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Increasing Interest in Science Concepts among Primary School Students through Tiktok

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Abstract

This study examined the increase in interest in science concepts among primary school students through TikTok. In an era of rapid development of educational technology, there is a need to improve science teaching approaches that can attract students' attention. The main objective of this study was to determine the effectiveness of TikTok as a learning tool in increasing students' interest in science. This study used a quantitative approach involving 321 randomly selected primary school students in Malaysia. Descriptive statistical analysis showed that the average interest in science increased slightly after using TikTok, from 3.50 to 3.55. Factors contributing to the increase in interest included preference and excitement for content (r = .676), attractive visual effects (r = .570), social interaction (r = .578), and scientific activities and professional interests (r = .463). Regression showed preference and excitement for TikTok as the most significant predictor of science interest (β = .526), followed by visual effects (β = .241), social interaction (β = .215), and scientific activities (β = .083). Although the increase in interest was statistically significant (p = .018), the effect was small (Cohen's d = -0.132). The study concluded that TikTok has the potential to be an innovative and fun learning platform, but its effectiveness in increasing scientific interest requires a more strategic content approach.

Keywords: Science Interest, Digital Learning, Innovative Education, Creative Approach, Primary School Students

Introduction

Education is an important foundation in developing the country's human capital and achieving the goal of competitive national development (Mohamed et al., 2018). The National Education Philosophy (FPK) which outlines the country's educational aspirations also emphasizes the importance of education in forming a balanced and holistic person (Ministry of Education Malaysia, 2020). FPK views education as not just academic achievement but also human development equipped with values, abilities, and solid leadership. In the context of the Malaysian Education Development Plan (PPPM) 2013-2025, one of the main aspirations is the integration of Information and Communication Technology (ICT) in the teaching and learning process (Ministry of Education Malaysia, 2012). This aims to strengthen the country's

education system through the application of technology in curriculum delivery, increase accessibility, and improve teaching efficiency.
International surveys such as Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) show the urgent need to improve student performance in science and mathematics subjects at a global level. This reminds countries of the importance of strengthening the foundations of science, technology, engineering, and mathematics (STEM) among the younger generation. In line with the rapid development of technology, the emphasis on the ICT in education is increasing. One of the main applications of ICT that is getting more and more attention is the integration of digital tools in the learning process.

Digital learning refers to the digital technology, especially the internet and special software, as a medium to deliver and support the learning and teaching process (Salmon, 2011). This approach involves various tools and digital resources such as videos, audio recordings, educational games, online learning platforms, and more to deliver information, provide interaction, and enable access to learning materials anywhere and anytime. The concept of digital learning emphasizes flexibility, accessibility, and a high degree of interactivity in the learning process, which allows learning to take place outside the classroom continuously (Salmon, 2011). This approach is in line with contemporary educational needs that emphasize the integration of technology in the learning process to improve quality and accessibility (Anderson & Dron, 2011).

Digital learning that is widely introduced starting from primary school level has opened a wider space for interactive and effective learning (Fauzi & Anindiati, 2020). Students are not only given the opportunity to explore knowledge in a fun way but are also given the freedom to learn at a time and place that suits their individual needs. The presence of digital learning also provides a suitable platform for questions and more organized discussions, ensuring that each student gets the support they need in their learning journey (Janelli, 2018). With the emphasis given by the Malaysian Ministry of Education (KPM) in utilizing digital technology to spread knowledge, the development of digital learning in this country shows great potential to strengthen the education process (Ghavifekr & Mahmood, 2017). Therefore, the emphasis on the digital learning in educational institutions in Malaysia reflects ongoing efforts to ensure continuity in the delivery of quality education (Zaili et al., 2019).

This study focuses on TikTok consumption in science subjects among primary school students, with the aim of improving their understanding of science concepts. Usage of TikTok in the teaching and learning process (PdPc) Science in primary schools is seen as an important factor in improving the quality of science learning. As suggested by Ahmad et. al (2020), the integration of digital technology in science PdPc can help create a more interactive and dynamic learning experience which in turn encourages deeper understanding among students. The hope of this study is to provide guidance to students in using digital technology, so that they can take advantage of it fully from potential TikTok to improve their understanding of science. Through using TikTok as a teaching aid, it is hoped that a learning atmosphere that is more interesting and stimulates scientific thinking can be created among primary school students, in line with the results of a study by Tan, Wong & Lim (2019) which shows that technology in education has a positive effect on students' interest in learning.

Background of the Problem

The education system in Malaysia is very important and must change according to current trends to produce students who are able to face the global changes of the 21st century. Adaptation to this education system requires the application of digital technology in teaching and learning. This is because ICT can bring changes in the culture of today's life, especially in the field of education. According to Ali, Yusof & Khan (2017), technological tools has brought changes in teachers' pedagogical techniques and led to a new era in Education. By integrating digital technology in teaching and learning, we can prepare students to face the global challenges of the 21st century.

In the context of science education in primary schools, the importance of using digital technology is increasingly emphasized. The development of technology requires the latest science teaching to ensure an effective and meaningful learning experience for students. TikTok is becoming an increasingly popular approach in strengthening the understanding of science among primary school students (Ali, Yusof & Khan., 2018). However, various challenges also appear in the process of teaching and learning science among primary school students. One of the main challenges in science education is finding an effective method in presenting science concepts in an interesting and easy-to-understand way for students. (Abdul Rashid, Abdullah & Ahmad, 2019)

Conventional approaches that only rely on textbooks and whiteboards have been identified as having weaknesses. According to Orlich et al. (2017), This method tends to promote rote learning without touching the real understanding aspect. In addition, studies show that traditional teaching approaches are often insufficient to attract students' interest, especially in science subjects that are considered difficult or abstract (Lee, 2018). Facts from KPM also show that almost 60% of primary school students report a lack of interest in science subjects. Therefore, technology in science learning is important in attracting students' interest and improving their understanding of science concepts (Gilbert & Treagust, 2018).

TikTok in learning offers a significant change in the approach to science teaching and learning. It allows teachers to deliver information interactively and give students the opportunity to be actively involved in the learning process. Through easy access to learning materials and various mediums provided on the platform, science learning becomes more interesting and enables the development of critical and creative thinking skills in dealing with scientific problems (Anderson & Smith, 2019). With that, digital technology in science education in primary schools is the key to increasing the effectiveness of teaching and learning in preparing the next generation of students.

Problem Statement

Improving the understanding of science concepts among primary school students is an important aspect in ensuring the quality of effective science education. Based on the Public Awareness Study Report on Science, Technology and Innovation (2004), 42 percent of Malaysians think that interest in science concepts is a complex and difficult challenge for primary school students. This emphasizes the need to overcome these challenges and

improve appropriate learning approaches to ensure increased interest in better science concepts among students.

First, the issue of limited interest in science concepts among primary school students is an important aspect in the educational arena. Research findings from the Education Endowment Foundation have highlighted this situation clearly, where more than 40% of 10-year-old students show a less than satisfactory understanding of basic science concepts. The critical implications of this situation show the need for more intensive efforts in improving the level of science understanding among primary school students, who play an important role in the development of a knowledge society. This requires detailed research as well as the implementation of a more effective and efficient learning approach to improve the understanding of science concepts among primary school students.

Conventional teaching methods such as lectures, readings, and practice questions are often insufficient to convey science concepts to students effectively. According to a UNESCO report, almost 60% of students tend to better understand science concepts when teaching is done through interactive methods. This shows the need to introduce a more innovative and engaging teaching approach in the science learning process. In the realm of efforts to improve science learning, further research needs to be conducted to identify the methods that best suit the needs and abilities of students in today's learning context.

In addition, the lack of interest and motivation of students towards science subjects is a problem that needs to be given serious attention in the educational arena. Many students lose interest in science because of the lack of appeal in conventional teaching methods. This can be supported by a study published in the Journal of Science Education and Technology (2020) showed that nearly 50% of students reported less interest in science after engaging in boring teaching. This shows the need for science teaching to be more dynamic and relevant to students' daily lives, as well as technology in teaching that can increase their involvement and motivation towards science subjects.

Student acceptance and interest in TikTok plays an important role in determining the success of online learning. A study by Ahmad, Khan & Yusof (2023) shows that almost 80% of students who are less interested or uncomfortable with technology admit that this becomes an obstacle in their involvement in the learning process. This finding confirms that students' readiness and acceptance of technology play a significant role in the effectiveness of TikTok. Therefore, is very important for students to understand and overcome obstacles that may arise in the adoption of technology, as well as create effective strategies to increase involvement in using TikTok.

The issue of imperfection in integrating students' learning styles with teaching methods in the classroom is a challenge that requires serious attention in the context of science education. The presence of different learning styles among students shows the need to coordinate teaching methods with individual needs. Accordingly, the results of a study published by the British Journal of Educational Psychology (2014) show that almost 60% of students are more successful in the learning process if the teaching methods used can be adapted to their learning style. This emphasizes the need to use various teaching strategies that can adapt to

the diversity of students' learning styles, to ensure that each student can understand and master science concepts more effectively.

Although TikTok has existed as a potential tool to increase interest in science learning among primary school students, it still lacks sufficient attention. According to Jamaluddin (2003), an expert in the field of science learning among primary school students has stated that TikTok in learning is a potential step to increase interest in science concepts among students. He emphasized that by using the right approach, this technology can be an effective tool in delivering science lessons in a more dynamic and interesting way. By using technology, science teaching can be delivered in a more interactive and fun way for students. This is contrary to conventional teaching methods which are often less interesting to students. By using TikTok as a learning tool, students can be actively involved in the learning process. For example, through interactive videos, learning games, or simulations that allow them to experiment and apply science concepts in a context that is relevant to their lives. However, to fully realize this potential there needs to be a greater effort in giving sufficient attention and support to this technology in the context of science learning in primary schools.

Study Objectives

In carrying out this study, there are several objectives that have been outlined to answer the problems raised.

General objective: investigate the effectiveness of using TikTok as an additional tool in the teaching and learning process of science among primary school students.

Specific objectives

Identify the level of interest of primary school students in science concepts before and after using TikTok.

Assess effectiveness of TikTok in increasing interest in science concepts.

Identifying the factors that influence the increase of students' interest in science through TikTok.

Study Questions

In order to achieve the goals and objectives above, this study was designed to answer several research questions as follows:

What is the level of interest of primary school students towards science concepts before using TikTok?

How does TikTok affect primary school students' interest in science concepts after a certain period?

Is TikTok effective in maintaining and increasing primary school students' interest in science in the long term?

Conceptual Framework of the Study

The conceptual framework of this study aims to examine the effects of use of TikTok to the understanding of science concepts, especially the topic of Earth and Space, among Year 3 students. The digital application is used as an independent variable in this study, where TikTok as a digital learning tool that provides a variety of interactive features that can attract students' interest. These features include videos, interactive quizzes, discussion forums, and multimedia learning materials that can be customized according to student needs. Intensity

of use refers to the extent to which students and teachers use this application in their daily teaching and learning process.

The understanding of science concepts is a dependent variable measured in this study. This understanding covers two main aspects: factual knowledge and application ability. Factual knowledge refers to the student's ability to understand and remember definitions, terms, and basic science facts taught through TikTok. Application ability refers to the student's ability to use learned science concepts in solving problems and conducting experiments, including the ability to think critically and apply knowledge in new situations.

This conceptual framework also considers several moderating factors that may influence the effectiveness of TikTok. These factors include student learning styles, teacher readiness, and access to technology. Student learning styles such as visual, auditory, and kinaesthetic can be met through various forms of learning materials provided by TikTok. The willingness and ability of teachers to integrate technology in teaching plays an important role in the successful use of TikTok. Teachers who are more experienced and trained in the educational technology tend to be more successful in improving student understanding. In addition, the availability and access of students to technology such as tablets and the internet is a critical factor. Students who have good access to this technology tend to be more easily involved in the learning process that uses TikTok.

The result of this study is an increase in students' interest and motivation towards science concepts. This interest and motivation can be intrinsic, driven by the student's own interest and desire to learn and understand science concepts, or extrinsic, driven by external factors such as rewards, praise, or the desire to achieve good results in exams. Overall, this conceptual framework illustrates that the TikTok which can effectively improve students' understanding of science concepts by making learning more interesting and interactive. This in turn increases students' interest and motivation to learn, while taking into account various moderating factors that can affect learning outcomes

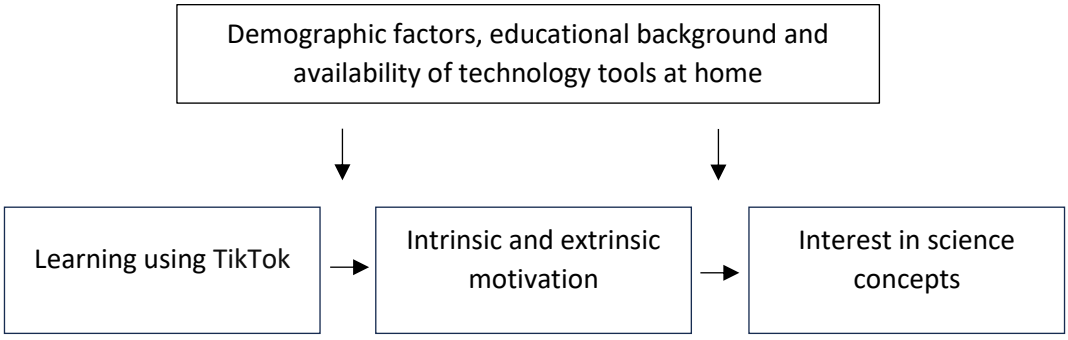

Figure 1.1: Conceptual framework of the implementation of the study

Importance Of Study

This study emphasizes the importance of using TikTok in improving the understanding of science concepts among primary school students. According to Ahmad et al. (2023), technology in learning is increasingly important along with digital progress in the context of modern education development. The TikTok app offers a great opportunity to enhance the science learning experience. With access to quality learning materials through this application, students can have a more interactive learning experience. They also gain an

advantage in terms of time and place flexibility in the learning process, allowing them to be more actively involved in science learning.

With access to quality learning materials, students can access more in-depth and comprehensive information about the science topics being taught. This means that they do not only rely on printed materials or limited notes but can also use digital resources that are more interactive and richer in various forms of media such as text, images, audio, and video. For example, in science topics such as astronomy involving the earth and space, students can access animations or simulations in TikTok that allow them to visually see how the earth moves around the sun, or how a lunar eclipse occurs.

The interactive learning experience offered by this application can also help improve students' memory and understanding of complex science concepts. For example, in teaching gravity in space, TikTok can provide an interactive video where students can "handle" the situation in the space simulation to understand how gravity affects the movement of objects in space. By interacting directly with these concepts, students can build a deeper and more abstract understanding of how gravity operates in the universe.

By better understanding the potential and limitations of this technology, education systems can take appropriate steps to ensure successful implementation and positive impact on science learning. For example, the education system can plan a more effective strategy to integrate this technology in the learning of earth and space topics by understanding the potential of TikTok in depth. They can provide learning modules that include topics such as rotation and revolution of the earth, eclipses, or the solar system by using animation and simulation that can provide a deep learning experience for students. For example, teachers can provide a simulation that shows how a lunar eclipse occurs, by allowing students to interact with the factors that affect the eclipse, such as the position of the earth, sun, and moon.

Overall, this study provides an important contribution in understanding how TikTok can improve science learning among primary school students. By providing evidence about the effectiveness of this technology, this study can help shape policies and practices in science education that are more effective and relevant to the needs of today's students (Smith & Johnson, 2019; Johnson et al., 2020).

Operational Definition

In this section, all the variables used in this study will be operationally defined to give a clear understanding to the reader so as not to cause misunderstandings about the meaning of the terms used during this study.

TikTok

TikTok Application in Science Learning refers to the implementation and interaction of students with digital social applications designed to deliver science learning materials in a creative and interesting way (Ali & Yusoff, 2021). These include short videos, visual tutorials, interactive quizzes, as well as explanations of concepts through easy-to-understand audio and visuals. TikTok as a learning app gives students the opportunity to learn flexibly, either

independently or under the guidance of a teacher, where they can customize the learning experience according to their needs and interests.

Compared to formal learning platforms such as Google Classroom, TikTok provides a more visual and interactive approach to learning. This application allows teachers to produce learning content presented in the form of simple videos that interest students and facilitate understanding. Pupils can also explore various science content produced by other users from around the world, giving them a wider perspective and a more enjoyable way of learning.

TikTok also provides access to various learning resources that can enrich the learning experience, such as mini science experiments, explanations of difficult concepts, and sharing knowledge in a simple and interesting way. For example, students can watch videos that show science experiments or animations that explain natural phenomena. With this visual approach, science learning becomes more interactive and can increase students' motivation to explore more deeply.

By leveraging social media technology, TikTok opens wider and more flexible learning opportunities. This application has the potential to transform the way learning is carried out, providing a space for student-centred learning, as well as offering a more relevant, fun, and meaningful learning experience.

Interest in Scientific Concepts

Interest in science concepts is a psychological phenomenon that involves the willingness and desire of individuals to be actively involved in the process of learning and understanding science concepts. This does not only involve a passive interest or simply knowing general science facts, but also reflects a deep desire to investigate and understand the basic principles of science and how these concepts relate to the world around us (Schiefele, 2009; Renninger & Hidi, 2016).

One of the important aspects of interest in scientific concepts is the willingness of individuals to explore and find new knowledge in the field of science. This involves a willingness to read, watch, or hear about different science topics, as well as a desire to understand the implications and applications of those concepts in everyday life. For example, someone who has a deep interest in scientific concepts related to the earth may research geological phenomena such as earthquakes and volcanic eruptions. They will learn about the geological processes that shape the earth's surface and how these changes affect human life and the surrounding environment (Renninger et al., 2014; Zimmerman, 2007).

Apart from that, interest in science concepts also involves involvement in practical activities that allow individuals to apply science concepts in a relevant context. This includes participation in science experiments, field research, or science applications to conduct simulations or data analysis. For example, a student who has a high interest in related concepts with space will study phenomena such as black holes, the discovery of planets outside the solar system, or the evolution of stars.

Interest in scientific concepts also involves critical skills in evaluating scientific information, finding evidence, and drawing conclusions based on sound scientific principles. Individuals

with a high interest in science concepts tend to ask questions, challenge assumptions, and integrate new information into their existing knowledge. They may also seek opportunities to share their knowledge with others, participate in discussions, or contribute to science projects that involve the community.

Overall, interest in the concept of science is a dynamic and complex condition that includes an individual's willingness to explore, understand, and apply the principles of science in everyday life. This involves the pursuit of knowledge, engagement in practical activities, as well as critical skills and deep reflection.

Study Scope

The scope of this study covers several key aspects of TikTok in science learning. First, the study will analyse the extent to which the science content produced on TikTok is consistent with the elementary school science curriculum, including its effectiveness in conveying basic concepts such as earth phenomena, the universe, and life science. Second, this study will evaluate the creative approach used by teachers and content creators on TikTok to attract students' interest and increase students' understanding of science concepts. The third aspect involves evaluating students' interaction with TikTok content, such as the level of engagement, the desire to watch again or search for further content, and how the application helps them understand difficult scientific concepts.

This study will also evaluate the effectiveness of interactive elements on TikTok such as question and answer sessions in the comment section, challenges or science experiments that can be done at home, as well as the visual and audio impact on science learning content. In addition, analysis will also be conducted on student feedback regarding their learning experience using TikTok compared to conventional learning methods. With this broad scope, this study hopes to provide a comprehensive view of the role of TikTok as a science learning tool capable of fostering students' interest and understanding of science in the context of primary education.

Limitations of the Stud

This study is based on the following study limitations as shown in Table 1.1.

No	Limitations	Justification
1	Quantitative study design	A quantitative design allows for systematic measurement and validation that can strengthen the validity of the study. This can be supported by Patton (2002) who stated that quantitative data can be measured using standard measurement tools, which help in improving the validity and reliability of the study.
2	Type of digital app: TikTok	TikTok has gained attention as a social media app with high potential to deliver educational content in a creative and engaging way. TikTok allows teachers or content creators to produce simple and interactive learning videos, with appropriate visual and audio elements to interest young students in science subjects. The short video formats on TikTok can help convey complex science concepts in an easy-to-understand and fun way, thus supporting the learning process in a more relaxed context.
3	Scope of science concepts	The scope of science concepts that will be studied includes several basic topics taught in the primary school science curriculum, with the aim of evaluating the effectiveness of TikTok in helping students understand these concepts. The main concepts included in the scope of this study are natural phenomena and the universe and the solar system
4	Sample selection: 321 people	This study only involved 321 students from primary school as a sample. A sampling method was used to select the study sample. This involves a careful process in selecting respondents or units to be included in the study. As explained by Johnson (2010), “Sampling is an important step in the research process, which ensures the reliability and comparability of the data obtained.
5	Location	The selection of Klang district is due to the location of the researcher who lives nearby
6	Variable control	This study considers factors such as the level of technology proficiency of students, teacher support, teacher-student interaction and the learning environment to ensure that the effects measured are due to TikTok.
7	Usage Aspects	This study will focus on TikTok in the context of online science learning. This includes several important aspects, including how students

		interact with the application, the strategies used to deliver science learning materials, as well as the impact on student learning achievement.
8	Time Frame	This study will be conducted over a period, focusing on the short-term effects of TikTok use on the understanding of science concepts among primary school students.

Summary

Overall, TikTok in improving the understanding of science concepts among primary school students offers great potential in strengthening the landscape of modern education. According to Pusat Sumber Digital Pendidikan Malaysia (PSDP), digital technology in learning is getting more and more attention to improve the quality of education in our country (PSDP, 2023). This is supported by studies that show that students tend to be more involved and interact when learning is conducted through social media application such as TikTok (Ali et al., 2021). According to a study by KPM, the integration of technology in teaching and learning is proven to be able to improve primary school students' understanding of science concepts (KPM, 2022).

TikTok not only provides access to creative and interesting science content but also provides an environment conducive to interactive learning. With attractive visual features and an engaging storytelling approach, TikTok can help students understand complex science concepts in a simpler and more enjoyable way. Therefore, TikTok in improving the understanding of science concepts among primary school students not only benefits the students but also brings positive effects to the education system.

By continuing to make smart use of digital technology in education, we can ensure that pupils are prepared to face the challenges of an increasingly complex and evolving world while improving their interest in science subjects through innovative and enjoyable learning experiences.

Literature Review

Introduction

This chapter aims to explore several important aspects including related learning theories, challenges in technology in science education, and suggestions for implementing the effectiveness of TikTok.

Top of Form

Bottom of Form

Learning Theory

In education, there are various learning theories that form the basis for the teaching and learning process. This subtopic will discuss some of the main learning theories that are relevant to TikTok in improving the understanding of science concepts among primary school students. These theories will be analysed to understand how they relate to the context of digital learning and how to apply them practically in the technology in science education. A deep understanding of these learning theories will help educators to plan effective learning strategies that suit the needs of students in digital learning tools.

Theory of Constructivism

Constructivism theory by Piaget emphasizes that learning is an active process where students build their own knowledge and understanding through interaction with information, reflection on experience, and interaction with the learning environment (Jonassen & Land, 2012). Related constructivist theory features include an emphasis on active learning, where students engage directly in learning activities; emphasis on the construction of their own knowledge by students through reflection and experience and an emphasis on social learning, where interaction with peers and teacher plays an important role in knowledge construction (McMahon & Oliver, 2001). This means that the learning experience should be organized in a way that is related to the students' daily lives so that they can relate the concepts learned to the situations they experience in their lives. By understanding science concepts in a meaningful context, students are more likely to develop a deep and relevant understanding of the topic being studied.

When students use TikTok, they not only receive information passively, but are also active in the construction of knowledge. Through access to short videos provided on the application, students can explore science concepts in a more dynamic and fun way. For example, they can watch a video that illustrates the science process through creative animation, see a live recorded experiment, or follow an interactive narration that provides an in-depth explanation of the science concepts learned. Interactive features on TikTok also allow students to communicate and ask questions, increasing their engagement in learning.

In addition, specially designed interactive activities on TikTok can help strengthen students' understanding in an effective way. For example, there is a short video that displays an interactive quiz that tests their knowledge about the characteristics of the earth, such as the layers of the atmosphere and the geographical properties of the earth. In addition, students can also watch videos that display experiments and explanations of concepts that allow them to apply knowledge, for example, by choosing the best location to explore water resources based on their knowledge of the earth's hydrography.

In addition, TikTok also allows students to interact collaboratively with their peers through comment sections and duet videos. This gives them the opportunity to discuss science concepts, exchange ideas, and work together to solve problems. This social interaction is in line with the principles of constructivism which emphasizes the importance of dialogue and exchange of views in building knowledge.

Furthermore, social interaction in TikTok also gives students the opportunity to expand their understanding through exposure to various views and approaches in solving problems. By interacting with peers through comments and responses to videos, students can see science concepts from multiple perspectives and recognize strengths and weaknesses in their own approaches. This not only improves their understanding of the subject but also promotes critical and analytical thinking skills. For example, in the Earth and Space topic, students can discuss natural phenomena such as sunsets, lunar eclipses, or changing seasons through videos and comments. In this discussion, they can exchange opinions about the causes behind such phenomena, explain their effects on life on earth, and investigate various related scientific theories. Therefore, social interaction on TikTok not only helps in building

knowledge, but also fosters critical thinking skills that are important in the development of students as competitive learners.

Through the constructivist approach in TikTok, students not only develop a theoretical understanding of science concepts, but they are also guided to carry out practical experiments or projects that can be shared in videos. In this way, they can test and apply the knowledge they have learned interactively. Pupils can also see the relevance and usefulness of science concepts in a real-world context through creative and interesting short videos, which help increase their interest in learning. All of this contributes to building a solid foundation of scientific and critical thinking skills needed to face the challenges of an increasingly complex and evolving society. By making learning more interesting and interactive, TikTok is not only a tool for imparting knowledge but also a platform that encourages active involvement and creativity among students.

Cognitive Theory of Multimedia Learning

TikTok application elements in teaching is related to the cognitive theory of multimedia learning introduced by Mayer (2001). The cognitive theory of multimedia learning combines several theories, including the Dual-Coding theory by Paivio, the Cognitive Load Theory by Sweller, and the Working Memory Model by Baddeley. This theory is based on three assumptions that visual and auditory information is processed through different channels, with each channel having limitations in information processing or experience. In this context, active cognitive processes are designed to construct representations of information or experience (Mayer, 2014).

In TikTok, multimedia elements such as short videos, graphics, and sound can be used to convey information visually and auditorily to students. This allows multiple perceptual channels to be used to process information, which can improve understanding and memory. Furthermore, by allowing users to produce and share interactive videos, TikTok stimulates active cognitive engagement, aiding in the formation of solid mental representations of learnt concepts.

This cognitive theory explains that the mode of presentation of multimedia-based teaching materials is carried out through five steps: (1) suitable text is selected for processing in verbal working memory, (2) suitable images are selected for processing in visual working memory, (3) organizing the text in a verbal mental model, (4) organizing images are organised in a visual mental model, and (5) integrating the representation of verbal and visual information is integrated as new knowledge (Mayer, 2014). Rusli and Atmojo's study show that the teaching materials produced should meet several principles to ensure that multimedia presentations meet the needs of students. By adapting these principles in the design of TikTok content, we can ensure that the learning experience offered is not only interesting but also effective in improving students' understanding and memory of science concepts.

Mayer (2001) describes several learning principles related to multimedia design, namely:

Principles of multimedia	**:**	**Learning is more effective when applying a combination of graphics, text, audio, animation, pictures compared to textbooks**
Proximity principle	:	Presenting text and pictures when text and pictures simultaneously learning will improve
Principle of modality	:	Using animation is better than using printed text to explain new concepts.
Signalling principle	:	Arrange learning materials based on a clear framework

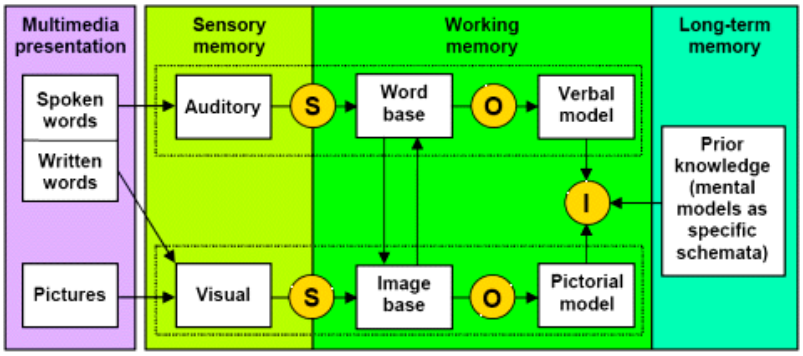

Figure 2.1: Thinking process based on the Cognitive Theory of Multimedia Learning.
Source: Mayer 2001

The Cognitive Theory of multimedia learning explains that applying multimedia elements in learning can increase the rate of student understanding. This is so because multimedia elements prioritize the visual and verbal techniques in the process of receiving knowledge to the maximum. When teachers use visual or verbal techniques simultaneously in explaining, especially to primary school students, the information received by students can also be transferred well. This is due to the explanation process that combines visual and verbal techniques can give clearer and more meaningful explanations to students, especially in science subjects. The combination of visual and verbal techniques also helps students think deeply in the learning process.

The cognitive theory of multimedia learning in the learning process through the TikTok has a significant impact in conveying information in an interesting way. Paivio and Mayer (2001) stated that combining text and picture resources in short videos helps build better memory. Teaching effectiveness increases when students can focus on these two elements simultaneously. The process of explaining concepts and demonstrations in the form of TikTok videos that combine visual, and verbal allows students to understand and remember information for a longer time.

In a study on TikTok to improve the understanding of science concepts among primary school students, it is important to understand that the visual and verbal techniques simultaneously can affect the way students learn. TikTok creates a fun and interactive learning environment,

making the learning experience more engaging. With this, students are more likely to be actively involved in exploring science concepts in depth.

This theory explains that visual and verbal techniques provide various benefits. For example, when the teacher uses appropriate pictures and text in the video to explain a phenomenon such as a lunar eclipse, students are more likely to understand the relationship between the concepts. The selection of clear pictures and easy-to-understand text helps them attract attention and gain a deeper understanding. Therefore, the right selection of pictures and text in TikTok videos can improve students' understanding compared to using only text. The effect of this technique not only helps students attract attention but also increases the effectiveness of the learning process.

The combination of images and text in TikTok videos can produce high achievements in knowledge and understanding of science concepts. When students use this technique, they can remember and achieve better understanding. As stated by Mayer (2001), graphic aids allow students to focus longer and understand concepts more easily. This shows that the combination of pictures and text in delivery has a positive effect on learning, improves student achievement and changes their attitudes for the better.

Overall, this theory asserts that the combination of image and text techniques in learning through TikTok provides a significant positive impact on students' understanding, memory, and achievement. The combination of visual and verbal elements in this application also improves their skills in connecting the concepts taught with applications in everyday life. Therefore, this technique plays an important role in building a solid foundation for effective and relevant science learning.

Cognitive Load Theory

Cognitive load theory is a psychological theory that aims to estimate learning outcomes by paying attention to human cognitive abilities and limitations (Plass, Moreno & Brunken, 2010). This theory states that everyone has a limited capacity in information processing, and cognitive load refers to the amount and complexity of information that a person needs to process in completing a task.

In the context of teaching and learning, cognitive load theory plays an important role in assessing the suitability of teaching methods and learning materials with the students' cognitive abilities. Excessive cognitive load, such as when an excessive amount of information is presented simultaneously or involves an overly complex task, can hinder the learning process and cause excessive mental stress. On the other hand, a cognitive load that is too low makes learning less challenging and less effective.

In this study, the theory of cognitive load is closely related to the way information is delivered and the interaction between students and learning materials. TikTok is also related to cognitive load theory. Cognitive load theory outlines that when students are exposed to a learning environment that requires task solving or conceptual understanding, they experience mental or cognitive load. By using digital learning tools, features such as multimedia, interactivity, and game-based learning activities can help reduce students' cognitive load.

Cognitive load theory emphasizes the importance of reducing memory workload to improve learning effectiveness. This is because, when the received information is too much, the working memory will be full and it will be difficult to process the information well (Chandler & Sweller, 1996; Driscoll, 2005; Sweller, 2005). Working memory plays an important role in receiving and processing information before storing it in long-term memory (Toh, 2005). Therefore, strategies such as the addition of visual and auditory elements can be used to reduce the working memory load. For example, videos or animations in digital apps such as TikTok gives students the opportunity to receive information visually that is easier to understand. This approach indirectly helps to reduce the cognitive load that often arises when information is presented in the form of text only.

As stated by Abdullah, Wong & Rahman (2013), individual memory is only able to absorb part of the information at a time, especially when verbal and non-verbal information is received simultaneously. Therefore, with clear content, organized teaching materials and the graphics or diagrams, the learning process will be more effective, increasing students' interest and understanding. This theory also asserts that using teaching materials that are easy to understand in the learning process is the key to achieving optimal results (Cauble et al., 2000). In addition, the delivery of multimedia materials in TikTok is an effective teaching method to increase learning achievement (Ignacio, Smith & Lee, 2009). Therefore, when arranging presentation tools in class, it is important to consider cognitive load theory to ensure a more efficient and interesting learning process.

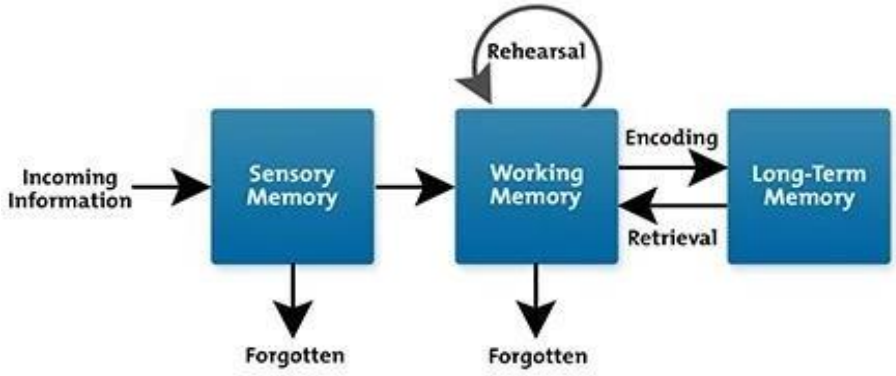

Figure 2.2: Cognitive Load Theory

Overall, cognitive load theory provides an important foundation in understanding how humans process information and solve the tasks at hand. In the context of teaching and learning, this theory provides valuable guidance for planning learning experiences that suit the students' cognitive abilities. Thus, the cognitive load theory can improve the overall learning effect, ensure effective learning and provide room for continuous academic growth.

Jean Piaget's Cognitive Theory

Children's cognitive development is an ever-evolving process, where they actively build knowledge by receiving information from parents and teachers (Wood, Bruner & Ross, 2001). Piaget (1958) divided cognitive development into four stages: sensory motor (0-2 years), pre-operational (2-7 years), concrete operations (7-11 years), and formal operations (12 years and above). The concrete operational stage marks the beginning of real knowledge formation, where children can integrate logical and systematic thinking, as well as build predictions and

deductive thinking (Storm, 2011; Wood, Bruner & Ross, 2001). In this level, they can also hypothesize and connect concrete objects with symbols (Lutz & Huitt, 2004; Storm, 2011).

In the context of using TikTok to improve the understanding of science concepts, the interactivity features and interesting learning activities are very important. Storm's (2011) study emphasizes the importance of digital applications in helping children develop self-expression and build complex ideas. At this stage, the interactive teaching aids are key. Piaget & Gracia (1987) emphasized that the most effective learning uses interactive materials to stimulate students' thinking and reasoning. TikTok not only creates a dynamic learning experience but can also make science learning more interesting and easier to understand.

Piaget also emphasized the importance of direct experience and interaction with the environment for effective learning. Through applications such as TikTok, interactivity allows students to engage directly, providing opportunities for virtual experimentation and practical application of science concepts. This is in line with Piaget's approach, where direct experience and exploration are key in building knowledge.

Jean Piaget's cognitive theory with digital applications such as TikTok is important to design activities that suit the student's cognitive development level. In addition, TikTok allows customization of the learning experience to meet various cognitive levels. With a variety of learning resources, teachers can provide materials that suit the students' level of concrete thinking at the level of concrete operations. Interesting and interactive activities can create effective learning.

The TikTok application also allows teachers to practice a student-centred learning approach that is in line with Piaget's educational philosophy. This encourages active learning and knowledge building through hands-on experience and direct interaction with learning materials. In this way, TikTok not only leverages Piaget's cognitive theory in designing activities, but also provides the flexibility and interactivity needed to meet students' learning needs holistically.

Connectivism Theory

Connectivism theory is an approach in education that emphasizes the role of technology and networks in the learning process. This theory was introduced by Siemens (2004), who states learning does not only occur through interaction with teachers or traditional reading materials, but also through access to various digital information sources and interaction with the ever-growing digital network. In the context of connectivism, learning is viewed as a process of providing, gathering, and communicating information in a dynamic digital environment.

An important feature in connectivism is the concept of "networking", where individuals not only obtain information from one source, but also make connections between information obtained from various sources. In the context of using TikTok, students do not only learn from teachers or textbooks, but also through various digital resources. For example, they can watch short videos about science phenomena, follow accounts of science experts, and join discussions in comments or through live sessions. In earth and space topics, students can access information from documentary videos, links to websites such as NASA, as well as

creative learning experiences shared by other users on TikTok. This allows them to understand concepts in a more interactive and interesting way, as well as make connections between the various sources of information available.

In addition, the concept of "lifelong learning" in connectivism emphasizes continuous and flexible learning, allowing students to continue to acquire new information and knowledge through digital networks, even outside the classroom. For example, through TikTok, students can watch interesting learning videos, follow presentations on space science, or participate in live sessions to deepen their understanding of concepts learned.

In addition, connectivism also emphasizes the importance of collaborative and continuous learning. In the context of TikTok, students can interact with peers through comments, share information resources, and create duets or video collaborations to explore space phenomena together. For example, in science class, they can work together to produce a short video explaining a certain concept, using information from various sources they find on TikTok. This is in line with the view of Farooq et al. (2020), who emphasized that digital application such as TikTok promotes collaborative and continuous learning.

Apart from that, connectivism also shows that learning is not limited to the classroom where learning can happen anywhere and anytime. Students can access various learning resources through TikTok on their computers, smartphones, or tablets. This provides flexibility in learning, suiting individual lifestyles and needs. With easy access to videos, tutorials, and other science information available on TikTok, learning can be done at home, on the go, or anywhere with an Internet connection.

Thus, the theory of connectivism provides an important basis for digital application such as TikTok in improving the understanding of science concepts among primary school students. Through the integration of the principles of connectivism in teaching and learning using digital technology, teachers can create a dynamic, student-centred learning experience, and foster continuous and collaborative learning.

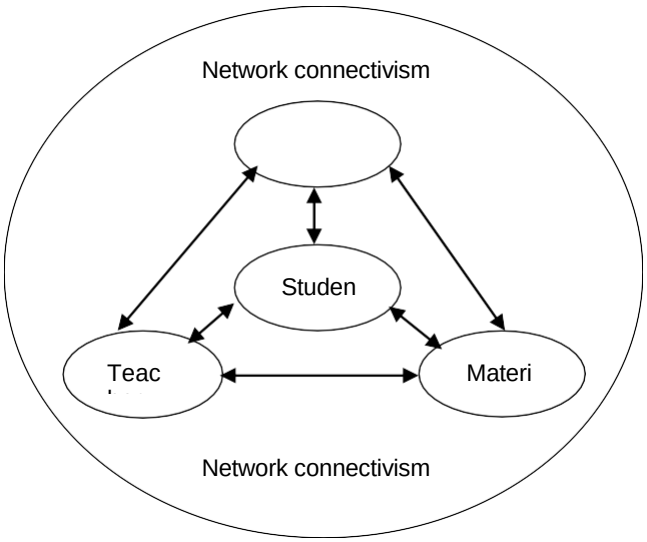

Figure 2.3: Interaction of students, teachers and materials in a connectivism environment

Educational Policy

Malaysian Education Transformation Policy 2013-2025

The Malaysian Education Transformation Policy 2013-2025 is an initiative that aims to revolutionize the country's education system to ensure that every individual can reach their maximum potential. This policy introduces various innovations and changes in education from preschool to higher education, as well as emphasizing the provision of quality, inclusive, and sustainable education.

An important aspect of this policy is increasing accessibility to quality education for all walks of life. This includes various initiatives to ensure that children from rural areas, low-income communities, and disadvantaged groups also get equal opportunities in education. For example, TikTok, which can be accessed from anywhere with an internet connection, allows students from various backgrounds to gain access to quality learning materials through creative and interactive educational videos.

In addition, the Malaysian Education Transformation Policy 2013-2025 emphasizes the technology in education. This includes the implementation of digital learning, where technology is used as a tool to strengthen the teaching and learning process. This step aims to ensure that students have the necessary digital skills in an era of globalization that is growing rapidly. In this context, the implementation of digital learning through TikTok fulfils this basic aspiration by introducing technology in the science learning process, strengthening the accessibility of learning materials, and increasing students' mastery of the science concepts taught (Chandra et al., 2019).

In this study, researchers will examine how TikTok will affect the quality of teaching and learning, as well as student academic performance. Through this study, researchers will gather relevant data to assess the effectiveness of implementing digital learning in achieving the goals of the Malaysian Education Transformation Policy 2013-2025. The results of this study can provide guidance to education authorities in perfecting digital learning strategies and initiatives to improve the quality of education in Malaysia.

Overall, the Malaysian Education Transformation Policy 2013-2025 is an important step in the journey towards a more inclusive and competitive education system. It not only reflects the government's seriousness in providing quality education for all citizens, but also reflects its long-term commitment to ensure Malaysia has excellent human resources and can compete at the global level. By continuously renewing its approach to education and integrating technology, Malaysia strives to produce a competent and potential future generation.

12th Malaysia Plan

The 12th Malaysia Plan (RMK-12) is an important development plan in promoting Malaysia's economic growth and improving the well-being of Malaysians (Abdul Halim, 2018). In the context of education, RMK-12 sets the goal of strengthening the country's human capital by emphasizing the development of quality and capable human resources. One of the main focuses of this plan is to improve the quality of education at all levels, including science education in primary schools.

The objective of improving the quality of education, including science education, is important because it helps ensure that students can face the increasingly challenging challenges of the future (Raza et al., 2019). RMK-12 supports and recognizes the importance of science education at the primary school level as a basis for developing critical thinking skills, creativity, and scientific thinking among students.

In addition, RMK-12 also recognizes the important role of technology in strengthening the education system. In the context of science teaching, digital application such as TikTok becomes very relevant. RMK-12 emphasizes the technology as a tool to strengthen the teaching and learning process, which is directly related to the title of the study that examines TikTok in improving the understanding of science concepts among primary school students. By using TikTok, teachers can create engaging and accessible teaching videos, allowing students to understand science concepts in a more fun way.

With the empowerment of technology in education, RMK-12 encourages the development of interactive and comprehensive digital applications. This means that, in addition to providing access to quality science learning materials, digital applications are also able to strengthen the understanding of science concepts through an interactive and fun learning experience. Through videos on TikTok, students can also engage in challenges or activities that encourage them to explore and explain science concepts in a creative way.

Overall, RMK-12 provides a solid foundation for the development of science education in primary schools through technology. This includes support for initiatives that encourage the innovative and effective digital applications such as TikTok. By practicing the policies set in RMK-12, it is hoped that science education in primary schools can be effectively improved to meet the needs of the digital society (Department of Education Malaysia, 2018).

Digital Malaysia Education Policy (2020-2025)

The Digital Malaysia Education Policy (2020-2025) is an important initiative that aims to promote transformation in the field of national education through the utilization of digital technology. In this policy, there are several main objectives to be achieved to strengthen the country's education landscape to face current challenges as well as pursue opportunities in the digital era.

First, the policy emphasizes the integration of digital technology in every aspect of education, including teaching and learning, school management, and assessment. For example, by using TikTok in teaching, teachers can provide interactive and comprehensive learning materials to their students. Students can access the materials from anywhere, providing greater flexibility in learning (Hamzah, 2020).

Second, the Malaysia Digital Education Policy (2020-2025) also focuses on improving digital skills among students. This includes the implementation of training programs to improve the ability to use digital technology in the teaching and learning process. For example, students are given training on how to use TikTok effectively for science teaching and learning in primary schools. Through this approach, they can produce short videos that explain science concepts in an interesting and creative way. This not only improves their understanding of the subject,

but also provides a more interactive and meaningful learning experience, as well as promotes communication and collaboration skills among students.

In addition, the Malaysia Digital Education Policy (2020-2025) also encourages innovation in learning using technology. This includes the development of educational applications and software that suit the needs of students. For example, education authorities can encourage the development of interactive modules specific to topics such as earth and space. This will make learning more interesting and easier for students to understand.

In this study, the Malaysian Digital Education Policy (2020-2025) provides support for applying TikTok as an effective method to improve the understanding of science concepts among primary school students. Through the implementation of this policy, it is hoped that science education in Malaysia can be strengthened through the effective use of digital technology in teaching and learning. By leveraging TikTok, teachers can create engaging and interactive video content, allowing students to access science information in a more fun and understandable way.

Teaching Characteristics

When planning lessons, it is important to consider the appropriate characteristics to effectively convey information to students. According to Choi & Johnson (2005), teaching needs to be aligned with the learning objectives that have been set. Every activity and learning material need to be carefully selected so that it is closely related to the aspects of the study that the students want to emphasize. Emphasis on learning objectives will help direct the focus of teaching and learning.

In addition, the problem-based learning (PBL) approach is also important in teaching. According to Savery & Duffy (1995), this approach brings students to face situations or problems related to the topic of study, allowing them to use the knowledge learned to find solutions. For example, in the context of the topic of earth and space, students might be given a problem about the differences between the planets in the solar system and asked to find the causes and effects of those differences. By using TikTok, teachers can create video challenges where students share their solutions in a creative way. Tasks like this stimulate students' critical and creative thinking, as well as encourage the knowledge in a practical context.

Furthermore, according to Ennis (1985), critical thinking skills are important in producing systematic and meaningful thinking. Emphasis will be placed on developing critical and creative thinking skills in the context of the study topic. This includes the ability to analyse information, draw conclusions, and propose solutions based on their understanding of the study. For example, students could be tasked with analysing data about the orbits of the planets in the solar system and identifying possible patterns or patterns, then presenting them through engaging TikTok videos.

Moreover, the role of technology is also important in supporting the teaching and learning process. In the growing digital era, technology has become an important aspect of effective teaching. For example, in the topic of earth and space, teachers can use TikTok to share simulation videos or interactive software that allows students to visually see complex

concepts such as planetary movements or celestial phenomena. In this way, teaching becomes more interesting and easier for students to understand, as well as helping to stimulate their interest in the field of science.

By considering the teaching characteristics that have been mentioned, the learning process can be carried out more effectively and comprehensively. This will indirectly ensure a deep and comprehensive understanding by students of science concepts, especially in the context of earth and space topics.

Summary

This chapter examines theories and teaching models that are relevant in the context of using TikTok to improve the understanding of science concepts among primary school students. This aims to provide a solid theoretical foundation on the factors that influence the learning of science concepts in a digital environment. In addition, this chapter also examines appropriate teaching models to integrate technology such as TikTok in the learning process of science concepts, emphasizing aspects such as curriculum suitability, interactive teaching strategies, and integrated assessment. This analysis will guide educators in formulating effective teaching strategies to maximize the potential of TikTok in improving the understanding of science concepts among primary school students. By using short, engaging and creative videos, teachers can deliver information in a more memorable and fun way, while encouraging active student engagement.

Methodology

Introduction

Methodology in research is a scientific method to describe the method or approach used in research. In research, the objectives or goals of the study can be achieved based on methodology. This chapter contains a description of the selection of study design, population determination and sample selection, types of study instruments, pilot study findings, reliability and validity of study instruments, data collection procedures and data analysis used in the study.

Research Design

Research design is a planning, structure, strategy and research framework to ensure that research questions can be answered (Inaam, Patel & Khan, 2016). The results of the study obtained may not be accurate if the design used is not appropriate. This has a negative effect on other researchers who want to refer to the results of the study. According to Crawford, Smith & Lee (2009) quantitative design is suitable for descriptive research. Therefore, the quantitative method was chosen in this study. Data collected in the form of numbers and analysed using statistical methods. The act of collecting and studying numerical data to identify patterns and averages, formulate hypotheses, determine the causes and effects of study results, and extend findings to a larger population is known as quantitative research (Bhandari, 2023).

The survey research design in this study includes research on TikTok in improving the understanding of science concepts among primary school students. This study uses a survey method to collect data from respondents in the form of a questionnaire. This questionnaire is carefully designed to ensure that it reflects the objectives of the study and includes items

that are relevant to the study topic. In survey research, respondents are selected randomly or through appropriate sampling methods to maintain diversity in the respondent group.

By using a survey research design, researchers were able to collect data from a variety of TikTok users to gain a more comprehensive view of the impact of using this application on science learning. TikTok as an interactive and interesting social media application allows the dissemination of information in the form of short videos that are creative and easy to understand, making it a potentially effective tool in increasing students' interest and understanding of science concepts. Through survey methods, researchers can measure the effectiveness of TikTok in communicating science topics, such as the extent to which these short videos help in improving understanding, encourage repetition, and support fun and informal learning. In addition, this method allows researchers to identify patterns and trends in TikTok as a learning tool, including how popular content on this application affects students' interest in science. Thus, researchers can draw stronger conclusions about the potential of TikTok as a dynamic and relevant science learning medium.

Study Samples

The sample selection process in this study will begin with the random selection of several primary schools from different areas. After the schools have been selected, each school will be selected to contribute enough students to meet the required sample size, which is a total of 321 students. The process of selecting students from each school will also be done randomly to ensure fair representation from various backgrounds. In addition, the percentage of male and female students will also be considered to ensure gender balance in the sample.

The sample of this study will include students from various socioeconomic, ethnic, and geographic backgrounds to ensure that the study can reflect diversity among the primary school student population. This study will also consider various levels of academic achievement and student abilities to ensure a comprehensive representation of the spectrum of academic achievement. By including students from various backgrounds and ability levels, this study can provide a more complete picture of the impact of using TikTok in improving understanding of science concepts. TikTok, with its short and creative video features, has the potential to appeal to students from all walks of life and ability levels. This allows researchers to assess the extent to which the application can support different types of students in mastering science concepts in an interactive and fun way, as well as identify the advantages or limitations of TikTok as an inclusive science learning tool.

Research Instruments

Questionnaire

Questionnaire instruments are very important in this study to evaluate the effects of TikTok use in science learning. Questionnaire is a popular measurement tool, and according to Syed Arabi (1993), the quality of the questionnaire greatly affects the overall value of the research. In this study, the researcher prepared a set of questionnaires containing questions about students' understanding of TikTok for learning after the intervention. According to Siti et al. (2018), the construction of the questionnaire needs to be adapted to the objectives of the study that have been set. Therefore, each questionnaire item is built based on the objectives of the study to ensure that the data obtained is relevant and authentic. The questionnaire

used in this study was divided into four sections to obtain more detailed data on the effects of TikTok use in science learning:

Part A: Includes informant demographic information such as age, gender, socioeconomic background, and geographic location. This section aims to understand the background of each student involved in the study.

Part B: Assess students' interest in science subjects before the intervention is carried out. The questions in this section will give an idea of the students' initial level of interest in science, which will serve as a basis for comparison with the results after using TikTok.

Section C: Assessing the influence of TikTok on students' interest in science. The questions in this section focus on how TikTok affects students' interest and engagement in science subjects.

Part D: Assessing students' learning experiences through TikTok in understanding science concepts. The questions in this section measure the extent to which TikTok helps in the learning process, including the level of understanding, engagement, and overall experience in mastering science topics.

The questions in this questionnaire use a five-point Likert scale to give respondents more flexibility in evaluating their perceptions. This five-point scale includes options such as: (5) Strongly Agree, (4) Agree, (3) Neutral, (2) Disagree, and (1) Strongly Disagree. This approach allows respondents to give their views more accurately, as they can choose the answer that is closest to their true opinion, including a neutral option if they do not have a clear opinion. According to Jazmi (2009), questionnaire items should be arranged in simple, short, clear, and easy-to-understand sentences. This means that each question is structured so that it can be understood without confusion, making it easier for respondents to answer accurately and avoiding different interpretations of each question.

All data collected will be coded and analysed using descriptive statistics through IBM Statistical Package for the Social Sciences 23 (SPSS 23) software. This method allows the researcher to determine the frequency and percentage for each item in the questionnaire. The descriptive statistics will help researchers describe the pattern of answers obtained from respondents, providing a comprehensive view of students' perceptions of TikTok in science learning.

The items in this questionnaire are adapted to the respondent's level of thinking. This is important to ensure that they can answer the questionnaire honestly and accurately without feeling stressed or confused. During the questionnaire session, the researcher will read the instructions to each respondent and give clear explanations to avoid any confusion among the students. Respondents will then be asked to choose one of the scales provided for each question. Respondents will be given 20 minutes to complete the questionnaire in the classroom. In addition, students are reminded from time to time to answer the questionnaire honestly and transparently.

Pilot Study

This pilot study is an initial step in research on TikTok as a science learning tool before the actual study is conducted. According to Chua (2011), a pilot study is known as a mini study or a small study conducted to test the elements of the study before the full study is carried out. Mod Majd (2012) states that a pilot study is an experimental study conducted on a small group of respondents to assess the reliability and validity of the question items. Borg & Gall (1993) also emphasized the importance of pilot studies to obtain preliminary information about the validity and reliability of the instrument as well as to determine the appropriateness of the study's conceptual model.

The purpose of this pilot study is to ensure that the questionnaire used can accurately and consistently measure the experience and perception of primary school students towards TikTok in science learning. Validity refers to the degree of accuracy of the measurement, while reliability refers to the instrument's ability to produce consistent results if repeated. In the context of this study, the pilot study involves preliminary testing of the questionnaire by a group of subjects to ensure that the question items related to TikTok are valid and reliable.

The specially designed questionnaire in this pilot study contains various questions to evaluate aspects such as the suitability of TikTok video content for learning, the level of usability of the application, user satisfaction, as well as the effectiveness in improving students' understanding of science concepts. These questions are carefully formulated so that they are easy to understand and relevant to the objectives of the study.

The data obtained from the pilot study will be analysed using the Cronbach's Alpha method to assess the reliability of the questionnaire items. If there are items that are not suitable or do not reach a satisfactory level of reliability, adjustments will be made before the implementation of the actual study. According to Chua (2012), instruments with reliability values between 0.80 to 0.95 are considered suitable for use in a full study.

In addition, this pilot study allows the researcher to evaluate and improve the research procedures, including the data collection process and analysis techniques, before the actual study is carried out. This helps the researcher identify any weaknesses in the questionnaire design or challenges in the study procedures that may need to be improved or adapted for the smoothness of the actual study and better-quality results.

In addition, this pilot study provides an opportunity for researchers to understand the potential practical challenges that may arise during the implementation of the actual study, such as difficulties in TikTok by respondents or ethical issues related to exposure to social media. By identifying these issues early, researchers can provide proactive measures to overcome these challenges.

Overall, pilot studies play an important role in ensuring that research instruments and procedures can produce valid, reliable, and quality data. By conducting a pilot study, researchers can conduct a full study with higher confidence that the results of the study will be accurate and relevant to answer research questions about TikTok in science learning.

Legality

Determining the validity of the questionnaire is an important step in the process of compiling research instruments. There are several important steps that need to be taken to determine the validity of the questionnaire. First, content validity needs to be ensured where the questions in the questionnaire are evaluated by experts or individuals who are skilled in the field of study to ensure the reliability of the concept to be measured. In addition, face validity is also important where the questionnaire is handed to the respondents. These respondents may consist of primary school students representing various levels of academic achievement. During the initial test, respondents will be asked to fill out a questionnaire and provide feedback on the questions provided.

The data obtained from the preliminary test will be carefully analysed using statistical methods such as Cronbach's method to assess the reliability of the questions. This analysis will help determine the reliability of the questionnaire and identify any weaknesses or defects that may need to be corrected. If there are questions that are inappropriate or do not provide high reliability, the researcher will make the necessary adjustments or improvements.

Construct validity involves statistical analysis to check the relationship between the items in the questionnaire and the construct to be measured. Finally, temporal criterion validity is also used, where respondents fill out the questionnaire at different times to assess the consistency of the results or the validity of the instrument at different times. By combining these various methods of validity, researchers can ensure that the questionnaire compiled has high validity and is reliable to measure the desired construct or characteristic.

Usability

In a study that evaluated TikTok for science learning, the usability of the questionnaire played an important role in ensuring that students could understand and answer the questions easily. The usability of this questionnaire was tested first with the aim of collecting respondents' feedback regarding the understanding of the questions, the level of difficulty that may be encountered, and any confusion when filling out the questionnaire. To facilitate understanding, the questionnaire is structured clearly and concisely and uses language that can be easily understood by primary school students. The organized layout and structure and clear instructions also help to improve the usability of this instrument.

The first step in assessing the usability of this questionnaire is to perform an initial test on a small group of students. This initial test provides an initial overview of the students' understanding of the questionnaire items regarding their experiences using TikTok in science learning. The observation method was also used during this preliminary test to directly see how the students interacted with the questionnaire. Through observation, the researcher can identify any confusion that may arise when students read questions or choose answers. Pupils can also provide direct feedback on how easily they can answer each question.

The preliminary data analysis from the questionnaire test also gave the researcher an indication of the usability of the questionnaire. If many respondents report difficulty understanding the questions or find the questionnaire confusing, then the researcher may need to adjust the questionnaire to make it more user-friendly and clearer. For example, if

students are confused by the Likert scale format or lack understanding of certain terms, then changes will be made to make the questionnaire more suitable to their level of understanding.

According to Sauro and Lewis (2016), this usability test is an important step to ensure that the questionnaire can be answered easily and smoothly. By combining approaches such as preliminary testing, observation, and respondent feedback analysis, researchers can ensure that the questionnaire that will be used in the actual study has high usability. This helps to guarantee that the data obtained is accurate, of good quality, and relevant to the objectives of the study in evaluating the impact of TikTok use on students' understanding of science.

Questionnaire Instrument

Data validity is an important element in every study and requires special attention from the researcher to ensure that the data obtained is accurate and reliable. The questionnaire instrument is one of the main components that need to be paid attention to in this effort. Therefore, the selection of the right questionnaire instrument is an important initial step in the research process. As suggested by Azizi Yahya (2007), the chosen questionnaire instrument should be tested for validity and reliability before being used in the study to increase trust in the data obtained, as well as make it stronger in the analysis and drawing conclusions of the study.

In this study, the questionnaire used was modified from existing sources to match the objectives of the study. This modification process involves the involvement of experts in the field of study, where they provide insight and critical evaluation. With expert views, researchers can perfect and improve questionnaire items so that this instrument has high validity and reliability.

This step gives the researcher access to views from multiple perspectives, which allows them to identify and improve aspects that may have been overlooked in the questionnaire preparation process. Expert opinions and modification results based on previous studies help to increase the validity of the questionnaire items to ensure that they really measure the elements that are important in this study. This process also allows the researcher to adjust the questionnaire if necessary, ensuring that the instrument is user-friendly and able to provide accurate and reliable data.

Data Collection Procedure

The process of data collection in this study begins with obtaining permission from the schools involved. After obtaining consent, the researcher will begin the data collection process. The researcher will explain the implementation process to science teachers and students involved in this study. This explanation is intended to ensure that they understand the process that will go through throughout the study. Quantitative data collection procedures have been listed in Table 3.2 as follows.

Table 3.2
Data Sources

Quantitative Data	Questionnaire about interest in science concepts and the effectiveness of TikTok use

Quantitative data collection in this study uses a questionnaire that has been prepared. After the questionnaire is filled out by the respondents, the data obtained will be coded to facilitate analysis. The next step is to enter the data into the computer using statistical analysis software such as SPSS (Statistical Package for the Social Sciences). Through this software, data will be systematically analysed to obtain information that is relevant and related to the objectives of the study. By using this procedure, the researcher can ensure that the data obtained from the questionnaire can be interpreted accurately and provide a valuable contribution to knowledge in the field being studied.

To ensure that the study is carried out smoothly, the researcher will follow the study procedure as shown in Table 3.3.

Table 3.3
Study Implementation Procedure

NO	PROCESS	DESCRIPTION
1.	State the purpose of the study	**Listing purpose of the study and develop research questions related to the purpose of the study.**
2.	Getting to know definitely the required resources	**Identifying sources to build instruments, collect data and analyse data by referring to relevant journals, theses and books.**
3.	Identify the target population	**Identify school that was selected, the year of the students involved in the study and the number of students.**
4.	Determine the study method	**Choose the appropriate research method.**
5.	Provide research instruments	**Build instruments to study by referring to examples that have been built by previous researchers.**
6.	**Analyse study data**	**Study data will be analysed using the appropriate statistical test which is SPSS version 21.0' for Windows (Statistical Package for Social Science).**

Data Analysis

Once the data were collected, statistical analysis was conducted using IBM SPSS Statistics software, with a significance level of 0.05 set as the threshold for all statistical tests. This means that analysis results that have a p value of less than 0.05 are considered significant, indicating that there is a relevant relationship or difference in the context of the study. Researchers used a combination of descriptive and inferential statistics to analyse the data of

a study focusing on "Increasing Interest in Science Concepts Among Elementary School Students through TikTok."

According to Villegas (2023), descriptive analysis is a methodological approach in data analysis that aims to explain or summarize data, helping researchers identify patterns in the dataset. For this purpose, descriptive analysis will be used to list averages, percentages, and frequency distributions, which will provide a comprehensive picture of the characteristics of the primary school students involved in this study. Demographic data such as age, gender, and student experience in using digital learning tools will be analysed and presented in the form of tables, graphs, or other statistical summaries. In this way, the researcher can see the general characteristics of the respondents and how their demographic profile may influence interest in science concepts.

Also, according to Questioner (2023), inferential statistics predict data from smaller samples to provide estimates and conclusions about larger populations. It estimates population parameters and tests population hypotheses based on sample data using statistical models and probability theory. The main objective of inferential statistics is to use sample data to provide knowledge about the entire population to develop conclusions that are as accurate and robust as possible.

For inferential analysis in this study, one-way ANOVA, normal probability tests, and correlation tests will be used to examine the relationship between TikTok and increased interest in science concepts among elementary school students. The objective of the study will be to use one-way analysis of variance (ANOVA) to examine the relationship between digital learning tools and increased interest in science concepts. Normal probability tests and correlation tests will be used to investigate the desired relationship between the factors studied.

After the data analysis is completed, the researcher will formulate a conclusion based on the results of the study and interpret the data obtained. This conclusion will include practical implications for science education in primary schools, especially in increasing students' interest in science concepts through TikTok. The researchers will also provide suggestions for future studies, hoping to expand research in this area as well as better understand the relationship between the TikTok application and science learning.

Conclusion

This chapter has presented the methodological framework used in this study. This process includes systematic steps taken to collect and analyse data from the respondents involved. TikTok has been the focus, and through this questionnaire, the researchers aim to obtain clear and detailed information about how this application affects students' interest and understanding of science concepts.

The results obtained from this questionnaire are expected to provide a deeper insight into the potential of TikTok in increasing students' interaction and interest in science subjects. With this quantitative approach, researchers will also be able to statistically analyse data to obtain more objective conclusions about the impact of TikTok use in an educational context. Therefore, this study can not only provide guidance to educators regarding the digital tools in

learning but also contribute to the development of more innovative and effective teaching methods.

Theoretical and Contextual Contribution

This research makes a valuable contribution to the theoretical understanding of how social media, particularly TikTok, can influence students' interest in educational content, specifically science concepts. Theoretically, the study expands on existing educational theories related to engagement and multimedia learning by examining how short-form, user-generated content can foster curiosity and enhance learning. It challenges traditional views of formal education by introducing a non-traditional, digital application as a tool for academic development. Contextually, this research addresses the growing need for innovative and engaging methods to teach science to primary school students, particularly in a digital age where traditional teaching methods are increasingly supplemented or replaced by technology. By demonstrating how TikTok can serve as a vehicle for science learning, this study contributes to the broader discourse on integrating social media into educational practices, providing educators with new insights into how digital tools can be used to capture students' interest and improve their engagement with scientific concepts.

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