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Effectiveness of TikTok-assisted Learning Supplement to Improve Students' Concept Understanding Ability and Learning Interest

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Abstract

The use of social media such as TikTok in mathematics education and row and sequence materials is still rarely explored, although it has the potential to change the paradigm of presenting supplementary materials. This is because generally additional material is presented through platforms that are specifically for learning such as Geogebra, learning modules, or Kahoot. This study aims to determine the effectiveness of TikTok-assisted learning supplements on the ability to understand concepts and students' interest in learning the material of arithmetic rows and series from the results of test work and questionnaires through pre-test and post-test that have been carried out. This study involved students of class XI IPA 5 SMA Negeri 1 Manonjaya as the sample, with the population of all class XI students in the school. This research combines quasi-experimental method and quantitative approach. This study found two important things: First, the use of TikTok-assisted learning supplements proved to be effective in improving students' conceptual understanding of arithmetic rows and sequences. Second, the use of TikTok-assisted learning supplements did not show effectiveness in increasing students' learning motivation. This is evidenced by the higher interest in learning in the experimental class compared to the control class, as well as a significant increase in the average value of N-Gain (normalized gain) in concept understanding ability. For this reason, other research is needed regarding the effectiveness of a social media in the context of learning on the ability to understand concepts and students' interest in learning by using other social media and/or other cognitive aspects or affective aspects.

Keywords: Effectiveness; Learning Supplement; TikTok; Concept Understanding Ability; Learning Interest.

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Abstrak

Penggunaan media sosial seperti TikTok dalam pendidikan matematika dan materi barisan dan deret masih jarang dieksplorasi, meskipun memiliki potensi untuk mengubah paradigma penyajian materi tambahan. Hal ini karena umumnya materi tambahan disajikan melalui platform yang khusus untuk pembelajaran seperti Geogebra, modul pembelajaran, atau Kahoot. Penelitian ini bertujuan untuk mengetahui efektivitas suplemen pembelajaran berbantuan TikTok terhadap kemampuan pemahaman konsep dan minat belajar peserta didik pada materi barisan dan deret aritmetika dari hasil pengerjaan tes dan kuesioner melalui pre-test dan post-test yang telah dilaksanakan. Penelitian ini melibatkan siswa kelas XI IPA 5 SMA Negeri 1 Manonjaya sebagai sampel, dengan populasi seluruh siswa kelas XI di sekolah tersebut. Penelitian ini menggabungkan metode kuasi-eksperimen dan pendekatan kuantitatif. Penelitian ini menemukan dua hal penting: Pertama, penggunaan suplemen pembelajaran berbantuan TikTok terbukti efektif dalam meningkatkan pemahaman konseptual siswa terhadap materi barisan dan deret aritmatika. Kedua, penggunaan suplemen pembelajaran berbantuan TikTok tidak menunjukkan efektivitas dalam meningkatkan motivasi belajar siswa. Hal ini dibuktikan dengan minat belajar yang lebih tinggi pada kelas eksperimen dibandingkan kelas kontrol, serta peningkatan nilai rata-rata N-Gain (gain ternormalisasi) yang signifikan dalam kemampuan pemahaman konsep. Untuk itu, diperlukan penelitian lain mengenai efektivitas suatu media sosial dalam konteks pembelajaran terhadap kemampuan pemahaman konsep dan minat belajar peserta didik dengan menggunakan media sosial lain dan/atau aspek kognitif atau aspek afektif lain.

INTRODUCTION

Mastering mathematical concepts, especially the material of rows and series, is the key for students to solve problems well. However, in fact, many students have difficulty understanding the concepts and procedures that should be used (Annisa & Kartini, 2021). This encourages the need for pupils' comprehension of mathematical ideas to be improved (Maarif et al., 2022).

One of the efforts to improve students' concept understanding and interest in learning is by using various learning media. Studies have often shown how beneficial it is to use media in math training. Examples of this include instructional videos (Aldi et al., 2022), VCDs (Farida, 2015), ICT tools (Rusmana, 2012), animated films (Safitri et al., 2020), Ispring Presenter software (Anwar et al., 2019), and even entertaining games like Kahoot! (Wigati, 2019). By judiciously selecting appropriate learning media, teachers can significantly elevate students' grasp of mathematical concepts and cultivate a more stimulating learning environment. This is in line with the goal of education, aiming to nurture a competent and mathematically astute younger generation.

Concept understanding ability is an individual's ability to master the mathematical ideas taught. This is indicated by the ability to complete related tasks quickly, precisely, efficiently, and smoothly (Sari, 2017). Duffin & Simpson (2000) explained that the ability to understand concepts is manifested in three aspects, namely the ability to reformulate concepts that have been taught, the ability to apply concepts in various situations and contexts, and the ability to understand the implications of the concepts learned. In addition, Kilpatrick (2001) states that concept understanding refers to the ability to understand ideas thoroughly and functionally, which also supports the ability to remember them well. In other words, the ability to understand mathematical concepts refers to an individual's ability to master mathematical ideas, apply them appropriately and flexibly, and connect their application to a broader context.

Conceptual understanding plays an important role in helping learners to avoid critical errors when solving problems, as well as enabling them to accelerate learning by finding deeper correlations between seemingly unrelated situations. With a strong conceptual understanding

of mathematics, students can connect ideas and methods and explain the reasoning behind facts. This ability fosters self-confidence, which is the foundation for achieving higher levels of understanding (Kilpatrick, 2001).

However, based on data from the 2022 PISA study, Indonesia obtained an average score of 366 in mathematics, which decreased from the 2018 PISA study with a score of 379 (OECD, 2023). This shows that students' understanding of mathematical concepts is low. Students' low understanding of mathematical concepts is a major obstacle in achieving learning objectives.

Understanding a concept can be done through an interesting learning activity design, such as exploring deeper knowledge and providing appropriate and fun concepts (Santrock, 2011). This explorative activity is done so that students no longer memorize a concept but already understand the concept.

Factors that influence the success of students in learning according to Ngalim (2007) are divided into two types, namely: 1) Individual factors, which include individual maturity or understanding, level of training intelligence, personal motivation, and personal factors that affect learning; 2) Social factors, which include the role of family and household circumstances, the influence of teachers and teaching methods, the availability of tools, the learning environment and available opportunities, and social motivation from the surrounding environment; and 3) Psychological factors of learners.

The purpose of learning mathematics at school has a focus on the ability to understand concepts (Depdiknas, 2006). The use of social media, especially TikTok, as a learning support video has been proven effective in improving understanding of subject matter. The use of social media, particularly TikTok, as a learning tool has been shown to be effective in aiding understanding of subject matter (Amelia et al., 2022). Social media such as TikTok, Twitter, and Facebook not only act as information dissemination platforms, but also become powerful learning tools (Basch et al., 2022). This is reinforced by Pujiono's research (2021) which found that the use of TikTok in learning has a positive effect, increases learning interest, and supports the achievement of math learning goals at school.

High learning interest usually has an impact on high learning achievement, on the other hand, a lack of low learning interest results in low learning achievement (Djamarah, 2002). This is in line with research conducted by Purnama (2016) which states that increasing students' interest in learning mathematics first is believed to be a more effective approach in improving their mathematics learning achievement. This will cause learners to feel more interested and like math subjects without any pressure. With a strong interest, learners will give their full attention and face difficulties as challenges that can be overcome. They will also be more eager in solving various math problems and will eventually produce a positive impact on overall math learning achievement.

Interest in learning is an innate trait or character that inspires and motivates a person to have a sustained preference for a particular area of learning or topic of study (Krapp, 1999). According to Lai (2010), interest in learning is a personal choice related to the learning process, which sometimes includes an individual's prioritization of certain activities over others and involves positive psychological experiences when interacting with situations that encourage the desire to learn more. In addition, Kpolovie et al. (2014) state that interest in learning is an individual's natural drive to explore knowledge

triggered by interest in the subject matter, reflected through feelings of pleasure. Thus, interest in learning can be interpreted as an innate characteristic that encourages individuals to choose and engage in learning on an ongoing basis, triggered by a sense of pleasure and interest in a particular topic.

The traditional approach to learning, refers to a method where the educator gives a lecture with the help of PowerPoint slides delivered through a projector onto a large screen or whiteboard, with learners following the educator and giving responses by raising their hands. According to Yu (2023), although this method is no longer considered sufficient to meet students' learning needs, combining important information with mobile apps can spark students' curiosity and passion for learning.

Social media platforms like TikTok not only provide entertainment, but also have tremendous potential as a useful learning tool. Septiani & Abadi (2022) research proves that the use of TikTok can increase students' motivation in learning mathematics. This is in line with other findings, such as Pechenkina et al. (2017) who showed that mobile apps can improve memory retention, Yu (2020) who found that TikTok can stimulate curiosity in learning, and Ladeji-Osias et al. (2018) who proved that TikTok can improve student achievement.

Efforts to increase low student interest in learning, as asserted by Putri et al. (2019), are in line with the strategy of using media and variations in teaching techniques. This is supported by Fuad & Zuraini (2016) who mention several elements that influence learning enthusiasm, namely internal student factors which include: a) Physical aspects, and b) Psychological aspects (kejiwaan). 2) Factors outside the learner's self (external), consisting of: a) Family, b) School; and 3) Community environment. The utilization of social media such as YouTube, Instagram, TikTok, and similar applications as learning tools or media, for example by making learning videos of mathematics and other teaching materials, can have a positive impact on students' interest in learning mathematics (Septiani & Abadi, 2022).

The use of the TikTok application as a learning media has several advantages and positive impacts (Fauziyah et al., 2022), including: 1) Influence on skill abilities, such as increasing reading skills, speaking skills, and listening skills; and 2) Influence on students' interest in learning. This is due to the popularity of the TikTok application today which affects its image as a product that is favored by all groups so that when its use is involved in the current generation it will increase their interest in learning. In addition, in the context of mathematics learning, according to Amelia et al. (2022) the use of TikTok as a learning supplement can make it easier for students to understand learning materials and help change learning from abstract to more real.

Awareness of mathematical concepts is fundamental for students before solving problems. However, there are still difficulties in the classroom because some learners are more likely to memorize concepts without deep understanding. Therefore, understanding mathematical concepts is not only an important foundation, but also requires an approach that considers internal and external factors to ensure optimal learning progress. Utilizing social media platforms such as YouTube, Instagram, and TikTok as a means of distributing learning supplements is an innovative strategy to improve the quality of existing learning resources Amelia et al. (2022).

Students' level of learning success is closely related to their learning interest,

which reflects the tendency and excitement towards a subject. Iskandarwassid & Sunendar (2008) emphasize that learning interest indicators such as enjoyment, participation, attention and interest are very important in assessing the level of learning interest. Increasing students' enthusiasm in learning, especially in mathematics, has been proven to improve their academic performance. Diverse learning resources, including cutting-edge strategies such as the use of TikTok, can be an effective tool to overcome low interest in learning (Putri et al., 2019). Therefore, to improve overall learning achievement, educators need to have a thorough understanding of the elements that drive interest in learning and implement appropriate learning practices.

At SMA Negeri 1 Manonjaya, there are problems in concept understanding and students' interest in learning mathematics. The results of interviews with mathematics teachers show that students' weak basic math skills are the main factor in their lack of enthusiasm in learning. One way to overcome difficulties and low interest in learning is to use technology facilities provided at school in learning. The availability of technological facilities at SMA Negeri 1 Manonjaya such as computer laboratories, laptops, and infocus is good enough, but other media are needed to improve students' concept understanding ability and interest in learning.

Based on the description of the above problems regarding the ability to understand concepts and students' interest in learning, this study aims to determine the effectiveness of TikTok-assisted learning supplements to improve students' concept understanding ability and interest in learning.

METHOD

This research was conducted at SMA Negeri 1 Manonjaya which is located at Jalan Patrol Kulon RT/RW 03/01, Margaluyu Village, Manonjaya Subdistrict, Tasikmalaya Regency, West Java Province. The quantitative approach was used in this study because it aims to evaluate the effectiveness of learning supplements on students' concept understanding ability and learning interest. The data used were the pre-test and post-test results of the concept understanding ability test, as well as a questionnaire of students' interest in learning. Therefore, the research method used was quasi-experiment.

Furthermore, the population in this study were all students of grade XI SMA Negeri 1 Manonjaya, consisting of 7 science classes and 5 social studies classes. Through the application of simple random sampling technique with the help of "RANDBETWEEN" formula in Excel, XI IPA 5 class was selected as the research sample that used TikTok-assisted learning supplement, while XI IPA 6 class was selected as the research sample that did not use TikTok-assisted learning supplement. This study used the "Randomized Pretest-Posttest Control Group Design" by Bulus (2021) to compare the pre-test and post-test results of two groups given different treatments. This research design is presented in Figure 1.

R	O	X	O
R	O		O

Figure 1. Research Design

Description:

R = *random sampling*

O = *pre-test observation before treatment or post-test after treatment in the form of a learning interest questionnaire*

X = *treatment in the form of learning supplements assisted by TikTok*

In this study, the quality of research data is influenced by two main factors according to Sugiyono (2017), namely the quality of research instruments and the quality of the data collection process. The quality of research instruments includes the validity and reliability of the tools used, while the quality of the data collection process is related to the methods used to collect data.

The results of the test instrument of the students' concept understanding ability test questions with indicators of concept understanding ability according to Hendriana et al. (2017), namely: First, restate a concept (PT1); Second, classify objects according to certain properties (in accordance with the concept) (PT2); Third, provide examples and non-examples of a concept (PT3); Fourth, present concepts in various forms of mathematical representation (PT4); fifth, developing necessary or sufficient conditions of a concept (PT5); sixth, using, utilizing, and selecting certain procedures or operations (PT6); and seventh, applying concepts or problem-solving algorithms (PT7), the correlation coefficient value regarding the validity of each item is presented in Table 1.

Table 1. Calculation Results of Validity Test of Test Questions for Students' Concept Understanding Ability

Item No.	Indicator	r_{xy} (r count)	r table (N = 30)
1.	PT1	0,504	0,374
2.	PT2	0,516	0,374
3.	PT3	0,562	0,374
4.	PT4	0,449	0,374
5.	PT5	0,793	0,374
6.	PT6	0,486	0,374
7.	PT7	0,521	0,374

The results of the reliability test of students' concept understanding ability test questions are presented in Table 2.

Table 2. Calculation Results of Reliability Test of Test Questions for Students' Concept Understanding Ability

Cronbach's Alpha	r table (N = 30)	Decision	Category
0,604	0,374	Reliable	High

The results of Table 1 show that the results of the validity test of each item of the learner's concept understanding ability test instrument meet the valid criteria. This indicates that all items in the test can be used as a tool to measure students' concept understanding ability. Furthermore, from Table 2, the reliability coefficient value for the test questions of students' concept understanding ability (r_{11} or r count) shows a Cronbach's Alpha value of 0.604, which is in the high category according to the predetermined criteria, namely the interval $0{,}60 < r_{11} \leq 0{,}80$. Thus, the instrument can be trusted to be used in research.

The results of the trial of the instrument of the questionnaire statement of students' learning interest with indicators of learning interest according to Iskandarwassid & Sunendar (2008), namely: first, feelings of pleasure (PS1-PS6); second, learners' interest (KTPD1-KTPD4); third, learners' attention (PPD1-PPD7); and fourth, learners' involvement (KLPD1-KLPD9), obtained the correlation coefficient value regarding the validity of each statement item presented in Table 3.

Table 3. Calculation Results of Validity Test of Student Learning Interest Questionnaire Statement

Item No.	Indicator	r_{xy} (r count)	r table (N = 30)
1.	PS1	0,460	0,374
2.	PS2	0,639	0,374
3.	PS3	0,623	0,374
4.	PS4	0,704	0,374
5.	PS5	0,823	0,374
6.	PS6	0,407	0,374
7.	KTPD1	0,794	0,374
8.	KTPD2	0,794	0,374
9.	KTPD3	0,909	0,374

Item No.	Indicator	r_{xy} (r count)	r table (N = 30)
10.	KTPD4	0,749	0,374
11.	PPD1	0,689	0,374
12.	PPD2	0,599	0,374
13.	PPD3	0,608	0,374
14.	PPD4	0,591	0,374
15.	PPD5	0,780	0,374
16.	PPD6	0,721	0,374
17.	PPD7	0,733	0,374
18.	KLPD1	0,678	0,374
19.	KLPD2	0,658	0,374
20.	KLPD3	0,485	0,374
21.	KLPD4	0,551	0,374
22.	KLPD5	0,503	0,374
23.	KLPD6	0,600	0,374
24.	KLPD7	0,535	0,374
25.	KLPD8	0,532	0,374
26.	KLPD9	0,509	0,374

The results of the reliability test of the student interest questionnaire statement are presented in Table 4.

Table 4. Calculation Results of Reliability Test of Student Learning Interest Questionnaire Statements

Cronbach's Alpha	r table (N = 30)	Decision	Category
0,910	0,374	Reliable	Very High

The results of Table 3 show that the results of the validity test of each item of the student interest questionnaire statement instrument meet the valid criteria. This shows that all statement items can be used as a tool to measure students' interest in learning. Furthermore, from Table 4, the reliability coefficient value for the learner interest questionnaire statement (r_{11} or r count) shows a Cronbach's Alpha value of 0.910, which is in the very high category according to the predetermined criteria, namely the interval $0{,}80 < r_{11} \leq 1{,}00$. Thus, the instrument can be trusted to be used in research.

The data collection techniques used in this study were concept understanding ability tests and student interest questionnaires. The test used in this study is a concept understanding ability test that refers to (Hendriana et al., 2017), namely restating a concept, classifying objects according to certain properties (in accordance with the concept), providing examples and non-examples of a concept, presenting concepts in various forms of mathematical representation, developing necessary or sufficient conditions for a concept, using, utilizing, and selecting certain procedures or operations, and applying concepts or problem solving algorithms. In this study, the concept understanding ability test consists of 7 questions with a minimum score of 0 and a maximum score of 21. The concept understanding ability test grid is presented in Table 5.

Table 5. Scoring Guidelines for Concept Understanding Ability Test

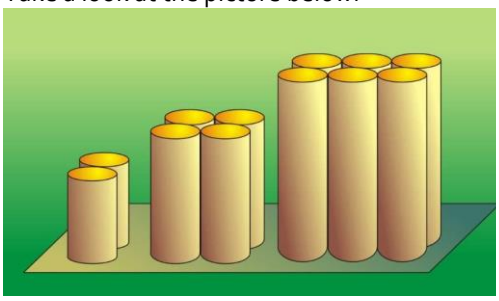
No	Indicator	Description	Score
1.	Restate a concept	No answer	0
		Although there are still many mistakes	1
		Although not yet precise	2
		Can restate a concept correctly	3
2.	Classify objects according to certain properties (in accordance with the concept)	No answer	0
		Although there are still many mistakes	1
		Although not yet precise	2
		Can classify objects according to certain properties in accordance with the concept appropriately	3
3.	Provide examples and non-examples of a concept	No answer	0
		Although there are still many mistakes	1
		Although not yet precise	2
		Can give examples and non-examples of a concept correctly	3
4.	Present concepts in various forms of mathematical	No answer	0
		Although there are still many mistakes	1
		Although not yet precise	2
		Can present concepts	3

No	Indicator	Description	Score
	representations	in various forms of mathematical representations appropriately	
5.	Develop necessary or sufficient condition of a concept	No answer	0
		Although there are still many mistakes	1
		Although not yet precise	2
		Can develop necessary or sufficient conditions of a concept appropriately	3
6.	Use, utilize, and select specific procedures or operations	No answer	0
		Although there are still many mistakes	1
		Although not yet precise	2
		Can use and utilize and select certain procedures or operations appropriately	3
7.	Apply problem-solving concepts or algorithms	No answer	0
		Although there are still many mistakes	1
		Although not yet precise	2
		Can apply problem-solving concepts or algorithms appropriately	3

The concept understanding ability test questions in this study are presented in Table 6.

Table 6. Test Questions for Concept Understanding Ability

1. Which is an arithmetic sequence and which is an arithmetic series? Explain!
   a. 1, 4, 7, 10, ..., 91, 94, 97, 100
   b. 1 + 4 + 7 + 10 + ... + 91 + 94 + 97 + 100
   c. 36 + 32 + 28 + 24 + ... + (-24) + (-28) + (-32) + (-36)
   d. ..., (-36), (-32), (-28), (-24), ..., 24, 28, 32, 36, ...
2. A number as 12, 16, 20, 24, ..., U_n. Determine:
   a. The formula of the nth term and the formula of the sum of the n^{th} term
   b. The value of the 10^{th} term plus the sum of the 8^{th} term
3. Which of the following is an arithmetic sequence?
   a. 0,5; 0,75; 1; 1,25; 1,5; 1,75; 2; ...
   b. 4, 1, -2, -5, -8, -11, -14, ...
   c. 5, 8, 11, 14, 18, 21, 24, ...
   d. $\frac{4}{5}, 2, 3\frac{1}{5}, \frac{22}{5}, 5\frac{3}{5}, \frac{34}{5}, \ldots$
4. An arithmetic sequence is expressed by 1 + 4 + 7 + ... + 91 + 94 + 97. Find another formula that can calculate the entire arithmetic sequence!
   (other than $S_n = \frac{n}{2}(2a + (n-1)b)$ dan $S_n = \frac{n}{2}(U_1 + U_n)$)
5. The 4^{th} term and the 12^{th} term are 13 and 29 respectively and the difference between each term is 2. Find the 100^{th} term!
6. Take a look at the picture below!



   Based on the figure, find the value of the first term and the number of terms if the sum of all the terms is 18,360!
7. A high school student is conducting an experiment on gravitational force. The experiment was conducted by dropping a marble from the top of a 327 meter high building and the bounce decreased by 3 meters each bounce.
   a. What is the amount of height the marble traveled until it stopped?
   b. After what number of bounces does the marble have a total height of 6,501 meters?

The questionnaire used in this study is a learning interest questionnaire that refers to Iskandarwassid & Sunendar (2008), namely feelings of pleasure, learner interest, learner attention, and learner involvement with the Likert scale form. The Likert scale questionnaire was chosen because it requires students to express their perceptions and opinions in the form of a scale that has gradations from very positive to very negative. In addition, this method can provide an overview of individual or group attitudes towards the potential and challenges of a subject

(Sugiyono, 2017). In this study, the learner interest questionnaire consisted of 26 statement items with a minimum score of 0 and a maximum score of 130. The lattice of the learner interest questionnaire is presented in Table 7.

Table 7. Scoring Guidelines for the Student Learning Interest Questionnaire

Statement	Alternative Answer				
	SS	S	N	TS	STS
Positive	5	4	3	2	1
Negative	1	2	3	4	5

Scoring was carried out after the learning process ended by conducting two tests of concept understanding ability and filling out a learning interest questionnaire by students, both those who used TikTok as a media supplement to be teaching materials and those who did not. Thus, researchers will compare the level of students' interest in learning and data on the results of students' concept understanding ability between the two groups to assess the impact of using TikTok-assisted learning supplements.

The analysis technique used in this research is quantitative method. In quantitative data analysis, information is taken using numbers and calculations using statistical methods. The data is then grouped into certain categories using special tables, thus facilitating analysis using the IBM SPSS Statistics 25 for Windows program. The analytical tool used to test effectiveness is N-Gain Score analysis by conducting Normality test, Homogeneity test, and Independent Sample T-Test test. The N-Gain Score (normalized gain) formula according to Hake (1999, p. 2) is as follows.

$$< g >= \frac{\% < G >}{\% < G >_{max}} = \frac{(\% < S_f > - \% < S_i >)}{(100 - \% < S_i >)}$$

Description:

$< g >$ = *average value of normalized gain*
$< G >$ = *average value of gain obtained*
$< G >_{max}$ = *maximum possible mean gain value*
$< S_f >$ = *mean value of post-test (final)*
$< S_i >$ = *mean value of pre-test (initial)*

The following table illustrates the categories of N-Gain values according to Hake (1999) presented in Table 8.

Table 8. N-Gain Score Category

N-Gain Score Category	N-Gain Score Range
High	$(< g >) > 0{,}7$
Medium	$0{,}7 \geq (< g >) \geq 0{,}3$
Low	$(< g >) < 0{,}3$

RESULT AND DISCUSSION

Result

This study aims to examine the effectiveness of using TikTok-assisted learning supplements to improve students' concept understanding ability and learning interest. This is based on previous research which shows that the low average score obtained indicates that students still find it difficult to understand mathematical concepts (Sipayung, 2018) and one of the factors that cause it is the low interest of students in learning mathematics subjects (Suendarti & Liberna, 2021).

Based on the results of research conducted by Aldi et al. (2022), Lasmiyati & Harta (2014), Safitri et al. (2020), dan Syaifuddin & Rahmasari (2023), showed that the use of various types of learning media, such as modules, videos, educational games, and animated films, can improve students' concept understanding and interest in learning mathematics. Thus, it appears that the use of learning media with social media is still small, especially in learning mathematics.

Therefore, the use of social media in this study is utilized as a means of learning mathematics that provides different values and motivation. The advantages of social media that are flexible and have an attractive appearance with a combination

of text, images and videos can captivate the interest of students. In fact, social media also allows triple communication between educators, students, and other students (Pujiono, 2021). This is based on previous research which shows that the use of social media, such as Whatsapp Group, can have a positive effect on Amalia & Puwaningsih (2020) concept understanding ability and social media, such as TikTok, can have a positive effect on students' interest in learning mathematics (Septiani & Abadi, 2022).

The social media used in this study is TikTok as a learning supplement. The reason for using TikTok as a social media used for learning supplement media is because the characteristics of the application are the use of videos with a short duration, around 15 to 60 seconds. This affects user behavior to continue accessing the application because it gives the impression of being hypnotized by the instant pleasure provided (Firamadhina & Krisnani, 2021).

TikTok is a popular social media platform that offers photo and short video sharing services with various multimedia features. Launched in September 2016 in China, TikTok has shown rapid growth globally, especially among millennials and generation Z. The use of TikTok as a learning supplement involves the use of social media as a learning supplement. Using TikTok as a learning supplement involves presenting learning information in short videos of 15 to 60 seconds, often with the use of background music, to increase concept understanding and learner interest.

In order to make the presentation of material on TikTok more interesting and effective as a learning medium, it needs to be packaged nicely using various features of the platform. Utilizing voiceovers, additional music, filters and hashtags can be the solution. The additional music element is TikTok's main attraction, allowing educators or users to create video content with music that suits the audience's learning style. The voiceover feature is equally important, allowing the recording duration to be adjusted to match the video duration. On the other hand, hashtags help students find interesting videos based on their interests, and filters can be used to enhance the visual appeal of videos.

The effectiveness of using TikTok-assisted learning supplements is evidenced by the significant difference and increase in the average value of N-Gain (normalized gain) of students' concept understanding ability in the experimental class which is significantly better than the control class. In addition, the use of TikTok-assisted learning supplements is said to be effective if there is a significant difference and an increase in the average value of N-Gain (normalized gain) of students' learning interest in the experimental class is significantly better than the control class.

Normality Test

The normal distribution of the data was tested using the Normality Test. Given the large amount of data (>30), the data of this study was considered typical and did not require further testing. This opinion is supported by the concept of central limit which states that for a large sample, the distribution of the sample mean X will approach the normal distribution (Healey, 2010). Thus, it can be concluded that the Normality test in this study has been fulfilled.

Homogeneity Test

The homogeneity of samples from the same population was verified using the homogeneity test. In this study, the homogeneity of variance test with Levene Statistic was run through the IBM SPSS Statistics 25 for Windows application.

Homogeneity test results of students' concept understanding ability test data in experimental and control classes are presented in Table 9.

Table 9. Results of Homogeneity Test of Students' Concept Understanding Ability Test in Experimental and Control Classes

		Levene Statistic	df1	df2	Sig.
Hasil Tes Kemampuan Pemahaman Konsep Peserta Didik	Based on Mean	.138	1	63	.711
	Based on Median	.029	1	63	.865
	Based on Median and with adjusted df	.029	1	62.703	.865
	Based on trimmed mean	.164	1	63	.687

Source: Primary Data Calculation Results

Levene Statistic analysis shows a significant Sig value on the student concept understanding ability test data, both in the experimental and control classes. This indicates that the variance of the post-test data of the two groups (experimental and control classes) is homogeneous, with a Mean value (0.711) which is greater than 0.05. In conclusion, there is no significant difference in the variance of post-test data between the two groups (homogeneous).

Homogeneity test results of student interest questionnaire data based on pre-test and post-test in experimental and control classes are presented in Table 10.

Table 11. Results of Homogeneity Test of Student Learning Interest Questionnaire in Experimental Classes and Control Classes

		Levene Statistic	df1	df2	Sig.
Hasil Kuesioner Minat Belajar Peserta Didik	Based on Mean	.072	1	63	.790
	Based on Median	.069	1	63	.793
	Based on Median and with adjusted df	.069	1	59.675	.793
	Based on trimmed mean	.072	1	63	.789

Source: Primary Data Calculation Results

Analysis of student interest data with Levene Statistic shows an insignificant Sig significance value (0.790 > 0.05). This shows that the variance of student interest data in the experimental class and control class is not significantly different (homogeneous).

Independent Sample T-Test

Based on the assumption that both groups have homogeneous characteristics and follow a normal distribution pattern, this study used the Independent Sample T-Test to analyze whether there is a significant difference between the two groups based on the data collected.

The use of IBM SPSS Statistics 25 for Windows resulted in an Independent Sample T-Test analysis of student concept understanding ability test data, the results of which are listed in Table 11.

The "Independent Samples Test" table shows the variation in students' concept understanding test scores with a

Table 10. Independent Sample T-Test of Students' Concept Understanding Ability

Independent Samples Test

		Levene's Test for Equality of Variance		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil Tes Kemampuan Pemahaman Konsep	Equal Variances assumed	.138	.711	5.198	63	.000	5.364	1.032	3.302	7.426
	Equal variances not assumed			5.190	61.957	.000	5.364	1.033	3.298	7.429

Source: Primary Data Calculation Results

significance value (0.000) < 0.05 (2-tailed), confirming the significant difference between the two groups. This indicates that there is no significant difference in the mean scores of concepts understanding capacity between students who used the TikTok-assisted learning supplement and those who did not. Therefore, considering the considerable difference, it can be concluded that the use of TikTok-assisted learning supplement did not show any visible benefit in students' concept understanding of arithmetic series and sequence material.

The findings of the Independent Sample T-Test on the student interest questionnaire data are presented in Table 12. Data analysis was conducted using IBM SPSS Statistics 25 software Windows version.

Based on the "Independent Samples Test" table which measures the variation in the findings of the student interest questionnaire, it is known that the Sig value. (2-tailed) value of (0.377) is greater than 0.05. This indicates that there is no significant difference between the two groups. In conclusion, there is no significant difference between the mean scores of students' interest in learning who use TikTok-assisted learning supplements and those who do not. The absence of this substantial difference indicates that the use of TikTok-assisted learning supplements does not have a significant effect in increasing students' interest in learning arithmetic sequence.

N-Gain Score

Table 12. Independent Sample T-Test Test of Students' Learning Interests

Independent Samples Test

		Levene's Test for Equality of Variance		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil Kuesioner Minat Belajar Peserta Didik	Equal variances assumed	.072	.790	-.890	63	.377	-.2.132	2.395	-6.918	2.654
	Equal variances not assumed			-.892	62.513	.376	-2.132	2.391	-6.909	2.646

Source: Primary Data Calculation Results

Table 13. N-Gain Score Test of Students' Concept Understanding Ability

Descriptives

	Kelas			Statistic	Std. Error		Kelas			Statistic	Std. Error
NGain_Persen	Pertanyaan Tes Eksperimen	Mean		65.8335	4.39854	NGain_Persen	Pertanyaan Tes Kontrol	Mean		38.5030	3.58718
		95% Confidence Interval	Lower Bound	56.8626				95% Confidence Interval	Lower Bound	31.1961	
			Upper Bound	74.8044					Upper Bound	45.8098	
		5% Trimmed Mean		66.5676				5% Trimmed Mean		38.5996	
		Median		64.9123				Median		27.7778	
		Variance		619.109				Variance		424.640	
		Std. Deviation		24.88189				Std. Deviation		20.60681	
		Minimum		16.67				Minimum		5.26	
		Maximum		100.00				Maximum		68.75	
		Range		83.33				Range		63.49	
		Interquartile Range		46.95				Interquartile Range		37.87	
		Skewness		-.086	.414			Skewness		.170	.409
		Kurtosis		-.960	.809			Kurtosis		-1.557	.798

The N-Gain Score test is used to determine the increase in concept understanding ability and students' interest in learning after being given treatment in the form of using learning supplements assisted by TikTok in the experimental class. This method involves the implementation of pre-test and post-test in experimental and control classes.

The following is a table of the results of the N-Gain Score test analysis of students' concept understanding ability test data using the IBM SPSS Statistics 25 for Windows program presented in Table 13.

The "Descriptives" table above shows some important findings, namely 1) The average value of N-Gain Score for the experimental class (with TikTok-assisted learning supplement) is 0.658335, which is categorized as "medium"; and 2) The average value of N-Gain Score for the control class (without TikTok-assisted learning supplement) is 0.385030, which is also categorized as "medium". The use of TikTok-assisted learning supplements in teaching mathematics is proven to be effective in helping students understand the concept of arithmetic series and sequence with a simple category. This is evidenced by the achievement of better understanding in students who used the supplement compared to those who did not.

The N-Gain Score test analysis for student interest questionnaire data was conducted using IBM SPSS Statistics 25 for Windows software, and the results are presented in Table 14 below.

Based on the descriptive analysis in the table, several important findings were obtained, namely 1) The average N-Gain Score value for the experimental class (which used TikTok-assisted learning supplements) was 0.130531. This value is included in the "low" category; and 2) On the other hand, the average N-Gain Score for the control class (which did not use TikTok-assisted learning supplement)

Table 14. N-Gain Score Test of Students' Learning Interest

Descriptives

	Kelas			Statistic	Std. Error
NGain_Persen	Pernyataan Kuesioner Eksperimen	Mean		13.0531	1.84936
		95% Confidence Interval	Lower Bound	9.2813	
			Upper Bound	16.8249	
		5% Trimmed Mean		12.7001	
		Median		10.1010	
		Variance		109.445	
		Std. Deviation		10.46158	
		Minimum		.00	
		Maximum		32.69	
		Range		32.69	
		Interquartile Range		15.31	
		Skewness		.672	.414
		Kurtosis		-.905	.809
NGain_Persen	Pernyataan Kuesioner Kontrol	Mean		10.7680	1.46849
		95% Confidence Interval	Lower Bound	7.7768	
			Upper Bound	13.7592	
		5% Trimmed Mean		10.2603	
		Median		10.0000	
		Variance		71.163	
		Std. Deviation		8.43585	
		Minimum		.00	
		Maximum		31.11	
		Range		31.11	
		Interquartile Range		13.69	
		Skewness		.773	.409
		Kurtosis		.035	.798

Source: Primary Data Calculation Results

was 0.107680. This value is also included in the "low" category. So it can be concluded that mathematics learning both using and not using TikTok-assisted learning supplements is not effective for increasing students' learning interest in the material of arithmetic rows and series with a low category.

Discussion

Concept Understanding Ability

The effectiveness of TikTok-assisted learning supplements to improve students' conceptual understanding is measured using the N-Gain value, as shown by the research results. Both the control group and the experimental group obtained N-Gain values that were classified as moderate. The N-Gain value is categorized into three levels, namely high (more than 0.7), medium (between 0.3 and 0.7), and low (less than 0.3). Indicators used in the test of students' concept understanding ability include restating a concept; classifying objects according to certain properties (in accordance with the concept); providing examples and non-examples of a concept; presenting concepts in various forms of mathematical representation; developing necessary or sufficient conditions for a concept; using, utilizing, and selecting certain procedures or operations; and applying concepts or problem solving algorithms.

The results of data analysis showed significant differences between the two groups (Sig. (2-tailed) (0.000) < 0.05), so the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. This is evidenced by the higher average N-Gain Score in the experimental group (0.658335) compared to the control group (0.385030). In conclusion, the use of TikTok-assisted learning supplements in classroom teaching proved effective in helping students understand the concept of arithmetic sequence. This is supported by the activities and involvement of students during learning by using TikTok-assisted learning supplements presented for each learning syntax so as to improve their concept understanding abilities and learning achievement.

Thus, based on the results of research and data analysis, it is obtained that the use of TikTok-assisted learning supplements is effective for improving students' concept understanding abilities on arithmetic series and sequence material. These results are inseparable from various activities in the learning process that have a positive impact on improving students' learning achievement. TikTok-assisted learning supplements are used by utilizing its characteristics, namely the short duration of the video and automatically replaying the video so that it makes students seem hypnotized by the video. In addition, the addition of background music (backsound) makes students not feel bored and continue to scroll through the learning supplement content that has been created.

In addition, the addition of text to the TikTok video helps learners focus more on understanding the content of the learning supplement video content because the text displayed is adjusted to the speed of the researcher's voice when speaking so that learners will pay more attention to the text if the surrounding conditions are noisy and do not have good hearing aids such as earphones or the like.

Thus, the use of TikTok-assisted learning supplements is able to be in the moderate category to improve students' concept understanding abilities when the content created is not boring by making short videos, adding backsound and text to the video. This finding is in line with Firamadhina & Krisnani (2021) who state that the use of social media such as TikTok in the realm of education can provide

benefits and positive impacts, especially if used with positive purposes such as disseminating information or exploring new knowledge intentionally or unintentionally. This is in line with the results of research conducted by Pratama et al. (2020) which shows that the use of learning video media as a learning supplement is effective in improving students' understanding of learning materials. In addition, using TikTok-assisted learning supplements of the audio-visual type, according to Adam (2023) states that the use of audio-visual learning media in the learning process can stimulate students' interest in learning.

In addition, based on factors that can affect students' concept understanding abilities according to Ngalim (2007), namely individual factors and social factors. One of the individual factors related to students' interest in learning is personal motivation. According to Fazri (2023), a lack of motivation in learners can affect concept understanding and reduce their interest in learning and learning outcomes, while creative and innovative educators are able to make math learning more fun, interesting, and liked by students without feeling boring. On the other hand, social factors that can affect learners' concept understanding ability related to learners' interest in learning are the influence of educators and teaching methods, availability of tools, learning environment and available opportunities, and social motivation from the surrounding environment. Where these are also external factors that can affect the learning process.

By using TikTok-assisted learning supplements to implement ways that can be done to increase students' interest in learning according to Slameto (2015), namely creating a democratic atmosphere and using tests and assessments wisely, what is done in creating a democratic atmosphere is to provide independent learning opportunities, encourage discussion, and develop students' thinking, problem-solving, and curiosity skills. In addition, tests and assessments are only carried out at the beginning and end of learning. However, individual assignments are still given to develop learners' thinking and problem-solving skills. Thus, based on factors that can influence learners' concept understanding, such as personal motivation and environmental influences, creative and innovative learning approaches and a democratic atmosphere can strengthen their interest in learning. The use of TikTok-assisted learning supplements can facilitate a democratic atmosphere by providing independent learning opportunities, stimulating discussion, and enriching learners' thinking and problem-solving skills, along with a thoughtful evaluation approach in the application of tests and assessments.

Learning Interest

Both in the experimental and control groups, the results showed that the N-Gain value used to assess the effect of TikTok-assisted learning supplements on student learning motivation was low. N-Gain is categorized into three levels, namely high (value > 0.7), medium (value between 0.3 and 0.7), and low (value < 0.3). Indicators used in the learner interest questionnaire include feelings of pleasure, learner involvement, learner attention, and learner interest.

Based on the data analysis of the students' interest questionnaire, no significant difference was found between the two groups. This is evidenced by the Sig. (2-tailed) (0.377) which is greater than 0.05. These results indicate acceptance of the null hypothesis (H_0) and rejection of the alternative hypothesis (H_a). In the experimental class, the average value of N-Gain Score was 0.130531 (low category),

while in the control class it was 0.107680 (low category), based on the N-Gain Score test. Thus, the use of TikTok-assisted learning supplements in arithmetic sequence material was not effective in increasing students' interest in learning. This is due to the characteristics of TikTok which is more suitable as an entertainment platform than a structured and focused learning resource.

The results showed that the use of TikTok-assisted learning supplements was not effective in increasing students' interest in arithmetic series and sequence. This conclusion is based on the findings and analysis of the data obtained. Although there was an increase in the average intensity of using TikTok as a learning supplement every day, it did not have a significant impact on increasing students' interest in learning.

In addition, based on the results of data analysis of students' learning interest questionnaires on the increase in the average value and N-Gain Score value of each indicator of students' learning interest in both groups, it was found that the use of TikTok-assisted learning supplements was not effective in increasing students' learning interest. The use of TikTok-assisted learning supplements is not effective for increasing students' feelings of pleasure. This can be seen from the attitude and behavior of discipline, paying attention to lessons, and repeating lessons of students in the experimental class which is not better than the control class.

In addition, the use of TikTok-assisted learning supplements is not effective in increasing learners' engagement. This can be seen from the attitudes and behaviors of happy to discuss in class, trying to answer questions from the educator, and the desire to increase students' reading resources in the experimental class which is not better than the control class.

In addition, the use of TikTok-assisted learning supplements was not effective in increasing learners' attention. This can be seen from the attitudes and behaviors of completing notebooks, always doing the exercises given, and being eager to take part in the lessons of students in the experimental class which are not better than the control class.

Finally, the use of TikTok-assisted learning supplements is not effective for increasing learners' interest. This can be seen from the attitudes and behaviors of participating in teaching and learning activities (KBM) in class, attitudes in difficulties, efforts in dealing with difficulties, and habits in following lessons of students in the experimental class which are not better than the control class.

Thus, based on the results of the data analysis of the students' learning interest questionnaire on the increase in the average value and the N-Gain Score value of each indicator of students' learning interest in both groups, it can be concluded that the use of TikTok-assisted learning supplements is not effective for increasing students' learning interest with a low category in each indicator of learning interest, namely 1) feelings of pleasure, 2) student involvement, 3) student attention, and 4) student interest.

The content of the songs in the TikTok-assisted learning supplement is not in accordance with the characteristics of the learners, which involves tones from songs such as "Balonku" and "Naik Kereta Api". This is not in accordance with the characteristics of learners based on various aspects, as described by Munawaroh (2021), such as interest and motivation. Interest, which is related to individual interests, plays an important role in the learning approach. Therefore, it is necessary to continuously develop materials according to learners' interests. Motivation, which is reflected in the quality of learners'

involvement, feelings, affective engagement, as well as learners' efforts to maintain motivation, also needs to be considered in developing learning content.

Thus, the use of TikTok-assisted learning supplements can be in the low category to increase learners' interest in learning when the content created is not in accordance with learner characteristics such as interest and motivation. This finding is in line with Meilana & Aslam (2022) who state that the content in the development of teaching materials needs to be adjusted to the characteristics of learners, even though each child has different characteristics. Educators need to understand the initial characteristics of learners to easily deal with everything related to learning, such as lesson composition, ability, and the choice of management strategies that affect the teaching in question. These components can be adjusted to the individual characteristics of learners so that they can affect the interest and motivation of learners to learn.

In addition, according to Fuad & Zuraini (2016, pp. 45–46), there are factors that can affect students' interest in learning such as internal factors and external factors. Internal factors such as psychological aspects include several factors that can affect learners' interest in learning, such as response, memory, and thinking (Sardiman A.M., 1990). These factors are related to the concept understanding ability of learners, where the attitude of learners in responding, solving, and thinking about questions given by educators after watching video shows on TikTok-assisted learning supplements does not show feelings of pleasure, involvement, attention, and interest from learners in answering questions orally.

On the other hand, external factors such as schools consist of various factors that can affect students' interest in learning, such as teaching methods, facilities and infrastructure, learning resources, and learning media need to be considered (Fuad & Zuraini, 2016, pp. 45–46). These factors are also included in the factors that can affect students' concept understanding ability. Although during the learning process students are given the opportunity to be more interactive and involved, there is still a need for teaching methods, facilities and infrastructure, learning resources, and other learning media that can increase students' interest in learning. The use of TikTok-assisted learning supplements is not effective in increasing students' interest in learning because the factors that influence learning interest, both internal and external, show that teaching methods, facilities and infrastructure, learning resources, and learning media need to be considered as a whole, not just by utilizing one particular social media platform such as TikTok.

Implications

This study finds out the effectiveness of TikTok-assisted learning supplements to improve students' concept understanding ability and interest in learning on the material of arithmetic rows and series. By knowing the effectiveness, mathematics educators are expected to improve students' concept understanding ability and interest in learning using appropriate and effective social media in creating innovative and interesting learning. In addition, students are expected to use social media as a medium to find information or additional material not only for entertainment media to improve concept understanding ability, interest in learning and foster active learning.

This research provides and adds knowledge and insight into learning supplements assisted by social media, especially TikTok which can be used in learning mathematics to improve students'

concept understanding ability and interest in learning on the material of arithmetic rows and series. Therefore, for future researchers who are interested in conducting research on the effectiveness of a social media in the context of learning on the ability to understand concepts and students' interest in learning, they can use other social media and/or other cognitive aspects or affective aspects.

Limitations

This research is limited to the material of arithmetic rows and series. Therefore, the results of this study only discuss the concept understanding ability and learning interest of students related to this topic. In addition, the respondents used in this study were at the senior high school level in one district in Indonesia, so the results of this study do not represent the concept understanding ability and learning interest of students in other schools or junior high school levels. Nevertheless, the respondents involved came from a class that was carrying out the material of arithmetic rows and series, namely grade 11, so the results can be used as evidence of concept understanding and learning interest of grade 11 students at the school.

CONCLUSION

Based on the results of research conducted by researchers in class XI IPA 5 SMA Negeri 1 Manonjaya related to TikTok-assisted learning supplements to improve students' concept understanding ability and interest in learning, it is concluded that the application of TikTok-assisted learning supplements on the material of arithmetic rows and series shows promising results in improving students' concept understanding (cognitive) abilities. This is evidenced by the increase in the moderate category, with a percentage value of 0.658335. However, in terms of increasing students' affective learning interest, this supplement has not shown significant effectiveness. The assessment results show a percentage value of 0.130531 with a low category, which indicates that the use of TikTok-assisted learning supplements is not effective enough to increase students' affective learning interest in the material.

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