.05, and then Ho is accepted, and Ha is rejected (Sugiyono, 2017).

Fig 1. Example of Content in Ethnophysics Module



Pendahuluan

Pernahkah kalian melihat alat yang disebut sumpit atau *sipet* dari suku Dayak? Sumpit suku Dayak merupakan salah satu alat yang dimanfaatkan oleh masyarakat suku Dayak untuk berburu hewan di hutan. Sumpit dilengkapi dengan anak panah atau peluru sumpit yang dinamakan sebagai *damak* atau disebut juga anak sumpit. *Damak* dilumuri dengan racun dari getah tumbuhan *ipu* atau *siren* yang berfungsi untuk mematikan hewan buruan.

Gambar 1 Sumpit suku Dayak dan peluru sumpit (damak) (Sumber: https://www.carousell.com.my/)

Sejauh ini, sumpit Dayak tidak hanya digunakan untuk berburu namun digunakan sebagai alat permainan atau perlombaan dalam acara khusus suku Dayak yang dikenal

1 | Modul Konsep Energi

Gawai Dayak. Kita dapat menemukan konsep fisika pada proses kerja alat sumpit Dayak. Konsep energi terdapat dalam proses kerja alat sumpit Dayak. Selain konsep energi, juga dapat dijelaskan konsep gerak parabola pada sumpit Dayak yang akan Anda dipelajari lebih lanjut pada tingkat selanjutnya.

Gambar 2 Lomba menyumpit pada acara gawai suku Dayak di Kalimantan (Sumber: www.pariwisataindonesia.id)

Pada modul ini, Anda akan mempelajari konsep energi pada berbagai bentuk dan contoh dalam kehidupan sehari-hari secara khusus pada kegiatan berburu menggunakan sumpit Dayak dan kegiatan *nutuk* padi. Terdapat beberapa konsep fisika yang dapat dijelaskan pada sumpit Dayak dan kegiatan *nutuk* padi. Namun, Modul ini akan berfokus pada konsep energi.

Setelah mempelajari modul ini, Anda diharapkan mampu:

Modul Konsep Energi | 2

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3. RESULTS AND DISCUSSION

A. The Improvement of Students' Critical Thinking Skills

The improvement in students' critical thinking skills before and after using of the ethnophysics module in both the experimental and control classes was measured using the N-Gain score. The results are presented in Table 4.

Table 4. Improvement in Students' Critical Thinking Skills and Learning Independence

	Class			
	Control		Experiment	
Critical Thinking Skills	0.31	Medium	0.52	Medium

As shown in Table 4, there was an increase in critical thinking skills based on the N-Gain scores. However, the critical thinking N-Gain score category remained in the "medium" range for both classes, although the experimental class achieved a higher score than the control class. Critical thinking is an aspect of learning outcomes that requires continuous effort to develop significantly. Critical thinking is in the skill domain of learning outcomes. Therefore, this skill must be trained continuously to reach a high proficiency level. This finding is consistent with Suryanti et al. (2017), who emphasized that critical thinking skills must be developed using appropriate topics and materials to achieve meaningful growth.

B. Effectiveness of Learning Using Ethnophysics Module with Scaffolding Approach

Table 5 below presents the results of the Mann-Whitney U test for the dependent variable of critical thinking skills.

Table 5. Results of the Mann-Whitney U Statistical Test for Critical Thinking Skills

Test Statistics[a]

	Kemampuan Berpikir Kritis
Mann-Whitney U	170.500
Wilcoxon W	605.500
Z	-3.006
Asymp. Sig. (2-tailed)	.003

a. Grouping Variable: Kelas

The results of the Mann-Whitney U test show an Asymp. Sig. (2-tailed) value of 0.003, which is smaller than the significance level of 0.05. Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. It indicates that the ethnophysics module with a scaffolding approach significantly influences students' critical thinking skills. In other words, there is a significant difference in the critical thinking skills scores between the experimental and control classes. It is evident from the difference in the average posttest scores of students' critical thinking skills between the experimental and control classes (Table 6), where the average posttest score of the experimental class ($\bar{x} = 55{,}3$) is higher than that of the control class ($\bar{x} = 36$).

Table 6. Average Posttest Score of Students' Critical Thinking Skills

Class	Average Posttest Score	Maximum Score	Minimum Score
Eksperiment	55,3	80	10
Control	36	57,5	5

The statistical test results indicate that learning through an ethnophysics module with a scaffolding approach is more effective than learning through the conventional lecture method. Similar findings were reported by Stelzer et al. (2009), who found that students who used modules performed significantly better than those who relied on traditional textbooks. Integrating local wisdom from the Keninjal Dayak tribe into the physics module provides a contextualized learning resource that meets students' needs. This module was specifically developed to support the learning needs of students of the Keninjal Dayak tribe, aiming to facilitate a better understanding of physics concepts. The concept of energy, illustrated through examples commonly encountered in daily life, is expected to help students from the Keninjal Dayak tribe and the Melawi Regency better understand physics concepts. The material explanations are supplemented with images to assist students in relating theoretical concepts to examples from everyday life. The cognitive process involves students connecting physics concepts to familiar situations or environments. This process can improve student understanding (Dasilva et al., 2019). Presenting physics concepts with the local wisdom of the Dayak Keninjal offers an alternative approach to developing contextual learning resources for students in the Melawi Regency.

In addition, the module was developed using a scaffolding approach. This scaffolding approach in the module assists students as they engage in independent learning. Scaffolding refers to the support offered by more knowledgeable individuals or adults to help learners accomplish tasks they cannot complete independently (McDevitt & Ormrod, 2002). It is associated with Vygotsky's zone of proximal development (ZPD) concept, which plays a crucial role in developing students' cognitive and personal growth. The ZPD represents the distance between the child's actual development level, defined as the ability to solve problems independently, and their potential development level, defined as the ability to solve problems with guidance from a more capable individual. Vygotsky believed that children will experience development and achieve specific expected abilities if given assistance or guidance. Based on this concept, it can be concluded that children (in this case, students) can reach their potential skills or abilities expected by the teacher if given assistance or guidance (Margolis, 2020). Therefore, the module was developed using a scaffolding approach, a learning approach to the ZPD concept, by assisting students in achieving the expected abilities.

The scaffolding approach in the ethnophysics module offers assistance through instructions for solving questions, providing parallel examples, and explaining additional materials. Determining the assistance is guided by several examples of scaffolding from Anghileri (2006)**.** The module provides instructional guidance (instructions for solving problems) and presents additional material to support students in completing exercise tasks, which are categorized as prop scaffolds. In addition, the module provides examples of questions parallel to the task categorized as parallel modelling. Parallel modelling is a scaffolding technique that offers examples of solving or completing tasks with characteristics similar to those assigned to students (Anghileri, 2006).

Assistance is provided to help students who have difficulty understanding the material can more easily learn the material presented. For instance, the energy material in the developed module requires prerequisite knowledge, such as the concept of work, which relies on an understanding of trigonometry. The developed module assists in understanding the concept by explaining additional prerequisite material to help students understand the energy material more easily. Furthermore, when students encounter difficulties completing the practice questions, they are supported through detailed instructions and examples of parallel problems. Through the scaffolding provided in the module, it is expected that students will be able to achieve the learning objectives set by the teacher, particularly in mastering the material more effectively.

The findings of this study are relevant to the research conducted by Kurniawan & Syafriani (2021), who developed a module based on local wisdom. Their results indicated that the module was appropriate for physics instruction. Learning materials integrated with local culture provide students with new knowledge and understanding. Students may struggle to connect scientific knowledge with their cultural context or everyday life examples without linking learning materials to examples of local wisdom from

the students' environment (Syahmani et al., 2022). Therefore, developing learning resources integrating scientific knowledge, particularly physics, with local wisdom plays a crucial role in enhancing students' understanding and knowledge acquisition.

4. CONCLUSION

Relevant and contextual learning resources are still essential in classroom-based physics education. Based on the experimental results, the finding indicates that applying an ethnophysics module integrated with a scaffolding approach impacts students' critical thinking skills. The module supports students who struggle to understand the material by presenting content through examples that are familiar and relatable examples.

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Performance Baseline and Recommendations for the Development of Islamic Education at MTsN 3 Surabaya

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ABSTRACT

This study aims to analyze the baseline of performance achievements, the implementation of Madrasah Self-Evaluation (EDM), and formulate recommendations for the development of Islamic education in MTsN 3 Surabaya. This study uses a qualitative approach through field and analytical descriptive methods. Data were collected through observation, interviews, documentation, and literature review. The results of the study show that MTsN 3 Surabaya has a structured and good performance baseline, and has the trust of the community. The implementation of EDM routinely has a significant impact on improving the quality of madrasas. Recommendations for educational development formulated after EDM have proven to be relevant and support the growth of madrasas. However, there are still challenges in terms of funding and infrastructure optimization. Madrasah recommends several developments, including improving teacher competence, building and renovating facilities such as libraries, laboratories, and health facilities. In addition, religious programs are also offered to strengthen the identity of Islamic education. With structured management and the right strategy, MTsN 3 Surabaya is expected to continue to develop as a superior Islamic educational institution, adaptive to the changing times, and able to produce a balanced generation between science and Islamic values.

Keywords: ***performance baseline , madrasah self-evaluation, development of islamic education***

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1. INTRODUCTION

Islamic education has a very important role in shaping the character, morals, and personality of Muslims. The main goal is not only so that students are smart in general lessons, but also so that they understand religion and can live their lives according to Islamic teachings. Therefore, Islamic education plays a very important role in creating a good generation and beneficial to society. In today's era that continues to change and is increasingly full of challenges, Islamic education must also develop. In order to continue to be able to answer the needs of society and an increasingly complex world, the quality of Islamic education must continue to be improved and adjusted to the development of the times.

In the journal of religious science entitled "Economic Problems and Da'wah: A Study of the Reality of Access to Education in Islamic Boarding Schools and the Impact of Costs" it is explained that along with the development of times and technology, the cost of education also continues to increase so that it becomes one of the main factors that hinder students' access to education, especially for underprivileged families. The journal also explained the impact of rising costs and solutions to overcome these problems. (Scotland, 2024)

Meanwhile, in the journal of Islamic religious education and Islamic education management entitled "Strategies for the Implementation of Risk Management in Increasing Students' Learning Interest in SMK Muhammadiyah 1 Kadungora" it is explained about the strategic management of Islamic educational institutions that have been made and also have risks to be faced, in the article the author explains how the role of risk management in the management of the strategy is made. In addition, strategy management is a process that directs all members of the organization to succeed in the strategy that has been made. One of the factors that hinders the success of the strategy is the interest of interested students. (Tanti Fitri, 2023)

In an education and counseling journal entitled "The Implementation of Strategic Management in Improving Islamic Education Management", Nawawi said that strategic management is a process or series of decision-making activities that are fundamental and comprehensive, accompanied by determining how to implement them, which are made by top management and implemented by all ranks

in an organization, to achieve their goals. (Asmarina Siregar, Era Yunita, Indri Sofia, Maulina, Rahmat Effendi, 2022)

Educational management is actually a way to organize all activities in schools or educational institutions to run well and according to the goals. So, everything such as teachers, students, lesson schedules, and school facilities is arranged to support the teaching and learning process to the maximum. Meanwhile, education management strategies focus more on how everyone involved in the school—from principals, teachers, to other staff—can work together with a clear goal. Thus, the results of the educational process can be better and the quality of the institution will improve. (Ramdani, 2023)

In addition, recommendations for the development of Islamic education are very important to ensure an adaptive and competitive education system. There are many recommendations offered as a form of strategy for developing the quality of Islamic education, one of which is collaboration with various parties to expand access and quality of Islamic education.

In an effort to improve the quality of Islamic education, a comprehensive evaluation of the performance of educational organizations is needed. The baseline of performance achievement results is an initial benchmark that can be used to assess the effectiveness of the system that has been running. Self-evaluation is also needed to identify strengths, weaknesses, opportunities, and challenges in Islamic education units. Furthermore, development recommendations need to be formulated systematically so that the improvement stages can be implemented appropriately.

Based on the above explanation, there is a need for further study of the baseline of the performance of Islamic education organizations, the results of self-evaluation of the achievements and challenges faced by Islamic education units, as well as the sequence stage of providing recommendations that can help MTsN 3 Surabaya in developing an Islamic education system that is of higher quality and relevant to the needs of modern society.

Islamic education at Madrasah Tsanawiyah Negeri (MTsN) has a strategic role in shaping the character and competence of students. As an educational institution that integrates general science and Islamic values, MTsN is required to continue to improve the quality of education in order to be competitive in the era of globalization. In this context, MTsN 3 Surabaya as one of the leading madrasas needs to evaluate its educational performance in order to get an idea of the effectiveness of learning and the obstacles faced.

Evaluation of the performance baseline of MTsN 3 Surabaya is important to find out the extent of the achievements that have been obtained in academic aspects, religious aspects, managerial and organizational aspects, as well as participation and partnership aspects. This research was carried out with the aim of analyzing the performance baseline, Madrasah Self-Evaluation (EDM), and formulating recommendations for the development of Islamic education in MTsN 3 Surabaya. The first step of the purpose of this article is to identify the strengths, weaknesses, opportunities, and challenges faced by madrassas in carrying out their functions as quality Islamic educational institutions. By understanding the latest or current conditions, development recommendations can be designed in a more targeted and data-driven manner.

Several factors such as curriculum, teacher competence, infrastructure, and parent and community participation are the main variables that determine the success of education at MTsN 3 Surabaya. Therefore, this study will examine in depth various aspects that affect the performance of madrasas. Not only that, the resulting recommendations are expected to make a real contribution to efforts to improve the quality of Islamic education at the Madrasah Tsanawiyah (MTS) level. With this research, it is hoped that MTsN 3 Surabaya can further develop as a superior Islamic educational institution, adaptive to the changing times, and able to produce a generation that has a balance between science and Islamic values.

All the problems studied will be analyzed in this article entitled "Performance Baseline and Recommendations for the Development of Islamic Education in MTsN 3 Surabaya" This article aims to explain the results of the study and provide a clear picture of the condition of Islamic education and strategic steps that can be taken to improve Islamic education today.

2. RESEARCH METHOD

In this study, the author uses the type of field research or field research in depth and detail as well as an analytical descriptive approach to explore the phenomenon that occurs in MTsN 3 Surabaya, using

qualitative research methods. Romlah, 2021) This research is focused on the baseline of performance achievements, evaluation, and recommendations for determining the conditions and direction of development of Islamic education units in MTsN 3 Surabaya.

In addition, qualitative research is descriptive. The collected data is presented in the form of words and pictures. The research report contains data citations as illustrations and factual support in the presentation. This data includes interview transcripts, field notes, photographs, videos, tapes, documents, and other recordings. In understanding the phenomenon, researchers try to analyze as richly as possible as possible as close to the form of data that has been recorded. (Romlah, 2021)

The data sources used in this study are primary data and secondary data. Primary data are the results of observations, interviews, and documentation conducted by researchers, because this research is a field research. Meanwhile, secondary data is data taken from writings or books related to the theme or theory being researched.

3. RESULTS AND DISCUSSION

A. Baseline of Organizational Performance Achievements in Islamic Education Units at MTsN 3 Surabaya

Islamic education units play an important role in producing a generation that is not only skilled in general knowledge but also has a solid understanding and application of Islamic values. To ensure the effectiveness and efficiency of education implementation, a measurement tool is needed that can objectively assess the performance of Islamic education organizations. One of the measuring tools used is the baseline of organizational performance achievements.

Baseline is the initial data or reference point used to measure changes or developments in a condition before intervention or improvement is made. A baseline is a starting point that is used as a basis for assessing an organization's performance by determining what it wants to achieve and describing the results of the project. Syafi'i, 2024) The baseline of organizational performance achievements in Islamic education units are two initial data that are used as benchmarks to assess the effectiveness of the implementation of Islamic education in an institution. This baseline reflects the current conditions of various key aspects of education, including academic, religious, managerial, and partnership. The baseline serves as a reference in measuring the development and effectiveness of Islamic education units on a regular basis. MTsN 3 Surabaya is one of the madrasas that is often in demand by parents who want to register their children at the junior high school level. This madrasah is predicted to be a school that creates quality graduates in both academic and non-academic terms.

MTsN 3 Surabaya as one of the state tsanawiyah madrasas has a strategic role in producing a generation that excels academically, religiously, and has good organizational management with the support of participation from various parties. Therefore, it is important to measure the baseline of organizational performance achievements in Islamic education units. To get a comprehensive picture of the performance of Islamic education units, several key indicators are used in baseline measurements. As explained, the baseline of organizational performance results has several aspects of achievement, namely: academic aspects (graduation rate, academic achievement, and teacher competence), religious aspects (adherence to Islamic practices and integration of Islamic curriculum), managerial and organizational aspects (educational governance and infrastructure), and finally participation and partnership aspects (parental and community involvement and partnerships with Islamic institutions). (Shawn, 2024)

The baseline of organizational performance achievements in Islamic education units is an important element in measuring the effectiveness and efficiency of educational institutions. By understanding the main indicators, measurement methods, and challenges faced, Islamic education units can make more targeted and sustainable improvements. The use of accurate baselines also helps in data-driven policymaking to improve the overall quality of Islamic education.

MTsN 3 Surabaya also has all the aspects that have been mentioned, starting with the academic aspect, namely the use of a national and Islamic-based curriculum, adequate classroom facilities, and academic achievements. It is evidenced by all students graduating with grades in both general and religious subjects, and have academic achievements in general and religious subjects, as well as non-academic achievements. One of the factors that students can develop is with adequate and comfortable facilities, such as classrooms that are equipped with air conditioning, smart TVs, fans, and internet

networks that support learning, so that they can provide students with access to explore material that is not in the module. As for the teacher's own competence, MTsN 3 Surabaya always provides workshops or training for teachers who feel less competent in several fields. And the workshop that is attended must be in accordance with what is needed by the relevant parties.

Based on the results of observations from the religious aspect itself, this madrasah has a program of habituation of daily worship, tahfidz Al-Qur'an, BTQ, and ma'had which are attended by students. The daily habituation program that must be followed by students is to carry out dhuha prayers every morning before learning begins. Tahfidz Al-Qur'an was attended by several children who had achievements in this field, the BTQ Program which was attended by all madrasah students every morning after the implementation of daily worship habits. And the last is the ma'had program which is attended by several students who want to explore religious knowledge with special guidance such as in Islamic boarding schools.

This madrasah also fulfills good managerial and organizational aspects and is in accordance with the baseline, as evidenced by structured educational governance, adequate facilities and infrastructure, both mandatory facilities and supporting facilities such as: laboratories, places of worship, libraries, etc. Viewed from the aspect of participation and partnership, this madrasah strongly includes the role of parents and the community in every activity. In addition, this madrasah has strong support from parents and the community such as the holding of committee fees which are used to support school operations. Not only that, this madrasah also collaborates with the nearest Islamic boarding school for the implementation of religious activities that have been programmed.

In addition to the aspect of performance baseline assessment, there are also provisions for results and performance baseline evaluation. The results and evaluation of the performance baseline can be seen from the performance summary, improvement recommendations, and follow-up plan. Dewi Susita, n.d.) MTsN 3 Surabaya always identifies the strengths and weaknesses of the madrasah every year, after which the authorities provide a strategy to improve these weaknesses, and then is the follow-up of the improvement strategy. Like madrasas in general, MTsN 3 Surabaya also has shortcomings in several parts, this madrasah has shortcomings in the field of facilities and infrastructure, this is overcome by madrasah facilities and infrastructure staff and also assisted by other staff. After knowing what is lacking and how to improve it, the madrasah infrastructure staff will begin to apply for financial assistance to the office and start repairing what is lacking in madrasas. With evaluations that are routinely carried out every year, qualified graduates, and interesting learning programs make this madrasah always develop over time and become one of the madrasas that are very popular with the surrounding community.

Based on the results of the baseline analysis of organizational performance in Islamic education units and the results and evaluation of performance baselines, it can be concluded that academic, religious, managerial and organizational aspects, as well as aspects of participation and partnership at MTsN 3 Surabaya are well structured and can be carried out in accordance with the provisions. With the performance baseline, it is hoped that Islamic education units can develop more effective strategies to improve the quality of education and produce graduates who excel in academic and Islamic aspects.

In addition to optimizing academic, religious, managerial, and community participation aspects, MTsN 3 Surabaya also continues to strive to improve the quality of educators and education staff. Teachers in this madrasah are not only expected to master the subject matter in depth but must also be able to integrate Islamic values in every learning. To achieve this, madrasas routinely hold trainings, seminars, and workshops related to improving pedagogic competence, professionalism, and the use of technology in learning. This training includes the application of digital-based learning methods, improving teaching skills based on Higher Order Thinking Skills (HOTS), and strategies to instill Islamic character in students. With the improvement of the quality of teaching staff, it is hoped that the learning process in madrassas will be more innovative, interactive, and in accordance with the times.

In addition to increasing educators, this madrasah also maximizes the use of technology in the learning and administration system. Along with the development of the digital era, MTsN 3 Surabaya strives to utilize various digital platforms in the teaching and learning process. One of the innovations implemented is the use of the Learning Management System (LMS) to facilitate access to online learning materials. In addition, the use of digital-based applications for exams and academic assessments has also been implemented to increase efficiency in the evaluation of student learning

outcomes. Digitization of madrasah administration is also carried out to increase the effectiveness of managing student data, attendance, and learning outcome reports, so that all information can be easily accessed by teachers, students, and parents. With this structured system, MTsN 3 Surabaya can manage education administration better and transparently.

One of the main factors in creating a conducive educational environment is the availability of adequate facilities and infrastructure. MTsN 3 Surabaya realizes the importance of comfort and safety in the learning environment for students. Therefore, various efforts are still being made to improve school facilities. In addition to equipping classrooms with modern facilities such as air conditioning, smart TVs, and stable internet networks, the madrasah also plans to add more representative laboratory spaces to support experiment-based learning. In addition, library renovation by adding a collection of digital and printed books is carried out so that students have wider access to learning resources. Not only that, the improvement of sports facilities and extracurricular activities is also a concern of madrasas to support the development of students' potential and interest in non-academic fields.

In addition to academic aspects and facilities, strengthening the Islamic character is also the main focus of madrasas. Daily worship habituation programs such as dhuha prayers, Qur'an tahfidz, and recitation guidance aim to instill religious values from an early age. This program is integrated into students' daily schedules so that they are used to carrying out worship with discipline and full of awareness. The participation of students in religious activities outside the madrasah, such as visits to Islamic boarding schools and da'wah training, is also one of the strategies in forming a strong Islamic character. Thus, it is hoped that the graduates of MTsN 3 Surabaya are not only intellectually smart but also have good morals and are able to be an example for the community.

To ensure that all programs run optimally, madrasas also conduct regular evaluations through monitoring mechanisms and feedback from various parties, including teachers, students and parents. This evaluation is carried out by measuring the achievements of each program that has been implemented and identifying the obstacles faced. The results of the evaluation are the basis for madrasas in developing new strategies and policies to increase the effectiveness of education delivery. In addition, good coordination between stakeholders, including school committees, education offices, and external partners, is key in realizing high-quality and highly competitive madrasas.

With all the efforts that have been made, MTsN 3 Surabaya continues to show significant developments in various aspects of education. This madrasah is an example that Islamic education units can compete with other educational institutions while maintaining the Islamic values that are its hallmark With the full support of all parties, both educators, students, parents, and the government, it is hoped that MTsN 3 Surabaya can continue to develop into a superior madrasah that gives birth to a generation of intelligence, virtuous ethics, and is ready to face future challenges.

B. Description of the Results of Madrasah Self-Evaluation of Achievements and Challenges Faced

Madrasah Self-Evaluation is one of a series of activities in the process of assessing the quality of education implementation carried out by stakeholders at the madrasah level, which is guided by the National Education Standards (SNP). In an effort to improve the quality of education, the culture that develops in the madrasah environment plays a very important role. The culture of discipline, for example, does not only apply to students, but must also be instilled in teachers, madrasah heads, and all madrasah residents. Disciplines that are believed to be consistently able to encourage the achievement of various educational standards, such as Content Standards, Process Standards, Graduate Competency Standards, and Management Standards. To measure the success of this discipline culture, seven indicators are used as a reference.

In addition, it is also important to foster a culture of self-development among teachers and education staff. When educators have the enthusiasm to continue learning and improve their competence, the Standards of Educators and Education Personnel can be achieved more optimally. This culture is measured through four main indicators that reflect how active and serious teachers and education staff are in developing themselves. No less important is the teacher's culture in planning, implementing, and assessing the learning process. The teacher's diligence in carrying it out comprehensively has a great influence on the quality of education provided. This work culture is closely related to the achievement of Process Standards and Assessment Standards, which are evaluated through seven specific indicators.

Madrasas also have a big role in providing adequate learning facilities for students and teachers. Culture provides learning facilities not only to complement the classroom, but rather to the awareness that facilities are an important part of supporting the teaching and learning process. This culture supports the achievement of Facilities and Infrastructure Standards, and its success is measured through five indicators. Finally, cultural transparency in budget management and a focus on quality improvement need to be instilled in madrasah governance. When madrasas are managed openly and efficiently, public trust increases and the quality of education is also raised. This culture is the driver for the achievement of Financing Standards, which are evaluated through three main indicators. (Muhtasar, Fahrurrozi, 2023)

The self-evaluation of the madrasah at MTsN 3 Surabaya shows that most of the facilities and infrastructure have met national standards, especially in the provision of comfortable classrooms with facilities such as good ventilation, sufficient lighting, internet network, fans, air conditioning, and multimedia devices. The madrasah has also made various efforts to improve the quality of education, including building new classroom buildings with SBSN funds and implementing a routine maintenance system for existing facilities. In addition, religious habituation programs such as reciting and praying dhuha also continue to be implemented to form a better character of students.

However, there are still several challenges faced, such as land use that is not optimal for libraries, laboratories that do not support learning, and health spaces that do not meet national standards. In addition, limited funds are the main obstacle in the procurement of supervision and maintenance of facilities, considering that madrasas do not collect fees from students and only rely on BOS funds, committee fees, and government grants. The capacity of the study room is also a concern, because the limitation of classrooms causes variations in the number of students in each study group.

As an improvement step, madrasas need to evaluate and re-plan land use, improve laboratory facilities to suit the curriculum, and renovate health spaces to make them more suitable for use. In addition, the search for alternative funding sources such as grants or CSR from the private sector can help in the procurement of better facilities. The development of technological infrastructure, such as improving internet networks and multimedia devices, also needs to be done so that learning is more effective.

C. Stage of Recommendation Sequence of Determination of Conditions and Direction of Madrasah Development

Madrasah development is a process that must be carried out systematically by going through several important stages, ranging from analyzing current conditions, identifying challenges and opportunities, formulating strategies, to program implementation and evaluation. With a structured approach, madrassas can develop into educational institutions that are superior, innovative, and adaptive to the development of the times. Support from various parties, both the government, educators, the community, and students, is needed to achieve the goal of developing quality madrasas. After the madrasah conducts a self-evaluation and compiles a madrasah profile, there are many suggestions on what needs to be done to improve the quality of education in the madrasah after the results of the EDM or the conclusion of the madrasah profile. However, given the limitations of madrasas in terms of human resources, infrastructure, funds, and time, it is impossible for madrassas to follow all the recommendations or conclusions of the madrasah profile.

The stage of the recommendation sequence in determining the conditions and direction of madrasah development generally involves systematic steps to analyze, plan, and implement development strategies. The stages are as follows: 1. Evaluation of the condition of the madrasah (initial assessment), 2. Identify problems and challenges that are the main obstacles, 3. Preparation of strategic planning for development (short-term, medium-term, to long-term), 4. Implementation and strengthening of policies, 5. Periodic monitoring and evaluation. (Mustofa, n.d.)

Based on the results of observations at MTsN 3 Surabaya, the determination of the conditions and direction of its development was carried out in several systematic stages. The first stage is the evaluation of the condition of the madrasah, namely by analyzing the condition of existing facilities and infrastructure, including the use of space, the completeness of facilities, and the obstacles faced, such as library land that is not optimal, laboratories that do not support learning, and health spaces that do not meet national standards. After knowing what are the weaknesses of the madrasah, problems and challenges are identified to find out the main obstacles in the management of infrastructure and resources, including limited funding and lack of optimization of available facilities.

Based on the results of the evaluation and identification of these problems, madrasas need to prepare a strategic development plan that includes short, medium, and long-term plans. The main focus in this strategy is land use optimization, improvement of laboratory facilities, renovation of health spaces, and strengthening digital infrastructure such as internet networks and multimedia devices. In order for this plan to be realized, madrasas must search and optimize funding sources, either through submitting proposals to the central government through the Simpro application, seeking grants or CSR from the private sector, and managing BOS funds and committee fees more effectively.

After funding sources are available, the next step is the implementation of the development of facilities and infrastructure by carrying out renovation or facility construction according to the priority scale. The main projects that need to be carried out include the construction of new library rooms, laboratory renovations, and the improvement of madrasah health facilities. To ensure the sustainability of facility management, madrasas also need to conduct periodic monitoring and evaluation of the effectiveness of the facilities and infrastructure that have been developed. This evaluation aims to ensure that all facilities function optimally in support of the learning process. In addition, more effective internal coordination, such as the use of WhatsApp groups for reporting on facility conditions, can be a quick solution in dealing with problems that arise.

By following this stage systematically, it is hoped that MTsN 3 Surabaya can continue to develop into a quality madrasah with better facilities and in accordance with national education standards. In addition, the active participation of all madrasah residents, including teachers, students, and parents is needed in supporting the development of facilities and infrastructure. This involvement can be realized through mutual cooperation programs, independent fundraising, and the use of alumni to contribute, both in the form of materials and expertise. Madrasas can also establish partnerships with universities or other educational institutions to get assistance in managing facilities and improving the quality of learning. With the synergy between various parties, it is hoped that each stage of development that has been planned can run more effectively and have a positive impact on the entire academic community of MTsN 3 Surabaya.

Madrasah is a very important place to educate children, not only in science, but also in the formation of character and morals. To make madrasas develop well and provide great benefits for students, we need to evaluate and develop in a planned manner. This process must go through several stages, namely analysis of current conditions, identification of challenges and opportunities, and formulation of appropriate development strategies.

The first stage is an analysis of the condition of the madrasah which includes several aspects, such as human resources, facilities and infrastructure, as well as curriculum and learning. In the aspect of human resources, evaluations are carried out on academic qualifications and teacher competencies, the welfare of educators, and the availability of adequate teaching staff. Aspects of facilities and infrastructure include the availability of classrooms, laboratories, libraries, learning support technology, and cleanliness and comfort of the madrasah environment. Meanwhile, curriculum and learning aspects include curriculum conformity with national standards, the effectiveness of learning methods, and extracurricular activities that support education.

After analyzing the condition of the madrasah, the next step is to identify the challenges and opportunities faced. The main challenges that madrasas often face include budget limitations, lack of qualified educators, low community participation, and competition with other educational institutions. However, there are also opportunities that can be utilized, such as government support in madrasah education programs, technological developments that can be integrated in learning, and increasing public awareness of the importance of Islamic-based education.

This strategy includes strengthening human resources through training and improving the welfare of educators, improving facilities and infrastructure with funding from the government and the private sector, developing a curriculum that is more adaptive with digital-based learning methods, and improving relationships with the community through good communication and scholarship programs for outstanding students.

After the development strategy is designed, the next stage is the gradual implementation of the program by involving all stakeholders, such as madrasah heads, teachers, students, and the community. This implementation must be supported by transparent budget management, strict monitoring, and assistance from experts in certain fields. In addition, periodic evaluation of the program is necessary to

measure success, identify obstacles that arise, and make recommendations for improvement for the next period.

The development of madrassas is a process that must be carried out systematically and in a structured manner. With the right steps, madrasas can develop into educational institutions that are superior, innovative, and adaptive to the development of the times. Support from various parties, both the government, educators, the community, and students, is needed to achieve the goal of developing quality madrasas.

4. CONCLUSION

From the results of the author's research, it can be concluded that MTsN 3 Surabaya has a well-structured performance baseline in academic, managerial, and infrastructure aspects that make this madrasah in demand by the community. The performance baseline has 4 aspects, namely: 1. Academic aspect, 2. Religious aspect, 3. Managerial and organizational aspect, 4. Participation and partnership aspect. If all aspects of the performance baseline have been met, results and performance evaluations will be formed, this evaluation can be carried out using Madrasah Self-Evaluation (EDM). The implementation of Madrasah Self-Evaluation (EDM) which is carried out regularly can make a positive contribution to improving the quality and performance of madrasas, as well as providing a clear picture of strengths and weaknesses that need to be improved. Armed with the results of self-evaluation, the madrasah proposed several recommendations for the development of Islamic education. The proposed recommendations include improving teacher competencies and building new infrastructure to support the development of Islamic education.

Although it has many good aspects, madrassas face challenges in terms of funding and optimization of existing infrastructure, so it requires better attention and planning. With the right strategy such as collaboration with various parties, MTsN 3 Surabaya is expected to continue to improve the quality of Islamic education and produce graduates who are competitive according to the needs of the times. With this conclusion, the article affirms the importance of periodic evaluation and planned development to achieve a better quality of education in madrassa

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Reconstructing Teacher Authority and Student Motivation: A Critical Discourse Analysis of Student Resistance among Generation Z in Great Teacher Onizuka

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ABSTRACT

This research explores student resistance, teacher authority, and motivation growth among Generation Z learners through Van Dijk's critical discourse analysis in the Japanese series Great Teacher Onizuka (GTO). Using a qualitative descriptive method, this study analyzes selected scenes from episodes 1 to 8, supported by relevant literature and online sources. Data were collected through observation, reading, and note-taking, and analyzed using data reduction, display, and conclusion techniques. The findings show that: (1) The text structure includes macrostructure elements such as themes of resistance and transformation, superstructure through the narrative plot, and microstructure in semantic (meaning, details), syntactic (sentence forms), and stylistic (tone, diction) aspects. (2) Social cognition reflects how both students and teachers construct meaning and interpret authority, empathy, and discipline. (3) Social context highlights how Generation Z's educational values and behaviors, shaped by digital culture and a desire for autonomy, challenge traditional schooling systems. The series illustrates how emotional intelligence and alternative teaching approaches can help bridge generational gaps and reconstruct authority in a more humane and effective manner.

Keywords: ***performance baseline , madrasah self-evaluation, development of islamic education***

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1. INTRODUCTION

For many years, teacher authority and student motivation have been major concerns in education. The emergence of Generation Z (born between 1997 and 2012) has introduced new challenges for educators, as this generation prioritizes autonomy, critical thinking, and digital engagement, contrasting with traditional, hierarchical teaching methods (Seemiller & Grace, 2016). Furthermore, Turner (2022, as cited in Binabise et al., 2024) stated that Generation Z, due to their constant exposure to digital media, has developed shorter attention spans, a preference for interactive learning, and a resistance to rigid, one-way instruction. Their dependence on electronic devices for entertainment, education, and communication has reshaped their learning preferences, making flexibility and engagement crucial in teaching approaches (Binabise et al., 2024). Consequently, traditional forms of teacher authority such as strict discipline and unquestioned obedience are often met with resistance, further widening the gap between educators and students (Twenge, 2017).

This phenomenon is evident in Indonesia, where student opposition to school authority has escalated. Instances of open defiance, disengagement, and even classroom disruptions have been reported. In South Barito, Central Kalimantan, Indonesia, for example, a high school student (HK, 16) was expelled for challenging his teacher to a duel after being reprimanded for improper attire (Detik, 2023). Additionally, between January and September 2024, 36 cases of violence in educational institutions were recorded, affecting 144 students. Among these, physical violence accounted for 55.5%, sexual violence 36%, psychological violence 5.5%, and policy-related violence 3% (Puslapdik Kemendikdasmen, 2024). Notably, 83.56% of these cases involved Generation Z students, while 27.78% involved Generation Alpha, particularly in elementary and middle schools.

In addition to raising awareness of the negative consequences of student resistance to school authorities, this issue has also been explored through various forms of media as part of broader social and cultural critiques. Among these, film stands out for its visual power, allowing it to depict the phenomenon of student opposition and influence public perception (Nafisa Aqilah & Surur, 2025). Furthermore, Nafisa

A & Surur (2025) argue that film can reflect social realities including student resistance through the portrayal of characters, dialogue, and narrative structures. One benefit of movies is that they can successfully convey a message by combining visual and aural communication (Simarmata et al., 2019). Popular culture captures this growing tension between students and educators, as exemplified in the Japanese film Great Teacher Onizuka (GTO). The film portrays the complexities of student resistance and a teacher's unconventional approach to regaining authority and inspiring his students. The protagonist, Eikichi Onizuka, defies traditional pedagogy by employing emotional intelligence, mentorship, and unconventional disciplinary methods aligning with contemporary discussions on effective teaching strategies for Generation Z.

Prior research has explored how critical discourse analysis (CDA) in films reveals underlying social issues, particularly within educational settings, with students as the central figures. Nafisa A and Surur (2025) examined the film From "The Ashes" using Van Dijk's CDA framework, uncovering how bullying discourse is structured through textual elements, social cognition, and social context. Their study highlighted how narrative structures, director perspectives, and public reception shape the portrayal of bullying within the Arab educational system, with students as the primary subjects experiencing and responding to bullying. Similarly, Hidayat and Rohmadi (2024) analyzed Kenapa Gue? focusing on the discourse of cyberbullying in university settings, where students, particularly those from Generation Z, are depicted as both victims and participants in digital harassment. Their findings revealed that social media serves as both a platform for harassment and a medium for constructing discourse on victimization, emphasizing the severe psychological impact of cyberbullying on young individuals. Both studies underscore the power of media in shaping public awareness of bullying and its consequences, demonstrating how films serve as a critical space for discourse formation involving Generation Z students. However, while these studies primarily address victimization and the societal implications of bullying, the present research shifts its focus towards student resistance and defiance against educational authority.

Unlike earlier research that mainly focused on bullying as a form of student aggression, this study focuses on acts of resistance, rebellion, and the transformation of teacher-student dynamics within the educational setting. By examining the textual structure, social cognition, and social context of the film, this study aims to reveal how Generation Z students oppose authority figures and institutional norms, both in fictional stories and in real-world educational settings. Building on previous studies that examined student resistance and bullying in films such as From the Ashes and Kenapa Gue?, this research applies Van Dijk's (2008) Critical Discourse Analysis (CDA) framework to explore how student defiance against educational authority is represented in Great Teacher Onizuka. Through the lens of CDA, the study analyzes how language, power relations, and underlying ideologies shape the portrayal of educational interactions in media. Furthermore, according to Van Dijk (2008), discourse has the following presumptions and characteristics: discourse as social interaction; discourse as dominance and power; discourse as communication; discourse as contextual situation; discourse as social semiotics; discourse as pure language; and discourse as complexity and shaper. When performing critical discourse analysis, this presumption is essential (Ratnaningsih, 2019). Critical discourse analysis examines language by relating it to context in addition to analyzing it in terms of linguistics or linguistic features. The study's context is the language's usage for certain activities or goals, like what (Silaswati, 2019). Using language as a tool, critical discourse analysis attempts to obtain a general understanding of the linguistic elements before connecting them to a context (Hidayat & Rohmadi, 2024). Since the text is the outcome of text production, it is necessary to monitor both the text and the process of text production, which is why Teun Van Dijk's critical discourse analysis does not solely concentrate on the text (Nafisa Aqilah & Surur, 2025).

In addition to examining the larger social and cultural aspects that impact these portrayals, the study will particularly investigate how macro, superstructure, and microstructure elements determine the representation of student disobedience. Understanding Generation Z students' perspectives on authority is essential for educators and legislators to rebuild teacher authority and improve student motivation in contemporary classrooms, as they are frequently described as independent, critical thinkers, and digital natives. This study adds to the body of knowledge on student resistance in education by integrating discourse analysis, educational sociology, and media studies. It also offers useful advice on how educators and schools can modify their teaching strategies to meet the changing demands of Generation Z.

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2. RESEARCH METHOD

A qualitative descriptive method is used in this study. Because the research data is in the form of dialogue between the characters in the movie, this research approach is employed. Primary and secondary data sources are the two types of data sources used in this study. The 1998 film "Great Teacher Onizuka," which was directed by Masayuki Suzuki, serves as the main source of data for this study. Journals, literature sources, and online resources pertaining to the subject of the study provide the secondary data, also known as supporting data.

Van Dijk's critical discourse analysis model is the analysis method used in this study, which seeks to expose the discourse in the film "Great Teacher Onizuka." According to Van Dijk, discourse analysis consists of three components: text, social cognition, and social context. Combining the three aspects of discourse into a single analytical unit is the essence of this study. In the text dimension, the use of text structures and discourse strategies to highlight a particular theme is examined, furthermore three structures; the macrostructure, superstructure, and microstructure are used to examine the text dimension (A. Munanjar, 2016); at the social cognition level, the process of creating news texts involving journalists' individual cognition is examined; and in the third dimension, the development of discourse on a problem in society is examined (Eriyanto, 2008, as cited in Ratnaningsih, 2019).

3. RESULTS AND DISCUSSION

A. Text Structure

Great Teacher Onizuka (GTO) presents a comprehensive narrative arc that explores the dynamics of resistance among students, the deconstruction and reconstruction of teacher authority, and the eventual growth of student motivation. From the outset, the series introduces a group of students who harbor deep mistrust and hostility toward teachers due to prior traumatic experiences and systemic failures within the school. These students, particularly Class 2-4, exhibit strong forms of resistance, mocking authority, sabotaging lessons, and isolating themselves emotionally. Their behavior is rooted in a history of being betrayed or neglected by adults, painting a grim picture of the power imbalance in traditional Japanese schooling.

In response, Eikichi Onizuka enters the narrative as an unconventional figure, his background as a former delinquent and his lack of teaching experience set him apart from the norm. However, it is precisely this unorthodoxy that allows him to approach the students differently. Early episodes (1–2) depict Onizuka's initial failures to gain the class's respect through conventional methods. But rather than asserting dominance through punishment, he begins to engage students on their own terms, listening to their frustrations and responding with empathy, humor, and sometimes reckless bravery. These moments mark the beginning of a slow reconstruction of what authority means in the classroom: no longer a tool for control, but a foundation for trust and care.

As the series progresses (episodes 3–8), pivotal scenes demonstrate how Onizuka gradually earns the students' respect not through fear, but through actions that prove his sincerity. He defends his students from abusive parents, protects their privacy, and even risks his own reputation for their wellbeing. In Episode 5, for instance, Onizuka confronts a vindictive parent who spreads false rumors about a student, choosing to uphold the student's dignity over his own safety. These scenes highlight how his authority is reconstructed, not through institutional legitimacy, but through relational trust.

By the middle to late episodes (9–12), the tone of the classroom shifts. Students who were once emotionally closed off begin to show signs of care, respect, and enthusiasm for learning. Moments such as students voluntarily helping each other, participating in class projects, and confiding in Onizuka reflect a significant transformation. One poignant example is when Miyabi, one of the ringleaders of resistance, breaks down and admits her insecurities, showcasing the impact of consistent emotional support from a teacher who never gave up on her. These scenes mark the emergence of genuine student motivation, born not from obligation, but from the realization that learning can be empowering when one feels seen, heard, and supported.

In essence, the film portrays the transformation of a dysfunctional classroom into a space of mutual respect and personal growth. The students' resistance serves as both a symptom of deeper social issues and a catalyst for change. Onizuka's reconstructed authority becomes a bridge for re-engaging a lost generation, Generation Z, with education. And in the process, the students' motivation is not only recovered but reshaped, now grounded in trust, relevance, and emotional connection.

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1) Macrostructure

The term "macrostructure" refers to a theme or issue that explains the main idea or message of the film and provides significant details that the scriptwriter want to convey (Afifuddin, 2016). When a text's subject is examined, its macrostructure or its main or overall meaning is revealed (Hasibuan & Sikumbang, 2022). We can then ascertain the actions the communicator made to address the problem.

The main idea of Onizuka is relational authority as a means of transforming education. Fundamentally, the story offers a critique of the strict, hierarchical, and frequently dehumanizing framework of the Japanese educational system. The ongoing hostility between students, especially those in Classes 2–4 and the faculty serve as a metaphor for a larger generational struggle that is indicative of the Generation Z environment.



Fig 1. Students Resistance



Fig 2. Students Resistance

The scene where two students chase after the vice headmaster with a bat occurs early in the Great Teacher Onizuka series and is a striking representation of student resistance and the breakdown of institutional authority. This particular incident reflects the extreme level of animosity and mistrust between students and the school's administration. The students, feeling cornered, disrespected, or perhaps provoked by the authoritarian behavior of the vice headmaster, resort to physical intimidation, a symbolic act of rebellion.

Their aggressive action with the bat signifies more than just delinquency; it reveals the depth of frustration among students who feel unheard and unfairly treated by those in power. It also illustrates how traditional disciplinary approaches have failed to address students' emotional and psychological needs. This confrontation doesn't stem from pure violence but rather from accumulated tensions, emotional neglect, and a punitive school environment that lacks empathy and understanding.

According to Lorion, Tolan, and Wahler (1987, quoted in Carroll et al., 2003), delinquent and at-risk behavior is a spectrum of actions that depart from accepted social norms in ways that may have major disciplinary or adjudicatory repercussions. Additionally, according to Lorion et al. (1987, quoted in Carroll et al., 2003), the continuum encompasses behaviors that are simply socially unacceptable to school authorities (such as disrupting class, refusing to accept help from teachers, or lacking motivation), that are unlawful and problematic due to the offender's age (such as status offenses like truancy, running away, or substance use), and that are unlawful criminal acts that are unrelated to the offender's age (such as assault, vandalism, arson, robbery, or rape). What Lorion et al. characterize as a spectrum of aberrant behaviors that frequently emerge in strict, unsupportive educational environments is powerfully reflected in this Great Teacher Onizuka episode. The pupils' severe reaction can be interpreted as a kind of protest within this behavioral continuum, rather than as a single instance of wrongdoing. It manifested as a result of emotional repression, inadequate direction, and the perceived authoritarianism of school administrators. The event highlights a deeper problem in the student-teacher relationship and the pressing need for restorative and sympathetic approaches to resolving resistance by illustrating how unmet emotional needs and institutional pressure can push kids beyond acceptable boundaries.

Student opposition stemming from trauma, betrayal, and alienation is a recurring theme in the plot. These kids question the legitimacy of school leadership because they have been subjected to

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authoritarianism and systematic neglect in the past. This opposition challenges the basic tenets of what a teacher ought to be; it is not just disciplinary.

Eikichi Onizuka, the main character, is a reconstruction of teacher authority within this tension. He embraces personal interaction, vulnerability, and honesty over conventional instructional conventions. His influence is restored via earned respect, emotional labor, and a moral dedication to his pupils' welfare rather than institutional power. Thus, the macro-theme depicts a change from relational influence to coercive discipline.

As a result, this changed dynamic causes student motivation to gradually rise. Students start to participate out of trust and personal investment rather than fear. By showing how a once-fractured class transforms into a supportive, driven community, the macrostructure shows how authority can be rebuilt via empathy and respect for one another, leading to significant educational change.

1) Superstructure

The next level is the superstructure. According to Van Dijk, the text's superstructure is recognized as a cohesive whole (Nurlaily, 2019). It has been noted that a text's schematic is its structure, the way its speech and construction elements are arranged (Hasibuan & Sikumbang, 2022). A movie or book should, as much as feasible, start with a strategy or plot. Furthermore, Hasibuan & Sikumbang (2022) state that the narrative demonstrates how textual fragments are grouped together and encouraged to create meanings that are related.



Figure 3



Figure 4



Figure 5

The superstructure of Great Teacher Onizuka follows a conventional narrative arc that effectively promotes the discourse of student opposition, teacher authority, and the eventual increase of student motivation. The exposition introduces a school climate plagued by distrust, disdain, and emotional separation between teachers and pupils, setting the stage for conflict. Strong student resistance is shown in the early episodes, which takes the form of manipulation, defiance, and outright rejection of authority figures and school values. These incidents progressively intensify into a rising action scene in which the protagonist, Eikichi Onizuka, uses unusual and emotionally astute strategies to address both the school's structural problems and the behavior of the pupils. His refusal to employ conventional authoritarian punishment and his attempts to identify the underlying causes of each student's hardship result in crucial moments that serve as the story's climax, especially in episodes where he shields pupils from embarrassment or accepts responsibility for their suffering. As pupils start to react favorably, reassessing their attitudes and becoming more receptive to emotional support and mentoring, the falling action takes place. The classroom environment has clearly changed as a result of the resolution: respect, trust, and genuine connection now serve as the foundation for teacher authority rather than fear or control. In addition to providing narrative satisfaction, this structural flow emphasizes how opposition can transform into inspiration and development when it is faced with compassionate leadership.

2) Microstructure

a. Semantic Aspects (Meaning and Detail)

Semantically, Great Teacher Onizuka presents a layered narrative that explores power dynamics between students and teachers, particularly in the context of a postmodern educational environment populated by Generation Z. Student resistance in the film, expressed through sarcasm, confrontation, silence, or aggression, is more than rebellion; it is a reaction to emotional neglect, institutional hypocrisy, and lack of relevance in schooling practices. The film also shows the reconstruction of teacher authority

through Onizuka's empathy, emotional engagement, and situational ethics, which eventually leads to renewed motivation and trust among the students.

For example, the recurring theme of students pushing back against adults who hide behind rules and reputation (e.g., the vice principal or manipulative parents) highlights a generational and moral dissonance. Onizuka's unconventional behavior (climbing into dorm windows, joking with students, or taking them out of class) challenges the traditional image of a teacher, but ultimately proves more effective in transforming students' attitudes and behaviors. As Seemiller and Grace (2016) note, Gen Z learners value authenticity and mentorship more than hierarchy.

b. Syntactic Aspects (Form and Structure of Sentences)

The film's dialogues are rich in syntactic variety, revealing emotional and relational tension. Early student speech often includes imperatives and short, clipped sentences:

"*Leave me alone*."

"*You wouldn't understand*."

"*What's the point of school anyway*?"

These constructions reflect defensive detachment and a rejection of adult authority.

Conversely, Onizuka's speech patterns often mix colloquialisms with reflective or humorous tone, forming complex or run-on sentences that invite engagement:

"*You know, life isn't about grades or popularity. It's about learning to stand on your own two feet—even if you fall face-first sometimes*."

Such syntax reflects dialogic openness, which slowly disarms students' resistance and fosters communication. According to Van Dijk (1998), sentence form in discourse can signal accessibility, authority, or resistance.

c. Stylistic Aspects (Choice of Words and Tone)

Stylistically, the film uses informal, emotionally expressive language, particularly from students. Words like "*jerk*," "*freak*," "*loser*," or "*I hate this place*" mark emotional wounds and a lack of belonging. These lexical choices convey alienation, but also reveal youthful vulnerability. Onizuka, in contrast, mixes street slang, humor, and motivational language, which makes him relatable to students without sacrificing influence. This stylistic shift is key to rebuilding trust. For example, when Onizuka says, "*I'm not your typical teacher. But I do give a damn.*" He uses plain, passionate language to bridge the emotional gap between him and his students, offering authenticity that resonates more than authority.

Wodak & Meyer (2009) argue that such stylistic patterns signal power relations and ideological shifts in discourse.

d. Rhetorical Aspects (Emphasis and Persuasion)

The film employs several rhetorical techniques to emphasize transformation. Visual symbolism (e.g., Onizuka standing alone on rooftops, students breaking down in tears, the school walls covered in graffiti) aligns with emotional and narrative turning points. The contrast between chaos and eventual catharsis is a rhetorical arc: from disorder to reconstruction.

Repeated use of rhetorical questions:

"Why should I trust any of you?"

"Are all teachers just fake smiles?"

Builds empathy and challenges the audience to see from the students' perspective.

Later, Onizuka's actions, such as putting himself at risk for his students, serve as embodied rhetoric, persuading not just the characters but the viewers of his sincerity and moral authority.

B. Social Cognition Analysis

Social cognition, which refers to the process of discourse development from the outset and various factors that impact the author when creating a discourse to build a complete discourse product, is closely related to Van Dijk's critical discourse analysis (Nur Ellya et al., 2023). In Great Teacher Onizuka, social cognition plays a crucial role in shaping the relationship between students and their teacher, Eikichi Onizuka. Social cognition refers to how individuals understand and interpret the behaviors, intentions, and motives of others within a social context. In this case, it explores how both students and the teacher perceive and react to one another, influenced by their backgrounds, experiences, and the broader educational environment. The film vividly portrays the complex dynamics of student resistance, showcasing how students' experiences and individual identities shape their resistance toward authority figures, particularly teachers.

From a social cognition perspective, students in the series, often depicted as rebellious or disengaged, develop a negative perception of authority figures. Their actions are shaped by a history of traditional, hierarchical teaching methods that have stifled their autonomy and creativity. This perspective is critical, as it reveals that students' resistance is not merely an act of rebellion but a response to their perceived powerlessness in a rigid, impersonal educational system. For example, students like Nanako, who initially resist Onizuka's unconventional teaching style, come to understand and appreciate his unique approach, which emphasizes emotional intelligence and mentorship rather than authoritarian discipline.

On the other hand, Onizuka's social cognition is shaped by his past as a former gang member, his unconventional personality, and his experiences with students. His interactions are driven by an underlying belief that students can be reached and motivated through emotional understanding, trust, and alternative disciplinary methods. Onizuka does not view students through the same lens as traditional teachers. Rather, he seeks to understand their emotional and psychological states, recognizing that their behavioral problems often stem from deeper issues, such as insecurity, neglect, or broken homes. This emotional awareness allows him to bridge the gap between himself and his students, enabling him to navigate their resistance and transform their attitudes toward education.

Moreover, the film illustrates how social cognition affects the way Onizuka is perceived by others, especially his colleagues and the school administration. Initially, many of his peers see him as an irresponsible and unqualified teacher, largely due to his unorthodox methods. However, as Onizuka demonstrates his dedication and success in transforming even the most rebellious students, their social cognition evolves, leading them to recognize his worth and unique approach to teaching. This shift highlights the power of social cognition in shaping perceptions of authority and competence within educational settings.

Ultimately, Great Teacher Onizuka portrays how social cognition influences the ways in which both teachers and students navigate their relationships, power dynamics, and resistance within the school system. It emphasizes that understanding students' backgrounds, motives, and emotional needs can lead to more meaningful and productive teacher-student interactions, allowing for the reconstruction of teacher authority in a way that is responsive to the needs of Generation Z.

C. The Social Context

According to Van Dijk's critical discourse analysis, social context examines how a text relates to society's more intricate social systems (Nafisa Aqilah & Surur, 2025). Two crucial facets of social context that are necessary to comprehend in Van Dijk's critical discourse analysis are the power structure and the way in which discourse is influenced by access (Nur Ellya et al., 2023). The social context of Great Teacher Onizuka is firmly anchored in the Japanese educational system's hierarchical structure, where power often moves in a rigorous manner from teachers and school administrators to the pupils. In the story, this hierarchy turns into a major source of contention as Generation Z students, who are renowned for their disdain for authority, oppose this inflexible power structure. The vice headmaster stands for institutional power that puts reputation, order, and discipline over the welfare and voice of students. Within this framework, students who are expected to fit in and be obedient are sidelined because they lack the ability to constructively voice their concerns and the authority to change institutional rules.

The social context is deeply shaped by the changing cultural values of the 1990s and early 2000s, as younger generations, including Generation Z, began to question the traditional norms of hierarchy and control in institutions. This generation, having grown up in a world increasingly influenced by technology and digital media, values autonomy, individual expression, and the freedom to explore knowledge in ways that traditional educational models do not always support. In this environment, the students' resistance becomes a form of protest against an educational system they perceive as stifling their individuality and creativity. The tension between the students' desire for freedom and the teachers' role as enforcers of authority creates a backdrop for the unfolding drama in the film.

Onizuka's role as a teacher highlights this clash of generational and institutional expectations. Initially, his authority is undermined by the students, who view him as just another figure of authority within a system they distrust. However, as Onizuka's teaching methods evolve, his relationship with the students becomes more personal and empathetic. He shifts from a traditional authoritarian role to one of mentorship, using emotional intelligence, humor, and unconventional teaching methods to engage his students. This change in Onizuka's approach represents a broader shift in educational practices, where

teacher authority is no longer based solely on position or discipline but on the ability to connect with students on a human level and address their individual needs.

The social context also includes the broader pressures students face, particularly those from challenging socio-economic backgrounds. Many of the students in Great Teacher Onizuka come from troubled homes or environments where the school system is seen merely as a stepping stone to an end goal, rather than a space for personal growth. These pressures manifest in their behaviors acting out in class, resisting authority, or disengaging from traditional learning. Onizuka's ability to recognize these challenges and respond with care and creativity allows him to begin bridging the gap between students' needs and the educational system's expectations.

Furthermore, Generation Z's growing reliance on digital media and technology influences their attitudes toward education. Having been raised in an era of rapid technological advancement, these students value instant access to information, interactive learning experiences, and digital engagement. Onizuka's unconventional methods, which include using technology and hands-on activities, reflect an understanding of these needs. By adapting to the digital preferences of his students and integrating them into his teaching approach, Onizuka not only redefines teacher authority but also fosters an environment where students can thrive.

4. CONCLUSION

This study aimed to explore the evolving dynamics of teacher authority and student motivation, focusing on the complex interactions between Generation Z students and their educators, as represented in the Japanese film Great Teacher Onizuka. As highlighted in the Introduction, the rise of student resistance, particularly within the context of Generation Z's values and characteristics, has posed significant challenges for traditional educational structures. The initial analysis laid the foundation by discussing the shift from hierarchical, authoritarian teaching methods to those that emphasize empathy, mentorship, and adaptability, in response to the demands of a new generation.

Through the application of Van Dijk's Critical Discourse Analysis (CDA), this research sought to uncover how the film portrays the intricate balance of power between teachers and students. It explored how social cognition, discourse structures, and contextual factors contribute to both student resistance and the reconstruction of teacher authority. The results and discussion, as elaborated in the subsequent chapters, provide a deeper understanding of how these elements play out in the classroom environment, illustrating how teacher authority is not only challenged but can be reconstructed through emotional intelligence, unconventional methods, and an understanding of students' social and technological realities.

By examining the interplay between teacher authority, student resistance, and motivation, this study offers insights into how educators can adapt to the changing expectations of Generation Z. The findings are expected to highlight the potential for a more effective and supportive teaching environment, one where students are empowered, motivated, and more engaged in the learning process. As the research progresses into the results and discussion, the analysis will demonstrate the ways in which Onizuka's character embodies these transformative practices, offering a model for educators to consider in contemporary educational settings.

Ultimately, this study aims to bridge the gap between theoretical frameworks on teacher-student dynamics and real-world applications, providing both academic and practical insights into the future of teaching and learning in the digital age.

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