

Theory of Relativity in Understanding Science

Syifauly Aini Mulyadi^{1*}, Chairatul Umamah¹, Muslimah¹, Mutmainnah¹, Pu'adi¹

¹*Prodi Pendidikan Fisika, Universitas Islam Madura, Indonesia*

*E-mail: syifaaini250@gmail.com

ABSTRACT

This study uses a qualitative descriptive approach with a literature study methodology. The results of this study indicate that the theory of relativity in Science describes the special theory of relativity: This theory demonstrates the concept of the speed of time, making time relative. Time as a physical variable is also affected by the lack of a universal frame of reference. When a frame moves relative to a frame of reference, a still reference, the time experienced by a person in a moving frame will be different from the time experienced by a person in a stationary frame. This time difference is called time dilation (relativity temporal) And only applies if moving at the same speed. At the same time, Science in the theory of relativity is used in various fields, including cosmology, satellite technology, and astrophysics. So, the theory of relativity in understanding Science Science has a relevant relationship. Applying the theory of relativity in Science can help overcome the difficulty of understanding students and the general public towards abstract physics concepts and facilitate the development of technology.

Keywords: Theory Relativity, Relationships, Science

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INTRODUCTION

The advancement of Science influences human life and how people think. From the 17th to the 20th century, physics developed and experienced a revolution [1]. Physics is an important part of Science closely related to the scientific process. According to Al-Kani [2] the scientific process plays a role in conducting scientific investigations and finding concepts, principles, and theories to develop previously existing concepts. In addition, physics has factual and abstract concepts or cannot be observed directly in the environment [3].

One of the physics materials that seems abstract and difficult to imagine for some students and also student is a theory special relativity. The Special relativity. The special theory of relativity studies the fundamental concepts related to time, space or mass, and objects or people moving close to the speed of light. This theory is one of the pillars of modern physics, especially building and simplifying the

basic concepts relevant in physics regarding spacetime momentum-energy as aspects of the kinematics of all phenomena, which raises light as a maximum speed signal carrier [4]. Time is an important part of human life; even if we do not realize it, time defines our lives. This change can have an impact on modern physics, especially on the theory of relativity. In modern physics, classical physics is not able to explain the phenomenon of dualism particles [5]

A German scientist named Albert Einstein, in one of his theories, namely the special theory of relativity, views time as relative to a reference point. This statement is known as time dilation, a consequence of special relativity. Time dilation discusses the difference in time observed by two observers [6]. Initially, scientists argued that time was not limited and absolute. Because no one knows when time begins or ends, only God knows and remains His secret, so many people adhere to this belief [7]. However, the theory of relativity

introduced by Albert Einstein has revolutionized this view and has significantly impacted our understanding of the universe, including the understanding and development of Science.

The influence of the theory of relativity on the development of Science and technology is vast. This theory changes the basic understanding of the universe and has practical applications in various fields. The problems that arise in the theory of relativity it was found that students or students have difficulty in learning due to material that is contrary to reason and difficult to visualize because this relativity discusses conditions that approach the speed of light and the concept of gravity and its relationship with the curvature of space and time [4]. In addition, examples of direct applications of time dilation in everyday life are tricky. This problem can be overcome by providing a deeper scientific approach and understanding to help students relate abstract concepts to everyday phenomena so that complex material can be more easily understood and applied.

Based on the analysis of various literature studies, the theory of relativity has been widely studied in various contexts, including Einstein's theory of relativity and its usefulness in the Islamic perspective. The theory of temporal relativity in the Qur'an and its relevance in modern Science. However, research on the theory of relativity in understanding sand has not been conducted. Therefore, we raise a literature study research titled "Theory of Relativity in the Understanding of Science".

RESEARCH METHODS

In this descriptive research, the researcher uses a literature study method to observe, find out, identify, assess, analyze, and determine topics of related research [8]. The theory of relativity in understanding Science is obtained from several journals indexed by Sinta, Garuda, Scopus, ISSN, Google Scholar, and others. The literature study method used is

to observe, analyze, identify, provide interpretation and evaluation of several studies that have been conducted [9] and are relevant to the research topic to answer research questions by providing additional learning materials and looking for gaps from previous research so that they can provide benefits for further research [10]. A total of 30 articles obtained from various domestic sources can be investigated in this study. The journals and texts used were obtained between 2016-2024. Researchers searched for, compiled, and collected information until they concluded from the results of descriptive research using the literature study research methodology shown in Figure 1.

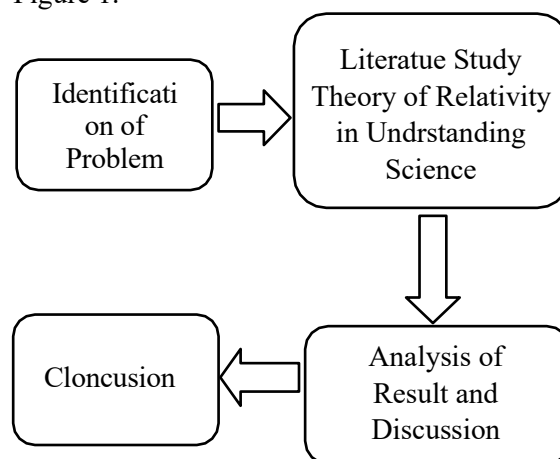


Figure 1. Research Flow

The initial part of this research focuses on identifying a problem that occurs. The second stage includes a review of 26 articles explaining the Theory of Relativity in the understanding of ScienceScience published between 2016-2024. The third stage of the research methodology is analysis, carried out by researchers after reading related articles, followed by a discussion of the results. Researchers make conclusions based on the findings and analysis in the fourth step by reading and understanding related articles.

RESULTS AND DISCUSSION

In the early 20th century, Albert Einstein introduced the theory of relativity as one of the pillars of modern physics that could radically

change our understanding of spacetime and gravity. Therefore, the writing of this article is entitled The Theory of Relativity in the Understanding of Science, which is sourced from several scientific articles in Table 1.

Table 1. Theory of Relativity In Understanding Science

N o	Title	Year/Au thors	Results
1	Teori Relativitas Ruang dan Waktu dalam Al-Qur'an	2024, Hawalida Rizki, Aulia Arianti	Hasil penelitian menunjukkan bahwa waktu tidak bisa dipisahkan dari kehidupan manusia sebagaimana telah diimplementasikan diimplementasikan pada bidang fisika modern khususnya teori relativitas
2	Ontologi Ruang dan Waktu: Refleksi Fisolofis Terhadap Struktur Realitas	2024, Muh. Alwi Naharuddi n, Ismail	Pentingnya pemahaman tentang antologi, kita dapat memahami bahwa ruang dan waktu adalah konsep yang fundamental dalam memahami struktur realitas
3	Telaah Teori	2023, Annisa	Menurut teori relativitas

Relativitas Khusus dalam Perspektif Sains dan Al-Qur'an	Fitri, Dini Aprida, Julianti, Maulidia, Norma Susanty, Nur Fadhila Maulidah, Normila Santi	khusus, dilatasi waktu, kontraksi panjang dan massa relativistik, yang membuatnya relative dan dinamis
4 Penerapan TPACK dalam Buku Teks Fiskia SMA Pada Topik Teori Relativitas Khusus	2023, Raffa Fitra Ramadannisa, Fauzi Bakri, Dewi Muliyati	Fisika memiliki konsep faktual dan abstrak sehingga melakukan penyelidikan ilmiah proses sains sangat berfungsi pada halnya dalam menemukan konsep, prinsip serta teori untuk mengembangkan konsep-konsep sebelumnya
5 Identifikasi Kesalahan Pengerjaan Materi Dilatasi Waktu berdasarkan Newman Error Analysis (NEA)	2023, Yusdarina Napsawati, Irma Sakti, Reski Idamayanti	Dilatasi waktu menceritakan tentang perbedaan waktu yang diamati oleh dua pengamat dalam pandangannya Albert Einstein

			seorang ilmuwan dari jerman ia memandang waktu itu bersifat relative terhadap titik acuan pada pernyataan tersebut dikenal dengan istilah dilatasi waktu	(Nature of Science) dan Peran Pentingnya Dalam Pembelajaran IPA		sebagai sebuah proses pencarian informasi, bukan sebagai sebuah produk yang dapat meningkatkan pemahaman siswa terhadap pelajaran IPA	
6	Relativitas Einstein dan Pandangannya dalam Islam	2023, Daeng Ahmad Daung Pagessa, Lisni Nor Khaliqa, Rizki Pangestuti Linuwih, Sri Rezeki	Jurnal ini membahas beberapa perspektif islam yang berpendapat bahwa waktu itu tidak terbatas dan tidak terpengaruh oleh materi benda di alam semesta. Pandangan ini bertentangan dengan teori relativitas yang berpendapat bahwa waktu relative pada kecepatan dan percepatan suatu benda	8	Analisis Dilatasi Waktu Berdasarkan Perspektif Sains dan Al-Qur'an Berbasis Video dengan Model Poe2we	2021, Riza Hasanudin, S Nana, Dwi Sulistyani Ngsih	Dalam jurnal ini membahas tentang waktu yang merupakan sesuatu yang absolut dan tak terbatas. Dimana permulaan waktu tidak dapat terungkap karena keterbatasan pengetahuan manusia dan menjadi rahasia tuhan
7	Hakikat Sains	2023, Listiani	Sains dapat disajikan	9	Kosmologi Ibnu Sina dan Relevansinya dalam Diskursus Kosmologi Kontemporer	2020, Yongki Sutoyo	Dari pengkajian tentang konsep alam semesta, ruang dan waktu, materi dan gerak, ditemukan relevansi

kosmologi
Ibnu Sina
dalam
diskursus
kosmologi
kontemporer

Theory Relativity

The theory of relativity is the most common law of physics used to understand and predict light and gravity on Earth. There are two types of theories of relativity, namely the special theory of relativity and the general theory of relativity [11] which have different views; in other words, two observers who are different from one other will see the same event in different times and spaces, but the laws of nature seem to be the same for both [12].

The general theory of relativity is a theory that discusses the relationship between the refined form of Newton's theory of gravity and macroscopic objects that include phenomena in the universe. This is part of modern physics, which has a broader and more advanced approach than physics classics. Modern physics can now handle questions that classical physics could not handle. Modern physics can answer questions that classical physics could not answer. The special theory of relativity developed by Einstein refers to frames of reference that move with speed constant And are based on two postulates, namely:

- Principle of Relativity: Laws of physics are still The same in all inertial systems
- The invariability of the speed of light: The speed of light has the same value in all inertial systems

These two postulates brought about significant changes in physics, especially in understanding natural phenomena on a macroscopic scale (can be seen using the naked eye or a magnifying device) and microscopic (cannot be seen with the naked eye or a magnifying device). As a result of the postulate of special relativity, length/space, time, and mass are not absolute but relative quantities [13]

According to Albert Einstein, space and time are relative, not absolute. He argued that space and time cannot exist separately; they are interrelated. It forms an entity known as spacetime, which affects all events. So, according to Einstein, spacetime cannot exist independently, but its matter and energy determine its existence. Besides Therefore, Einstein saw gravity not as a force as previously thought but as a result of the curvature of spacetime caused by mass and energy [14].

Understanding science

Science is a creation of human thought with free ideas. and the existence of concepts [15]. The term science comes from the Latin Scientia, which means knowledge. In general, ScienceScience is characterized by systematically collecting and testing information from various sources to explain the universe and its contents [16]. Science as knowledge and its application in society makes science education important. Science is the study of phenomena through scientific processes based on a scientific attitude.

Epistemologically, the nature of Science or *Nature of Science (NOS)* is a way of looking at natural Science from an epistemological perspective. Science is a series of scientific activities that continue to develop along with the changing times[17]. So far, the nature of science science has not been taught as teaching material in schools. In fact, in the journal [18] almost all scientists, science education, and science education organizations agree that it is important to understand the nature of science science. In the journal [19], The most important aspects of the nature of Science, among others:

- Science is developed based on empirical evidence
- Scientific theories and laws are the results of ScienceScience and have different relationships and functions
- The development of Science involves human imagination and creativity
- Science is influenced by theory
- Social and cultural factors influence

Science

- f. There are myths about the scientific method in ScienceScience and
- g. Science nature tentative

In studying ScienceScience, we will be introduced to many abstract concepts. In addition, concepts in ScienceScience can also have meanings of more than one, and each concept cannot stand alone. This shows that correctly understanding concepts is important in learning science [20].

Theory of Relativity in Understanding Science

Studies on the relationship between the theory of relativity and scientific understanding often attract attention. For scientists, especially the theory of relativity created by Albert Einstein in the 1900s. Which states that the concepts of space and time have undergone fundamental changes that have shaken up classical thinking. This shows that our view of the structure of reality is critical in developing scientific thought [21]. Although the theory of relativity is fascinating, understanding it is challenging because it requires complex mathematical knowledge and tools [22].

Science involves abstract concept such as relativity, quantum mechanics, and field theory. Understanding physics often requires understanding concepts that do not always fit our everyday intuition. It is important to remember that physics continues to evolve, with the emergence of new theories and discoveries that complement or even change our understanding of the universe [23]. So, it is necessary to have a deep understanding of the development of science science.

Dayadi (2008) believe that the development of ScienceScience will always bring new wonders. There is always the possibility that a theory initially believed to be true is later proven wrong, including Einstein's theory. Einstein's theory of temporal relativity has been scientifically tested. Einstein created the special relativity theory, meaning that speed can be relative to time. Since there is no

universal frame of reference, time as a physical variable is also constrained; time is felt by a person in a moving frame of reference and will experience a different time than a person in a stationary frame of reference. The difference in time is called widening time (temporal relativity) and only applies if the speed of motion is the same[13].

In that, Einstein also put forward 1905 the general theory of relativity, which is a theory of gravity that replaces Newton's law of gravity, explaining how mass and energy work. Can bend spacetime and how This effect affects the movement of objects and the path of light. This theory is also used in astrophysics and cosmology to understand phenomena such as black holes, gravitational waves, and the universe's expansion [4].

Meanwhile, the theory of relativity, which is utilized in understanding Science, can be used in several aspects:

1) Astrophysics

Astrophysics is a field of Science that studies properties, physics phenomena, and astronomical objects worldwide. In addition, astrophysics also discusses the Earth and its objects. Outer space. Naming astrophysics can sometimes be interchanged with astronomy because the scope of research is the same in the modern era. However, in the case of popular Science, "astrophysics" is the application of modern physics to space [24].

2) Cosmology

Cosmology is a branch of Science that learns about the universe's natural phenomena, such as stars, planets, galaxies, and other major ones. In contrast, scientific cosmology is a branch of astronomy that studies the origin and evolution of the universe, where the laws of Science govern this field [25]. With knowledge of cosmology, scientists can predict

significant astronomical phenomena that will occur in the past and future. One of the developments in astrophysics that studies cosmology is discovering the micro sky background, gravitational waves, black holes, etc

3) Technology Satellite

Satellite technology is a modern-day wonder that plays a vital role in many aspects of life. From telecommunications to earth observation and space exploration, satellites allow us to connect, understand, and explore our world. A satellite is an object that orbits a planet or other celestial bodies utilized in Earth observation and communication [26]

Based on the above description, the theory of relativity is one of the main pillars of science and provides the basis for many modern concepts and technologies.

CONCLUSION

This study concludes that the theory of relativity is an important foundation that can help explain natural phenomena that classical physics cannot explain. A deep understanding of this theory can open new insights into Science, improve scientific literacy, and encourage future scientific innovation. In addition, applying the theory of relativity in science education can help students and the general public overcome difficulties in understanding abstract physics concepts and facilitate the development of more advanced technology.

THANK YOU NOTE

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