



The Effect of Mathematic-English on Students' Tenses Mastery in Differentiated Instruction

Siti Zuliana Fatmawati¹, Olyvia Revalita Candraloka²

201320000510@unisnu.ac.id¹

olyviarevalita@unisnu.ac.id²

¹²Universitas Islam Nahdlatul Ulama, Jepara, Jawa Tengah

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Abstract

Mathematic-English is a combination of Mathematics and English. It is the use of basic mathematical concepts and patterns of understanding English tenses. This study aimed to find out the effectiveness of Mathematic-English on students' tenses mastery in Differentiated Instruction. This study employed the true experimental design featuring a pretest-posttest control group design. The research population was eleventh-grade students at SMA N 1 Tahunan. The research sample consisted of class XI-2 and XI-3, with XI-2 assigned as the control group and XI-3 as the experimental group. It has been selected through simple random sampling. The finding showed that there were significant differences in the mean scores before and after the test for both groups. In terms of the scores, there is a difference of 10.06 in the control group, whereas the experimental group exhibits a difference of 22.18. In addition, the analysis results using the independent sample t-test indicated that the t-test score was bigger compared to the t-table score ($10.534 > 1.668$). It indicates that the alternative hypothesis was accepted. Referring to the findings of the study, it can be concluded that the Mathematic-English model can improve students' tense mastery.

Keywords: *Differentiated Instruction; Mathematic-English; Tenses*

Introduction

English is one of the languages that is used as a tool of communication and it is the most appropriate language to use in Indonesian education in all grade levels (Candraloka

& Novitasari, 2022). It is also because English is widely regarded as the global language extensively utilized worldwide (Zakaria et al., 2022). From the explanation above, it can be concluded that English is a foreign language that is applied in education in Indonesia because it is a tool of communication in the world.

Grammar is a compilation of regulations devised to govern specific aspects of the utilization by indigenous speakers (Al-Jarrah et al., 2019). Shofiyuddin & Andriyani (2019) also stated that grammar is a set of regulations that govern the proper combination or alteration of words or their components to create a meaningful structure within a language. Grammar is a construct that establishes and organizes the meaning of language (Eunson, 2020). The conclusion drawn from the aforementioned explanation is that grammar is an English rule to create good sentences with acceptable meaning.

Grammar is an essential aspect that students must conquer to fully embrace the process of teaching and learning. It is because grammar is the soul of English (Robiasih & Lestari, 2020). Lutfiyah et al. (2022) also stated that when an individual becomes proficient in the grammar of acquiring a second language, they will possess the ability to effectively express their thoughts. The main aim of teaching grammar pertains to discovering the application of language structures and equipping students with mastery over the language through proficiently producing accurate and precise grammatical structures, whether in oral communication or written expression (Mitravinda, 2020). Thus, grammar is important to learn because it can improve the ability to express thoughts in oral or written. In written language, there are some rules to make sentences that are called tenses.

Tenses are an expression of time in spoken or written utterances. In English, there exist four fundamental tenses: past, present, future, and past future (Lestari et al., 2022). Simamora (2021) also stated that tense is a framework that identifies the overall interpretation of a statement as occurring in the past, present, or future based on the speaker's viewpoint. Tenses are a grammatical category that refers to the time of a situation and is indicated by the verb form. When a verb takes on a form to indicate the occurrence of an action or state, it is referred to as the plural of tenses (Kumayas, 2021). Consequently, it can be concluded that tenses involve the modification of verbs according to different times and forms such as present, past, future, and conditional, which will be further elaborated into sixteen types with different names, functions, and formulas according to the context of their use.

Tenses are widely known as an essential part that must be mastered by students. This is because tenses are related to the construction to make the correct sentences so that they become more proficient in the language (Listia & Febriyanti, 2020). Lutfiyah et al. (2022) stated that someone who achieves mastery in grammar while learning a second language, with a particular emphasis on tenses, will possess the ability to effectively convey their thoughts and ideas. Excellent communication skills have immense benefits in both society and the workplace. Nurlaela & Nawir (2020) stated that tenses are very important because a sentence can be classified as grammatically correct if matches the tenses. So, tenses are important rules to convey students' thoughts and ideas and to make correct

sentences.

In consequence, tenses are important to learn. However, there are some students' obstacles in learning grammar. According to Novianto & Rofi'ah (2022), students do not have motivation to learn about tenses. Then, the other researchers also found that in class students become more passive, confused, ashamed, afraid of making mistakes, and bored when learning English grammar (Manokaran et al., 2023). The lack of interest in grammar is due to the boring way the lesson is presented, making the learner indifferent to learning (Ghorbani & Ebadi, 2019). The same statement conducted by Arifin & Al Halim (2021) showed that the same obstacle in teaching tenses that the current learning process and method is still managed by teachers and is not accessible to students to develop their independence to achieve high-quality education in order to provide fun and enjoyable learning. So, the other obstacle to learning grammar is students' lack of motivation, passive in class, being afraid of making mistakes, and being bored learning grammar. It is because of limited teaching methods that have been used.

In addition, in learning tenses, students must know the names, functions, and formulas of sixteen tenses. However, the fact is many students have difficulties in learning tenses. Then, there are some obstacles in learning English that are faced by students, especially in studying tenses. The problems are 1) students have difficulty in distinguishing context and situation in tenses, 2) errors occur in constructing correct sentence patterns, and 3) lack of interest in learning tenses (Lutfiyah et al., 2022). According to Ghorbani & Ebadi (2019), students have common mistakes in many ranges of English language structure as tenses and viewpoints, the utilization of to be, verb modifier positions, and adjective expressions. In general, most beginner students do not master English grammar well. They are only beginning to memorize English so their composing expertise is still frail, particularly in grammar. It gets to be an issue when they have to make a composition that comprises sentences (Siregar et al., 2022). the main issue in learning English is that understudies need dominance of English language structure, particularly on how to compose sentences, and how to utilize legitimate conjunctions and verbs according to changing times (Mandasari & Wahyudin, 2019). So, linguistic use particularly tenses is the main issue of understudies since they are intrigued and don't know how to compose sentences based on the rules.

Furthermore, some obstacles also happened to eleventh-grade students at SMA N 1 Tahunan in teaching grammar, especially tenses. Based on the observation, students feel bored with learning tenses and consider that it is unimportant material. It is because they feel that teachers' model in teaching tenses is not interesting and not appropriate with their learning styles. The teachers only presented the topic, explained the materials, did a discussion, ended the class, and asked the learners to memorize the names, formulas, and functions of tenses independently. In addition, the various tenses that almost have the same name, function and formula confuse the students. Then, the existence of verbal and nominal formulas in tenses makes it even more difficult for students. Apart from that, the tenses formula also uses the infinitive verb, past simple, and past participle, the use of which varies according to their function. Most learners in there also experience difficulties in distinguishing the function of tense from other tenses. For example, learners cannot

distinguish between the uses of the simple present tense and present continuous. Although the differences are very clear, they consider that there are some similarities between the two types of tenses, and it is difficult to distinguish between them.

Moreover, the use of the Merdeka Belajar Curriculum can overcome the problem of students' lack of interest in learning tenses due to lack of learning models. This is because the concept of the Merdeka Curriculum is "Merdeka Belajar" that teachers must provide more activities and learning models through for the students based on students' needs (Suson et al., 2020). One of the best models highlighted in the Merdeka Belajar Curriculum to overcome the differences between students is Differentiated Instruction (Salassa et al., 2023). Differentiated Instruction refers to the type of learning that takes into account the individual learning requirements of students (Siagian et al., 2022). Herwina (2021) also stated that Differentiated learning aims to customize the classroom learning process to cater to the unique academic requirements of every student. According to (Smale-Jacobse et al., 2019), Differentiated Instruction is a pedagogical-didactical approach that provides teachers with a starting point for meeting students' diverse learning needs. It can be concluded that Differentiated Instruction is a learning model that is customized to students' different styles of learning.

However, there are some obstacle in Differentiated Instruction. The first, teachers have difficulties in creating different teaching modules, managing the class and implementing differentiated learning (Gusteti & Neviyarni, 2022). According to (Salassa et al., 2023), teachers must know their students' characteristics well, design a variety of appropriate learning strategies, and manage the class effectively. Elviya & Sukartiningsih (2023) also stated that the lack of experience by teachers is the main obstacle. Based on the explanation above, it can be concluded that less experience, difficulty in making a module, managing the class, and less time are the obstacles faced in implementing Differentiated Instruction. Hence, the Mathematic-English can be used as a solution to get students' improvement of tenses mastery in Differentiated Instruction. This is because the Mathematic-English is a learning model that only uses palms and an arithmetical concept to understand the sixteen tenses (Shofiyuddin & Andriyani, 2019). Therefore, with the use of this model, teachers do not need a complicated module and extra teaching time.

Mathematic-English is a tool to boost the ability of students to memorize in verbal form, the rules of 16 tenses. This is one of the models developed by the Islamic University of Nahdlatul Ulama Jepara lecturers, Muhammad Shofiyuddin and Santi Andriyani. It is one of the best models which must be disseminated but not many have used and researched. Mathematics-English Formula is a combination of two words, Mathematic and English. The combination of Mathematics and English is not only a simplification of names but also the use of basic mathematical concepts and patterns to become a pattern of understanding English tenses. Mathematic-English Formula uses the basic pattern of arithmetic as an approach to learning sixteen tenses so that the names, functions and formulas of tenses can be understood more easily, quickly and effectively (Shofiyuddin & Andriyani, 2019). Based on the explanation above, it can be concluded that Mathematic-English is a learning model that can problem-solve students' difficulties in learning tenses.

There are some previous studies about using Mathematic-English in teaching tenses. The first study was conducted by (Shofiyuddin & Andriyani, 2019). This research was to investigate the application of the Mathematic-English formula in teaching tenses within the English Education Program at Muria Kudus University. The second one was conducted by (Hendraloka, 2023). It was to find out the effectiveness of Mathematic-English at SMK N 1 Kalinyamatan. The other research was conducted by Rahma (2023). It aimed to find out whether Mathematic-English can improve students' writing skills or not at MA Darul Ulum Purwogondo. Simamora (2021) also conducted a study which aimed to find out whether the application of the smart fingers coding model significantly affects learners' ability to master tenses. The last research was conducted by Handungoda & Karunarathna (2019). It was to find out whether visual learners and auditory learners are significantly correlated with technique.

There are some differences between this study and previous studies above. This research was conducted at a school that had never been the object of previous research regarding mathematics-English. Then, this research not only used Mathematic-English as learning model but also combined with Differentiated Instruction. In implementing Differentiation Instruction, students are divided into three groups based on their learning styles, visual, auditory, and kinesthetic. Hence, students can express more their ideas and increase their motivation to learn tenses.

The researcher's interest was sparked by the challenges faced by students in learning tenses and the teaching-learning model. As a result, a study was conducted to investigate the effectiveness of using the Mathematic-English model on students' tense mastery in Differentiated instruction at SMA N 1 Tahunan. Hence, this study aimed to address the subsequent inquiries: (1) How significant are the differences between the students' tenses mastery taught with and without Mathematic-English Model using Differentiated Instruction?

Method

True experimental research using Pretest-Posttest Control Group Design was used in this research. It is because pre-test and post-test are important as an assessment tool that can assist guide and provide evaluations to improve students' mastery (Rosalia & Candraloka, 2023). There were 352 students in the first semester of eleventh grade at SMA N 1 Tahunan in the academic year 2023/2024 make up the population for this research study. A simple random sampling method was employed to get a sample of this research. In this study, the researcher utilized diagnostic tests in the form of 25 multiple-choice questions to determine the learning style of students. The researcher employed multiple choice as the chosen test format, emphasizing the application of tenses in various sentences. Then, the research was deemed valid based on empirical validity. The questions that have been created are consulted with experts. The expert is experienced lecturers in the English Education Department. After that, the test was tried out in other classes except for control and experimental classes. The validity of the questions was obtained by analyzing the result of that class using product moment. The questions were declared valid if the r test $>$ r table or the significance is more than 0,05. After testing the validity of the

items, there were 25 valid questions.

Pre-test was conducted on both control and experimental groups. It was to find out information about students' ability in grammar especially tenses before the researcher gives a treatment. Then, the treatments four times were given to the experimental class. The aim of the treatment was to help students improve their tenses using Mathematic-English. Post test was conducted after the students got treatments. It was to check the students' improvement of their tenses.

This research conducted some steps to analyze the data. The first step was to calculate the students' learning styles through the diagram. Second, the researcher performed the statistical descriptive analysis to calculate the mean of both the pre-test and post-test scores. Additionally, the homogeneity of the data was tested. The final step involved the computation of hypothesis testing through the utilization of the independent sample t-test. If the value of the t-test is greater than the value of the t-table, the Alternative Hypothesis is accepted and the Null Hypothesis is rejected. Conversely, if the value of the t-test is less than the value of the t-table, we reject the Alternative Hypothesis and accept the Null Hypothesis.

Results and Discussion

Results

The Results of Students' Learning Styles

Diagnostic tests have been given to both classes XI-2 and XI-3, which each class has 35 students. It is to find out students' learning styles before implementing differentiated instruction. The results are presented in the following diagram:

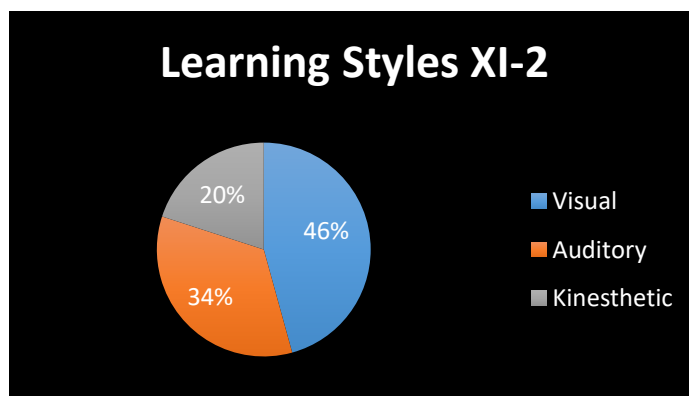


Figure 1. Diagram of XI-2

According to Figure 1, the visual learning style accounts for 46% of students in XI-2. Then, 34% of students who suitable with auditory learning styles. After that, there are 20% of students with kinesthetic learning styles. It means 16 students who like to learn with visual objects, 12 students who like to learn by listening, and 7 students who like to learn by trying directly.

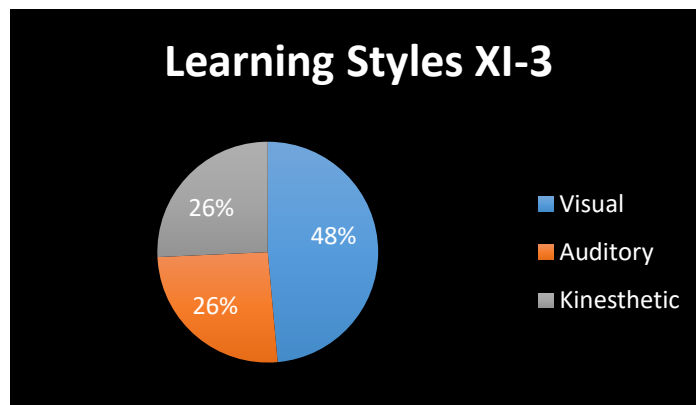


Figure 2. Diagram of XI-3

According to Figure 2, the visual learning style accounts for 48% of XI-2. Then, there are 26% of students who suitable for auditory learning styles. After that, there are 26% of students with kinesthetic learning styles. It means that 17 students who like to learn with visual objects, 9 students who like to learn by listening, and 9 students who like to learn by trying directly.

Descriptive Statistic and Homogeneity based on Pre-Test

Initially, a pre-test was administered to both the control and experimental groups. The aim was to make sure that both groups had an equal level of mastery in tenses. The homogeneity was observed by comparing the mean score of two groups in a pre-test and the result of the significance in Levene's Test for Equality of Variance using an independent sample t-test. The following table presents the result.

Table1 . Comparison of the both groups' pre-test scores

Pre-Test	Groups		<i>p-value (Levene's Test for Equality of Variance)</i>
	<i>Control</i>	<i>Experimental</i>	
Mean	47,31	48,91	
SD	4,801	4,761	0,992
N	35	35	

Based on the data in table 2, the pre-test scores of the control group had a mean score of 47.31 and a standard deviation of 4.801. Next, the pre-test score's mean for the experimental group was found to be 48.91, with a standard deviation of 4.761. An independent sample t-test was conducted to compare the pre-test scores of both groups. The outcome of the independent sample t-test revealed that the data from both the control group and experimental group exhibited homogeneity. The score signature shows that the value obtained in Levene's Test for Equality of Variance was 0.992, exceeding the threshold of 0.05. Consequently, one can infer that both groups had a similar level of mastery in tenses prior to the implementation of this research. Hence, it is possible to further pursue

this research.

Descriptive Statistics of Pre-Test and Post-Test Scores

The control group and the experimental group were subjected to distinct forms of treatment. After undergoing treatment four times, both groups were given a post-test to compare their scores with their pre-test scores. The following table displays the presented results.

Table 2. Descriptive Statistics of Pre-test and Post-test

Descriptive Statistics				
	Pre-Test		Post-Test	
	N		N	
	Mean		Mean	
Control	35	47,31	35	57,37
Experimental	35	48,91	35	71,09

The analysis of descriptive statistics indicates that there is an increase in the mean score of both the control and experimental groups. The control class score witnessed a rise from 47.31 to 57.37. Afterward, the experimental class saw an increase in their score from 48.91 to 71.09. This implies that there was a larger difference in score between the control group and the experimental group. The control group's difference score is 10.06, while the experimental group's difference score is 22.18. However, in order to determine whether there is a notable discrepancy in the proficiency of students' tenses when taught using the Mathematic-English model versus without it, conducting hypothesis testing becomes necessary.

Hypothesis Testing

The result of the independent sample t-test of both experimental and control groups is indicated in the following table.

Table 3. Hypothesis Testing of Post-test

Post-test	Independent Sample t-test		
	t	df	p-value
	10.534	68	0,000

According to Table 4, at a degree of freedom (df) of 68 and a confidence level of 95% with a significance level of 5%, According to the t-test results, the score obtained (10.534) is higher than the value in the t-table (1.668), indicating a significant difference. Next, we will discuss the significance of the score. The value (2-tailed) is less than 0.05 (0.000<0.05). The presence of a Mathematic-English Formula clearly shows a notable disparity in the

students' proficiency in tenses, compared to those who were not taught using the formula.

Discussion

This examination pointed to deciding the effectiveness of utilizing Mathematic-English in teaching tenses as an elective arrangement to help students improve their tenses mastery. The Mathematic-English model gives a modern environment in learning tenses for students because they have more excitement in learning tenses.

The research findings revealed significant disparities in the post-test results of the two classes. The post-test score mean in the control class is 57.37. The average score on the post-test for the experimental class is 71.09. An independent sample t-test also supports this hypothesis testing. Based on the findings, the t-test (10.534) was observed to be higher than the critical t-value from the t-table (1668), indicating a significant result. The value of (2-tailed) is less than 0.05, indicated as $0.000 < 0.05$. The comparison proved that Mathematic-English is effectively used in learning tenses. The findings indicate a similar result to Shofiyuddin & Andriyani (2019), who found that the Mathematic-English formula for learning tenses can enhance students' mastery of tenses. The incorporation of innovative tense learning models has the potential to enhance the acquisition of tenses greatly.

The students of the experimental group achieved mastery over the names, functions, and formulas of sixteen tenses effortlessly, without need to memorize more. When students are requested to showcase the capabilities and equations of sixteen tenses through the usage of Mathematic-English, this phenomenon becomes evident. The majority of students can demonstrate it without memorizing the sixteen tenses. It was in line with Shofiyuddin & Andriyani (2019) who stated that by studying tenses practically and effectively using Mathematic-English, students can avoid the complexity of memorizing various tenses and time signals. This is possible because practical tenses formulas have been introduced, which integrate basic Mathematic with English. The implementation of the learning tenses using the Mathematic-English formula has garnered an excellent response from the students. It is also in the same line with Simamora (2021) who stated that the students' memory will increase and they can master the sixteen tenses without more effort with the coding phase using fingers.

Differentiated Instruction involves the differentiation of learning in three distinct ways. First, the implementation of content-differentiated learning involves categorizing students based on their preferred learning styles, such as visual, auditory, and kinesthetic groups. To begin with, the implementation of content-differentiated learning involves categorizing students based on their preferred learning styles, such as visual, auditory, and kinesthetic. The second approach to Differentiated Instruction involves adapting instructions to accommodate the varying needs of visual, auditory, and kinesthetic learners. Finally, to fulfill different learning styles, assignments are assigned to students as a means of implementing product-differentiated instructions. Taking into consideration the unique characteristics of each student, delivering material in these three ways greatly enhances the flexibility in teaching. It is in the same line with Tanjung & Ashadi (2019) that Differentiated Instruction is an adaptable approach to providing substantial learning

experiences, considering the unique characteristics of each student. Distinguishing the content, process, and product of the lesson allows for its successful completion. In addition, the activities can be organized in such a way that allows the students to work individually, as a whole class, or in groups. Flexible grouping and tiered tasks are additional ways to enhance Differentiated Instruction even further.

The visual group was given a picture of palms and simple arithmetic formulas. It is to show how to use the Mathematic-English in learning tenses. With pictures, students can express their imagination through the material provided so that it is easier and faster for them to understand the names, functions, and formulas of sixteen tenses. This is because students with a visual learning style are better able to understand the material by looking visually. It was in line with Julaiha et al. (2022) who expressed that picture not only gives students the essential material but also stimulates their creative ability. It is additionally reliable to Tanamir et al. (2020) who expressed that students with a visual learning style inclined toward learning by seeing or outwardly, to be specifically learning utilizing media such as pictures, posters, and so on.

In implementing Differentiated Instruction in the auditory group, the researcher gave video as a media and more focused on the explanation. In addition, students in this group can easily understand the name, function, and formula of the sixteen tenses with more focus on listening to the explanation. It is in the same line with Farman et al. (2021) who stated that students in auditory groups learn by listening through lectures, discussions, or listening to tapes. Other research also stated that students in auditory groups are students who understand more about the process of learning by simply listening to the teacher's explanation, namely prioritizing the sense of hearing as a tool for absorbing information (Tanamir et al., 2020).

In the kinesthetic group, a matching game was applied in implementing Differentiated Instruction. With games, students can be more activate their motor and can understand more easily because matching games are the direct practice of names, functions and formulas of sixteen tenses. They also do not get bored because games create enjoyable learning. It is the same line with Wahab & Nuraeni (2020) who stated that kinesthetic is ideal for obtaining information through movement, practice, and touch. It is also the same results with Fouche & Moodley (2022) who stated that Learning will be more fun with educational games, especially in language learning.

Moreover, the involvement of students in learning tenses together as a group can be fostered through the use of Differentiated Instruction and the Mathematic-English model. This collaborative activity allows for the incorporation of students' unique learning styles. While grouping, individuals come together to support one another and collaborate to find solutions or get answers. It aligns with the same direction with Zakaria et al. (2022) who stated that engaging students in group-based collaborative activities can foster a sense of shared learning. When the students worked together, their supportive and collaborative attitude was evident as they utilized their devices to assist each other in finding the answer. As a result, students of all levels, from beginners to advanced learners, can join forces to assist one another in their work studies.

Furthermore, Students' projects demonstrate their ability to create sentences using various tenses. Students can construct sentences using different tenses based on their purpose and structures. Understanding tenses thoroughly can enhance students' expertise in writing, thus leading to the conclusion that a strong grasp of tenses is crucial for developing proficient writing skills. This is the same line as Pasaribu (2022) who stated that the recognition of the crucial role that the English tense plays in academic writing is paramount for achieving success in academic endeavors. This finding is also consistent with Novianto & Rofi'ah (2022), who stated that a revolutionary method known as the crossing tenses formulas method has emerged in formal education. The potential of this innovative approach to enhance students' understanding of tense formulas and their application in simple sentences is substantial.

From the explanation above, the implementation of Mathematic-English in Differentiated Instruction represented students' better achievement. However, this research has discovered certain challenges. The main issue is in implementing Differentiated Instruction. The researchers are currently facing challenges in creating multiple open materials that can effectively cater to the diverse learning styles of students. To address this issue, it is recommended to seek guidance from experts on developing teaching materials for tenses that are suitable for different learning styles, such as visual, auditory, and kinesthetic. Then, the constrained amount of time designated for the learning process is a challenge for researchers when it comes to effectively addressing the unique learning needs of every student. Consequently, to handle the class effectively, the researcher performed the treatment consecutively three times.

Conclusion

Based on the findings of this study, a noteworthy disparity exists in the level of tense mastery among eleventh-grade students at SMA N 1 Tahunan in the academic year 2023/2024, depending on whether they were taught with or without the Mathematic-English Formula. The increase in students' pre-test and post-test scores, along with the t-test score being higher than the t-table score, provided support for it. The mean score experimental group was 48.91 became 71.09 while the mean score in the control group was 47.31 became 57,37 after treatment. Then, the hypothesis testing showed that the t-test score obtained (10.534) is higher than the value in the t-table (1.668), indicating a significant difference. Next, we will discuss the significance of the score. The value (2-tailed) is less than 0.05 ($0.000 < 0.05$). The researcher suggests that Mathematic-English can be implemented in all grade levels at SMA N 1 Tahunan, based on these findings. In order to evaluate the effectiveness of Mathematic-English, future researchers have the option to select varying grade levels.

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