

A Comparison Study between Active and Passive Students in Intensive Mathematics I Course

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Abstract

Intensive Mathematics I (MAT037) is a basic mathematics course that is offered for pre-diploma students at Universiti Teknologi MARA (UiTM). The pre-diploma programme is a UiTM initiative that offers a special path for students who have completed the Sijil Pelajaran Malaysia (SPM) but do not meet the minimal requirements to further their studies at public universities. These students will be given the opportunity to apply to study at the diploma level in any of the UiTM faculties of their choice through the pre-diploma programme. MAT037 is designed to enhance the fundamentals of mathematics to prepare students for the diploma courses. This course content includes arithmetic operations, algebra, polynomials, equations, functions, indices, and logarithms. It also covers sequence, business mathematics, statistics, and applications of mathematics in basic business, finance, and investments. Based on the results of MAT037 for the past five semesters, the statistics showed that there were always a number of students who failed to perform. Therefore, this study aims to find out whether students' involvement in the learning process (actively or passively) correlates with their mathematics (MAT037) performance. Pre-diploma students at the UiTM Sarawak Branch, Mukah campus were the target population. A total of 175 students took part in this study. This research adopted the quantitative approach, and the correlational and quasi-experimental research designs were employed in this study. The questionnaire survey method was a measuring instrument for data collection. The data collected was analyzed using the IBM Statistical Package for Social Sciences (SPSS). The results indicated that the correlation was statistically significant and that there was a moderate positive correlation between students' involvement in the learning process and their MAT037 performance.

Keywords

Learning Styles, Learning Behaviours, Classroom Participation, Mathematics, Teaching and Learning

1. Introduction

The pre-diploma programme that is offered at Universiti Teknologi MARA (UiTM) is an alternative path for all Bumiputra, including Bumiputra from Sabah and Sarawak, who are unable to pursue their education at a higher level not only due to unsatisfactory Sijil Pelajaran Malaysia (SPM) results or high public institution of higher learning (IPTA) admissions requirements but also financial constraints. The pre-diploma programme is intended to provide education to low-income families. These low-income families are eligible for free education, free accommodation, and additional benefits, including a subsistence allowance.

Intensive Mathematics I (MAT037) is a course that is offered to UiTM pre-diploma students to enhance their fundamental mathematics. Students registered in this course are required to attend 5 hours of lectures and 5 hours of tutorials each week for a total of 14 weeks. They should be able to express their understanding of arithmetic, basic algebra, and polynomials at the end of the course. Additionally, work out questions involving algebraic equations, functions, indices, logarithms, sequences, business mathematics, and statistics. Finally, present the application of mathematics to basic business, finance, and investments.

Mathematics has always been recognized as a fundamental subject because arithmetic and logical reasoning are the basis of science and technology. However, many students continue to fall behind the standard of mathematics achievement and lose interest in mathematics; they eventually give up on learning mathematics (Yeh et al., 2019).

The results of MAT037 at the Mukah campus of the UiTM Sarawak Branch are displayed in **Table 1** for the previous five semesters. We can observe from **Table 2**'s UiTM passing scale that there are consistently students who get less than 50 marks. Students who pass, however, could score high marks—75 or more—by passing either with distinction or with credit.

Given that the majority of the students have a similar SPM mathematical background and that there are significant differences in the students' MAT037 mathematics performance, our research question is "Is the performance gap between the students related to their involvement (actively or passively) in the learning process?"

Adnan et al. (2013) reported that students' learning styles are an important element that can affect a student's ability to achieve something better. Each student has a different learning style that processes the information. Some students get actively involved, are observant, and listen to music while learning. These are

Table 1. MAT037 results for the past five semesters.

Status	Semester				
	20214 (Oct 21-Feb 22)	20212 (Mar 21-Aug 21)	20204 (Oct 20-Feb 21)	20202 (Mar 20-Sep 20)	20194 (Sep 19-Mar 20)
Pass with distinction	11.76%	10.53%	12.27%	23.08%	26.38%
Pass with credit	10.59%	5.26%	7.36%	7.69%	6.75%
Satisfactory Pass	22.35%	42.11%	20.25%	7.69%	20.25%
Pass	44.71%	31.58%	52.15%	38.46%	34.36%
Fail	10.59%	10.53%	7.98%	23.08%	12.27%

Table 2. UiTM passing scale.

Marks	Status
80 - 100	Pass with distinction
75 - 79	Pass with credit
65 - 74	Satisfactory pass
50 - 64	Pass
0 - 49	Fail

related to the student's learning style, which has to be identified by teachers to ensure the teaching and learning process can be implemented effectively to achieve the objective.

In this study, two objectives were developed as the outcome of this research question: one was to determine whether there is a significant difference in students' mathematics performance between active students and passive students. Second, to gauge the relationship between students' involvement in their learning and MAT037 mathematics performance.

In the literature review, various researchers investigated the types of learners and their academic performance. [Adu, Pylman, & Adu \(2020\)](#), [Villajuan \(2019\)](#), [Bosman & Schulze \(2018\)](#), [İlçin et al. \(2018\)](#), and [Adnan et al. \(2013\)](#) reported their research findings on the relationship between learning styles and academic achievement. One of the purposes of carrying out the research was because they believed that the poor academic achievement and negative attitude of learners were influenced not only by the teaching styles but by the learning styles as well.

The researchers also found that students' participation in class, whether active or passive, affects how well they perform academically. In this study, we separated the respondents into two groups based on their questionnaire responses: those who learn actively and those who learn passively, to carry out the analysis.

According to [Joey, Isabella, & Patricia \(2016\)](#), the active learner seeks out information and engages with it. They have an intention to learn and choose to participate in the learning process by reaching for new information. While the passive learner allows information to be brought to them. They are often de-

scribed as empty cups that are waiting to be filled with information. A similar statement was made by [Freeman et al. \(2014\)](#) as well; they stated that active learners are students who are engaged in the learning process through activities and/or conversation in class, whereas passive learners are students who simply listen to the teacher without participating in any of the learning themselves.

While for passive learners, [Haroon \(2019\)](#) revealed that passive learners are rarely disruptive, which is why they often go unnoticed and unchallenged. This lack of challenge results in poor progress and, ultimately, a student who is let down. He investigated the different techniques that can be used to encourage passive learners to be more involved during the lesson time, which in turn can increase student achievement.

[Zainal \(2007\)](#) discovered that students act more as listeners and less as speakers in the classroom. This category of students, in contrast to those who actively participate in classroom discussions, prefers to listen and take notes rather than contribute. Students tend to avoid classroom oral involvement. They appear to accept whatever topic is being discussed in class.

Students can be less involved in classroom discussions if they can't pay attention during lecture or learning time, are afraid of offending others ([Mustapha, 2010](#)), don't have much self-confidence, don't do their homework before class, are afraid of failing to show how smart they are, are afraid their answers will be criticized by the professors, or are confused ([Fassinger, 2000; Gomez, 1995](#)).

The literature review included quite a few studies on students' classroom participation. For example, in research by [Abdullah, Bakar, & Mahbob \(2012\)](#), they defined that participation in the classroom refers to acts of involvement in class activities. Asking questions, expressing opinions, and discussing the lecture topic are all examples of active participation. Passive participation includes activities such as taking notes, sitting quietly, listening to lectures, and doing other things.

Besides that, [Liu \(2001\)](#) identified four types of student participation in the classroom: full integration, participation in the circumstances, marginal interaction, and silent observation. These patterns of participation, however, are not constant at all times and in all places. There are students who may be actively participating in one discussion but become passive or silent in another ([Zainal, 2007](#)).

Students can interact with their teachers in two ways: verbally and nonverbally ([Lee, 2005](#)). To speak up and share ideas, ask and answer questions, and contribute to class debates are all examples of what we call "verbal" or "oral" engagement. Passive students are those who do not take any initiative to participate. Nonverbal involvement, on the other hand, is linked to students' actual actions in class, such as nodding their heads, raising their hands, moving around, and making eye contact with the teacher ([Zainal, 2007](#)).

Active student participation in classroom discussions is important for effective learning and plays an important role in the future success of students' education and personal development ([Tatar, 2005](#)). This is due to the fact that kids will learn how to think critically and improve their intellectual growth if they

participate actively in class (Mustapha, 2010).

It is crucial for the educators to be aware of their students' learning behaviours and styles in the classroom in order to select appropriate teaching strategies. Understanding student behaviour in the classroom will assist lecturers in planning and creating a conducive learning environment in which classroom activities are more participatory and engaging. Lecturers are encouraged to utilize active interactive teaching techniques such as problem-based learning and study groups. This pedagogical approach will establish student-centred and supportive learning settings (Abdullah, Bakar, & Mahbob, 2012).

Learning style is about how students learn rather than what they learn. The learning process is different for each individual; even in the same educational environment, learning does not occur at the same level and quality for all students. Learning styles may be useful to help students and educators understand how to improve the way they learn and teach, respectively. Determining students' learning styles provides information about their specific preferences. Understanding learning styles can make it easier to create, modify, and develop more efficient curriculum and educational programmes. Therefore, determining learning styles is quite valuable to achieving more effective learning (İlçin et al., 2018). One of the learning style models that is particularly valuable in class is the VARK model, which refers to the visual, aural, reading and writing, and kinesthetic modalities (Bosman & Schulze, 2018).

In this study, we compared the MAT037 performance of both active and passive students for the semester of October 2022-March 2023. The findings of this study will be valuable to the MAT037 lecturers in deciding whether to promote active or passive learning in their teaching and learning processes.

Paul (2017) conducted a survey to compare active and passive learning through learning points and inspirations. The comparison was done from the aspects of the definition: characteristics for both students and teachers, textbook assignments, writing, time, cost, the learning process, and feedback. He concluded that both active and passive learning have benefits and limitations. The adaptation of active and passive learning depends on learners' needs and practice.

Furthermore, Aji & Khan (2019) investigated the impact of active learning on students' academic performance. A comparison between the active-learning classroom and traditional classroom indicated that the active-learning pedagogy had a positive impact on students' academic achievement. They stated that the performance of students with active learning improved.

Lee, Atirah, & Jamilah (2018) investigated the effectiveness of using active teaching-learning methods on students' academic performance in Mandarin language proficiency. They analyzed the students' perspectives on the effectiveness of the nine active teaching and learning methods. Their research showed that homework and practice are perceived as the most effective among all the nine active teaching and learning methods. The team concluded that through the implementation of the nine active teaching-learning methods, students have im-

proved their academic performance significantly.

Freeman et al. (2014) reported that active learning will result in improved academic achievement in science, engineering, and mathematics. It was discovered that students who are active participants have higher academic achievement than students who are passive participants (Theberge, 1994). Astin (1999) agreed with this statement, saying that students who take part in classroom discussions are more satisfied with the learning process.

How students' involvement in their learning process is closely related to their mathematics performance. According to the findings of a study conducted by Reinholz (2022), student engagement in the classroom is linked to the mathematical performance of the student; however, this result is only valid for female students. The performance of the male students demonstrates otherwise.

Stehlíková (2011) discussed and stressed that it was important that the students learn mathematizing rather than mathematics. In her article titled "Doing Mathematics: From Passive to Active Students," she focused on concrete examples of teaching the same subject matter in several different ways. Each one is described, and its characteristics and potential are explored. The article allowed the readers to think about the approaches and the actual way we could be used in the lesson.

2. Methodology

This research aims to explore whether there is a significant difference in students' MAT037 performance between active and passive students, as well as to gauge the relationship between students' involvement in their learning and MAT037 performance. This research adopts a quantitative approach and a correlational research design. The purpose of using a quantitative approach is because it can predict likely outcomes, which are to identify the relationships among variables (students' involvement in their learning and their mathematics performance). While correlational research design is a form of quantitative research that is non-experimental and uses two variables (active and passive students and their mathematics performance) to understand and access the statistical relationship between them.

The target population for this research is pre-diploma students at the UiTM Sarawak Branch, Mukah Campus, who registered for the MAT037 course. In this study, probability sampling is adopted, in which samples are randomly chosen from MAT037 students at the UiTM Sarawak Branch, Mukah Campus. With a simple random sampling technique, every MAT037 student has the same probability of being chosen to be a part of a sample. The uses of probability sampling are to reduce sample bias and create an accurate sample to obtain well-defined data.

The data was collected using the questionnaire survey method as a measuring instrument. The survey was distributed to the MAT037 students from semester Oct 2022-Mar 2023 by 8 lecturers through a Google Form link. The total res-

pondents comprised 175 students from three different pre-diploma programmes: pre-diploma commerce, pre-diploma agrotechnology, and pre-diploma Islamic studies.

The instrument that was used in this research was a set of questionnaires consisting of three parts: Part I, Part II, and Part III. Part I of the questionnaire was designed to gather information on the socio-demographic profile of the respondents. This included student ID, gender, pre-diploma programme (pre-diploma commerce, pre-diploma agrotechnology, or pre-diploma Islamic studies), SPM mathematics result, and learning style preference (visual, auditory, reading and writing, and kinesthetic). For learning style preferences, the respondents can choose more than one answer.

Part II of the instrument focused on the questions that determine how active or passive the respondents are in their learning. In this part, the respondents were required to rate themselves on a Likert scale of 4 for 30 learning behaviours adapted from [Angel, Maria, & Francisco \(2021\)](#) to determine whether they learn actively or passively.

Lastly, in Part III, the respondents provided their MAT037 Assessment 1 marks. Assessment 1 consisted of nine questions with a total of 20 marks. The tested topics were from chapter arithmetic and algebra, which were on different forms of numbers, mixed operations on numbers using a calculator, operations on algebraic expressions based on the BODMAS rule, and factorization on algebraic expressions and algebraic fractions.

The response obtained was analyzed using graphical methods (bar graph, frequency table, pie chart, and scatter plot) and the Statistical Package for Social Sciences (SPSS) version 28, which employed an independent sample t-test and Pearson Product-Moment correlation coefficient to measure the relationship between the independent variable (types of learners) and the dependent variable (mathematics performance).

3. Findings and Discussions

A research study was conducted at one of the campuses at UiTM Sarawak Branch, Mukah. The respondents were randomly selected from pre-diploma students from semester Oct 2022-Mar 2023 who took the course MAT037 Intensive Mathematics I. [Figure 1](#) shows the respondents were composed of 175 students, of whom 123 (70.3%) were female and 52 (29.7%) were male. They were randomly selected from three different programmes: 35 (20%) respondents were from Pre-Diploma Agrotechnology, 134 (76.6%) from Pre-Diploma Commerce, and 6 (3.4%) from Pre-Diploma Islamic Studies. It can be clearly seen that there are approximately 2.4 times more responses from female students than from male students.

Besides that, students' prior mathematics performance (in SPM) is presented in [Table 3](#). The data shows a right-skewed distribution, which indicates that the majority of the students scored below the average and that there are only a few

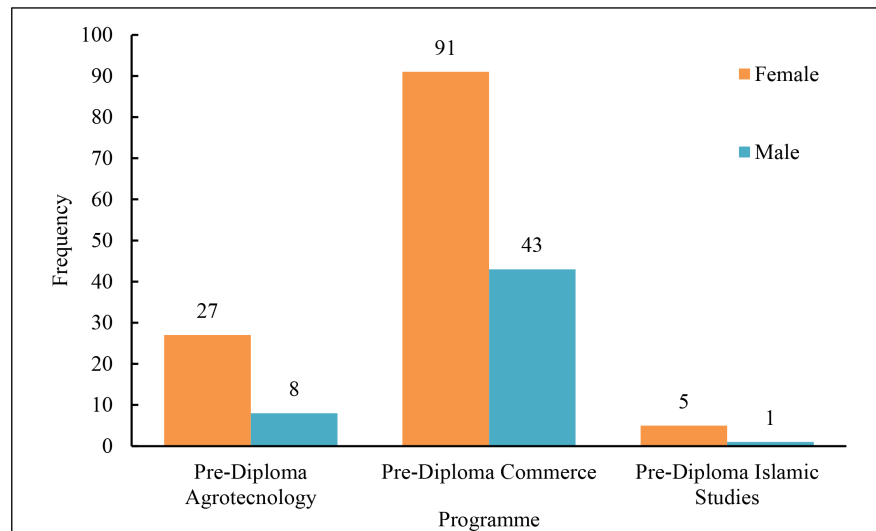


Figure 1. Demographics of respondents.

Table 3. Prior mathematics performance (in SPM) of respondents.

Grade	Frequency	Total
A+	0	
A	3	
A-	1	
B+	1	
B	5	
C+	6	175
C	4	
D	77	
E	75	
G	3	

students who scored high marks in SPM.

Figure 2 provides the ranking of the preferred learning styles among the students. The most preferred learning style among the students is kinesthetic, as it is the top-ranked style with 134 students. The second most preferred learning style is visual, which was selected by 131 students. Reading and writing tie for the third preferred learning style. Lastly, the fourth most preferred learning style is auditory, as selected by 110 students.

Other than understanding students' preferred learning styles, it is essential to understand students' involvement (actively or passively) in their learning in the MAT037 course. Each student might have a distinct learning pace, and it could have a highly influential effect on their academic performance. Thus, an analysis was done with the respondents to identify their learning behaviours. In this study, the research questionnaire with Likert scale 4 was adapted from [Angel](#),

Maria, & Francisco (2021). By taking the average of the Likert scale, the results of the top three highest and the top three lowest were shown in **Table 4**.

It can be clearly seen in **Figure 3** that most of the students who took the MAT037 course were active learners, and there were about 157 of them (90%). On the other hand, there were only 18 students (10%) who were passive in their learning.

A comparison between active and passive students in MAT037 performance was shown in **Figure 4**. According to the UiTM passing scale in **Table 2**, the passing rate for the active students (68.2%) is higher as compared to the passive students, whose passing rate was 44.4%.

This study aimed to determine whether there is a significant difference in students' MAT037 performance between active and passive students. Thus, an independent sample t-test was used, and data was analyzed using SPSS version 28. The hypothesis tested was as follows:

H_0 : There is no significant difference in students' MAT037 performance between active and passive students.

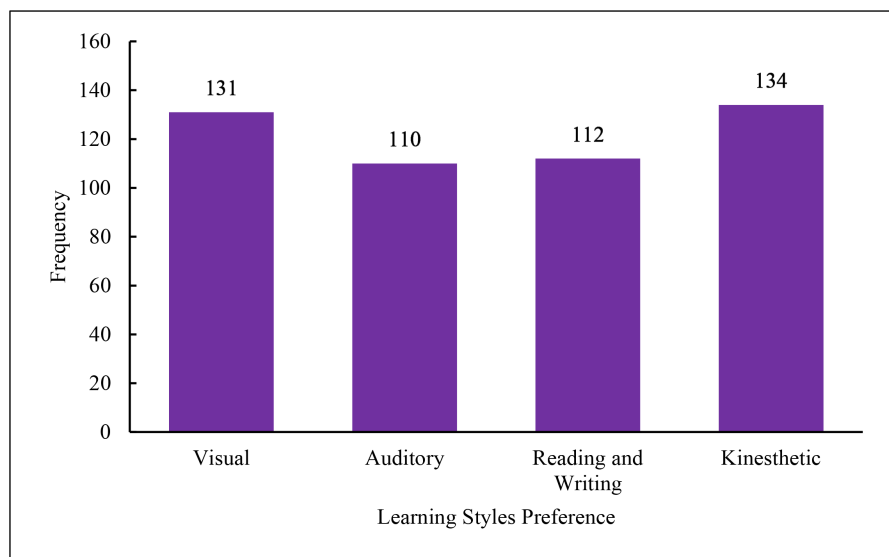


Figure 2. Rankings of the preferred learning styles.

Table 4. Indicator for active and passive students.

No.	Learning behaviours	Mean
22	I always take notes in class.	3.49
19	I always did my part during group work.	3.45
10	I always bring the required materials to class.	3.44
25	My lectures should deliver content in the unusual way.	1.89
24	I would be happy if the lecturer asks me to make own notes.	1.78
3	I am not only attending classes and tutorials more frequently before the exam.	1.51

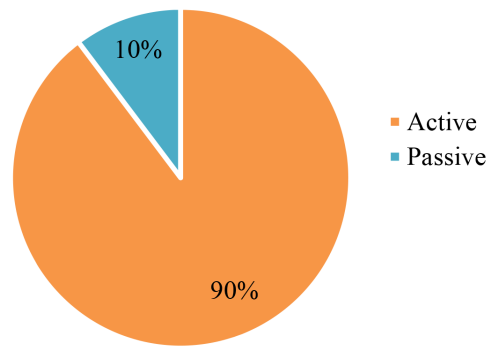


Figure 3. The Percentage of Respondents' Involvement (Actively or Passively) in the MAT037 Course.

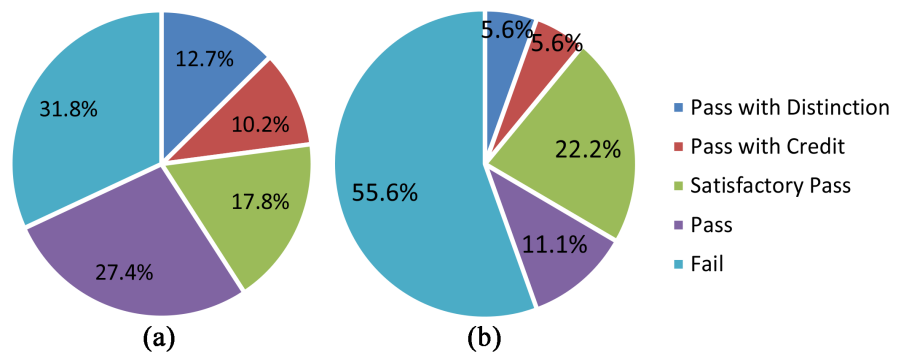


Figure 4. Comparison of MAT037 performance between (a) active students and (b) passive students.

H_1 : There is a significant difference in students' MAT037 performance between active and passive students.

As a result, there was no significant difference in the mean MAT037 performance between active students (mean = 56.895, standard deviation = 20.3896) and passive students (mean = 48.750, standard deviation = 22.2329) with $t = 1.591$, $p\text{-value} = 0.114$. The null hypothesis was thus failed to reject at the 5% level of significance.

To establish the relationship between active and passive students and their MAT037 performance, the following hypothesis was tested using Pearson Product-Moment correlation:

H_0 : There is no statistically significant relationship between students' involvement (actively or passively) and their MAT037 performance.

H_1 : There is a statistically significant relationship between students' involvement (actively or passively) and their MAT037 performance.

The results of Pearson Product-Moment correlation testing were $r = 0.339$ (with $p < 0.001$), which indicates that the null hypothesis is rejected at the 5% level of significance. This confirms that the correlation is statistically significant and that there was a moderate positive correlation between students' involvement (actively or passively) and their MAT037 performance. This result was supported by the scatter plot in **Figure 5**.

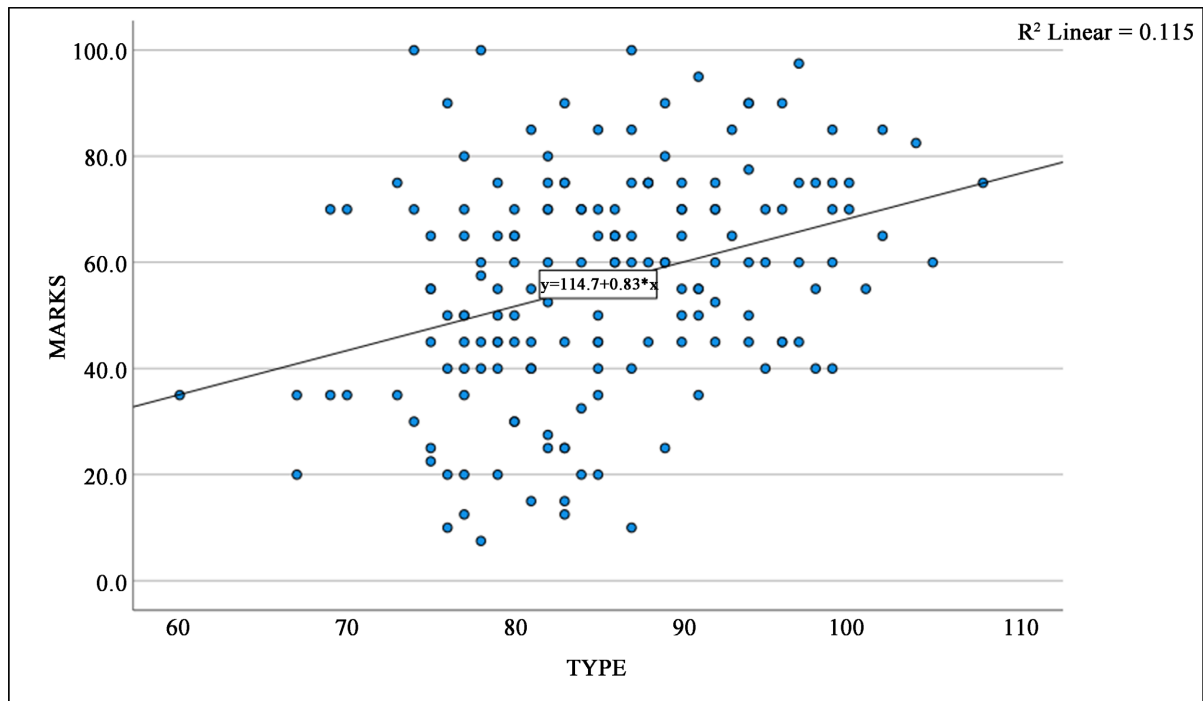


Figure 5. Scatter plot of the relationship between students' involvement and MAT037 performance.

4. Conclusion

According to our research's findings, the active students in the MAT037 course outperformed the passive students by a small margin. The result reported by numerous researchers is supported by this discovery. For instance, [Theberge \(1994\)](#) discovered that students who are active participants achieve better academically than passive participants. Students are more engaged and grasp information more efficiently when they actively learn. This is due to the fact that engaged and motivated students are more likely to retain information and foster a higher level of comprehension.

Although there was no significant difference in the mean MAT037 scores between active and passive students, the study found that there was a moderate positive correlation between students' involvement (actively or passively) and their MAT037 performance. This finding is consistent with the results presented by [Aji & Khan \(2019\)](#) and [Freeman et al. \(2014\)](#), who indicated that active learning has a positive effect on students' academic achievement, which will lead to improved academic performance in science, engineering, and mathematics.

As indicated by the results, when the students involve themselves actively in their learning process, they tend to perform better in the MAT037 course. Therefore, lecturers of MAT037 may encourage active learning in their students and develop strategies to involve them in the teaching and learning process in order to boost their students' MAT037 mathematics performance in the future.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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