Study of Student Learning Habits and Their Relationship with Learning Outcomes in Elementary Linear Algebra Courses

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Abstract. The Elementary Linear Algebra (ELA) course is a compulsory and basic course for several other subjects. Most students have not mastered this material well. One of the contributing factors is the students' not good enough study habits. The purpose of this study was to analyze student study habits and their relationship with learning outcomes in the ELA course. This type of research is comparative causal research. The research instrument was a questionnaire and learning outcome test. The populations are students of the mathematics study program for the 2018 academic year. Students are divided into three groups based on their learning outcomes (x), namely groups: high (x ≥75), medium (60 ≤x <75), and low (x <60). The results showed that in general, student learning outcomes were at a good level, but study habits affected student learning outcomes only by 30%, meaning that there were other variables that influenced student learning outcomes. From the average study habits, it is known that students in the high group do better than the medium and low groups.

1. Introduction

The Elementary Linear Algebra (ELA) course includes basic courses in the Mathematics Department, meaning that the material in this course is required for subsequent courses. So it is hoped that students can master this material well, but most students still get poor learning outcomes. Students seem to have difficulty understanding existing concepts. The subject matter consists of many definitions and theorems that are related to each other, such as the concept of determinants, which relates to the basis and solutions of systems of linear equations [1]. So that students must be able to master each of them by doing lots of exercises and discussions. Poor study habits are thought to be one of the factors that cause student failure in lectures. One example of poor study habits from students is that when given homework, the results of their work are quite good but if asked to explain in front of the class they are unable to explain the results of their work. This means that they may just copy their friend's homework without understanding what they are writing about. Poor study habits will certainly affect success or achievement in learning.

A person's study habits are actually influenced by many factors and are generally divided into internal factors and external factors. According to [2] and [3], the factors that influence student academic achievement, in general, include internal factors and external factors. Internal factors, namely those in students, consist of: (a) physical factors (health factors and disabilities), (b) psychological factors (intelligence, attention, talents, interests, motivation, maturity, and readiness), (c) fatigue factor (physical exhaustion and spiritual fatigue). External factors consist of: (a) Family...
factors (the way parents educate, relations between family members, home atmosphere, family economic conditions, understanding of parents, and cultural background), (b) School/campus factors (teaching methods, curriculum, teacher/lecturer and student/student relations, school/campus discipline, learning tools, school/lecture time, standard lessons above the size, building conditions, learning methods, and homework). Many factors influence student learning outcomes, but this study will focus on internal factors from within students, such as attention, interest, motivation, and readiness. This selection is because students are old enough so that it is assumed that internal factors are more dominant in influencing their study habits. The initiative factor in students will certainly play a more role because they have to respond with themselves.

According to [4], there are two kinds of study habits, namely 1). Good study habits include: (i). do regular study every day (ii). Prepare all study needs at night before leaving the next day. iii). Always attend the class before lessons start. iv). Accustomed to visiting the library to read more or looking at reference books looking for the meanings of terms. Next 2). Bad or bad study habits, these habits include i). Just do the study furiously after the imminent exam. ii). Shortly before leaving, you can quickly collect books and equipment that need to be brought. iii). Often late in attending. iv). Generally, learning is necessary so that the grains of knowledge is still obscure, and many are forgotten. v). rarely entered the library and no way to use encyclopedias and various other reference works.

Learning habits are not inherited traits but rather are actions that students can practice repeatedly. As stated [5], "the habit of learning is a method or method that is done by a person repeatedly, and in the end, it becomes a determination and is automatic". Furthermore, [4] suggested, "learning habits are student behavior that is carried out routinely from time to time in the context of implementing their learning". Furthermore, [6] also said, "Learning habits are methods or techniques that have settled in students, namely how to receive lessons, read books, do assignments and arrange a time to complete activities". Therefore, it is hoped that students can change bad study habits into good habits as long as they have the awareness to change. [7] said "the learning method used determines the expected learning outcomes. The right way will bring satisfactory results while the wrong way of learning will cause the learning to be less successful".

So it can be concluded that study habits are one of the factors that can affect student learning outcomes, but how much influence do these study habits have on their learning outcomes, and what are good and bad study habits for students. In order to obtain more detailed information about student study habits, data on student study habits were analyzed in three groups of students, namely: students with high, medium, and low groups.

Based on the above problems, the objectives of this study are (1) to see how the study habits of students (high group, medium group, low group) during Elementary Linear Algebra lectures (2) How much influence the study habits have on student learning outcomes in Elementary Linear Algebra courses.

2. Research Method
This type of research is descriptive and causal-comparative research. According to Kerlinger (cited [8]), causal-comparative research (also called ex post facto research) is a systematic empirical investigation in which the researcher does not directly control the independent variable because the existence of the variable has occurred or because the variable is basically not can be manipulated. In this study, the independent variable is the student's learning habits, and the dependent variable is the student learning outcomes during Elementary Linear Algebra lectures. The purpose of this study was to determine student study habits and their effects on learning outcomes. The research subjects were students of the Mathematics Study Program of the State University of Padang in the 2018 academic year totaling 30 people.

The research instrument was a questionnaire and a learning outcome test. Questionnaires were given to students to determine student learning habits in Elementary Linear Algebra courses. The
indicators for the questionnaire focused on internal factors, namely: Motivation, Attention, Interest, and Readiness. From this indicator, it is broken down into 22 items. The questionnaire assessment uses a Likert scale with a score of 1-4. A score of 1 means never, a score of 2 means rarely, a score of 3 means often, and a score of 4 means always. To interpret the average score of the questionnaire, the questionnaire average is made on a scale of 100 using the criteria formula

\[ X_i = \frac{\bar{x}}{4} \times 100\% \]  

Furthermore, the assessment criteria are used in table 1.

### Table 1. Criteria for assessment of study habits [9]

| Criteria | Score   |
|----------|---------|
| 81-100   | Very good |
| 61 – 80  | Good    |
| 41 – 60  | Good less|
| 21 – 40  | Not good |
| 0 - 20   | Not very good |

While the Learning Outcomes Test is made in a description test with a scale value of 1 - 1000, then the student scores \(x\) are converted into grades A, A-, B+, B, B-, C+, C, C-, D, and E as the criteria in table 2.

### Table 2. The criteria for assessing student learning outcomes

| Criteria | Score   | Criteria | Score   |
|----------|---------|----------|---------|
| 85 ≤ \(x\) <100 | A       | 60 ≤ \(x\) <65 | C+      |
| 80 ≤ \(x\) <85 | A-      | 55 ≤ \(x\) <60 | C       |
| 75 ≤ \(x\) <80 | B+      | 50 ≤ \(x\) <55 | C-      |
| 70 ≤ \(x\) <75 | B       | 40 ≤ \(x\) <50 | D       |
| 65 ≤ \(x\) <70 | B-      | \(x\) <40 | E       |

Furthermore, to see student learning habits in more detail, students are divided into three groups, namely: the high group, the medium group, and the low group. Selection of groups based on the final score obtained by students. The high group is students who score B+, A- and A. The medium group is students who score C+, B-, B, and B+. The low group is students who score C, C-, D, and E. Furthermore, it will be seen that students’ good and less good study habits in each group will be seen.

Meanwhile, to see the magnitude of the influence of study habits with learning outcomes used simple linear regression analysis. Previously, a normality test was carried out as a requirement for analysis. From the results will be seen in the regression equation and the value of determination R2. From the R2 value will be seen the large influence of study habits, which can be explained by the regression equation.

### 3. Results and Discussion

The data obtained in this study are data on student learning habits and data on their learning outcomes in Elementary Linear Algebra courses.

#### 3.1. Students Learning Habits

Based on the questionnaire that was given to students after lecturing in Elementary Linear Algebra, the data was processed by looking at the average of each student. Furthermore, data on a scale (1-4) is transferred to data on a scale of 100 using equation (*). For more details, the questionnaire results can be seen in Table 3 below.
Table 3. Average Student Learning Habits

| Student group | Average (scale 1-4) | Average (1-100 scale) | Category |
|---------------|---------------------|------------------------|----------|
| High Group    | 2.58                | 64.5                   | Good     |
| Medium group  | 2.78                | 69.5                   | Good     |
| Low Group     | 3.17                | 79.25                  | Good     |
| Total (all students) | 2.81            | 70.25                  | Good     |

From table 3, it can be seen that the overall average study habits of students are 2.81 which means that they are in the good category. This can be interpreted that in general the study habits of students in learning ELA material are good where students have often done positive things in learning. Most students have high motivation to study, want to get good grades. However, if you look at the study habits of each group in more detail, there is a difference in the average study habits of students, where the high group has a higher average learning habit than the medium and low group study habits. Even so, the three average learning habits of each group were still in the good category. Next, look again in detail at the good and bad study habits of each student group.

Study habits that have been well practiced by low-group students are: (a) I always try to focus fully on the lecturer's explanations (with an average score of 3.4); (b) I prioritize doing easy questions in doing ELA tests (with an average score of 3.27); (c) I noted the important parts of the ELA material explained by the lecturer. Meanwhile, the poor study habits carried out by low-group students were: (a) I was afraid to ask the lecturer about material that I didn't understand (with an average score of 1.7); (b) I do not have a fixed study schedule at home to study ELA material (with an average score of 2); (c) I did not read the ELA material for the next meeting (with an average score of 2.09). So it can be concluded that students with low achievement groups have a serious effort to pay attention to lecturers' explanations but are afraid to ask questions and do not have a fixed group study schedule for one week.

Study habits that have been good for students in the moderate group are: (a) I always try to focus fully on the lecturer's explanations (with an average score of 3.6); (b) Pay attention to the explanation given by the lecturer (with an average score of 3.5); (c) I noted the important parts of the ELA material explained by the lecturer (with an average score of 3.5). Meanwhile, the poor learning habits carried out by the moderate group are: (a) I always read / study ELA material before the lecturer delivers it in class (with an average score of 2.20); (b) I am afraid to ask the lecturer about material that I do not understand (with an average score of 2.21); (c) I do not read the ELA material for the next meeting (with an average score of 2.21). So it can be concluded that the study habits of middle group students in the Elementary Linear algebra course are to pay serious attention to the lecturer's explanation and then note important things but do not study the material before the lecture takes place.

The good study habits carried out by the High groups in a row are: (a) I always try to focus fully on the lecturers' explanations (with an average score of 4); (b) When given an assignment, I will finish it neatly and well (3.8); (c) I did not sit on the back (with an average score of 4). Meanwhile, the bad study habits carried out by the high groups are: (a) My friends and I have a group study schedule at least once a week (with an average score of 2.4); (b) I read the ELA material for the next meeting (with an average score of 2.8); (c) I always read / study ELA material before the lecturer delivers it in class (with an average score of 2.8). So it can be concluded that the study habits of high group students during the ELA lecture are to focus on the lecturers' explanations, do the questions well and sit in the front but do not have a fixed group study for a week and do not read material before lectures begin.

3.2. Student Learning Outcomes

Student learning outcomes are obtained from learning outcomes tests with essay questions given to students. Learning outcome data can be seen in Table 4 below.
Table 4. Student Learning Outcomes

| N  | SD  | $\bar{X}$ | $X_{\text{max}}$ | $X_{\text{min}}$ |
|----|-----|-----------|-----------------|-----------------|
| 30 | 14,19 | 60,84 | 87              | 31,8            |

From table 4, the average student learning outcomes are still low, still around the C+ value, which means that the lecture process and student learning habits must be improved. The highest score has just reached a value of 87, which is still far from the ideal value of 100. Furthermore, the learning outcomes of students per group are in table 5 below.

Table 4. Student Learning Outcomes

| Student group | Average | Number of Students |
|---------------|---------|--------------------|
| Low Group     | 44.3    | 11                 |
| Medium group  | 65.3    | 14                 |
| High Group    | 80.46   | 5                  |
| Total (all students) | 60.84 | 30                 |

From table 5, it can be seen that students in the high group have an A-grade on average - but the number of students is still very small (17%) while the most (46%) are still in the middle group whose average score is around B-. Furthermore, there are still quite a lot of students in the lower group (37%) with an average grade of D. So it can be concluded that the student learning outcomes in Elementary Linear Algebra courses most of the students are still in the middle and lower groups, namely as much as 83%. This is certainly far from being expected. In terms of material, the things that many students experience difficulty are at the stage of proving concepts and proving questions. In addition, students still find it difficult to connect between concepts, for example, the elementary matrix concept with the inverse matrix concept. Likewise, the relationship between the determinant concept and the system solutions of homogeneous and non-homogeneous linear equations. Almost in every part of the student material, it is difficult to prove the problem of proof.

3.3. Relations Study Habits with Learning Outcomes

To see the relationship between study habits and student learning outcomes in elementary linear algebra courses, linear regression analysis is used. Before conducting the analysis, a normality test was carried out on the two groups of data. From the normality test (Anderson Darling test) on the learning outcomes, data obtained $P\text{-value} = 0.074$. For $\alpha = 0.05$, the $P\text{-value}> \alpha$ so that $H_0$ is accepted, meaning that the student learning outcomes are normally distributed. Furthermore, the normality test (Anderson Darling test) on student study habits data obtained $P\text{-value} = 0.764$. For $\alpha = 0.05$, the $P\text{-value}> \alpha$ so that $H_0$ is accepted, meaning that the data is normally distributed. Then a simple linear regression analysis was carried out (with the help of Minitab software) to see the relationship and influence of the independent variable $X$ (student learning habits) with the dependent variable $Y$ (student learning outcomes). From the analysis obtained the equation: $Y = 13.4 + 26.2 \times X$ with $R\text{-Sq} = 30.4\%$.

From the value of $R\text{-Sq} = 30.4\%$ it can be concluded that the effect of learning habits, which can be explained by this regression equation, is only around 30.4%. This means that there are still 69.6% other factors that influence student learning outcomes.

The following can be seen in the distribution of learning habits data on learning outcomes in Figure 1.
From the data plot in Figure 1, it can be seen that there is still a lot of data that is somewhat away from the line equation, which means that student learning habits do not fully follow the linear line pattern in the equation. There are students whose study habits are in a good category, but their learning outcomes are still low, and there are also students whose learning habits are in the poor category, but learning outcomes are good. So it can be seen that to improve student learning outcomes in linear algebra courses, in addition to good study habits, students must also pay attention to other factors that influence. Then to see the relationship between study habits and student learning outcomes, Pearson Correlation is used, and a correlation value of 0.552 is obtained with P-value 0.002. Because the P-value <α, then reject H0, meaning that there is a significant relationship between study habits and learning outcomes by 55%.

In addition, in order to improve learning outcomes in Elementary Linear Algebra courses, students must be able to improve their poor study habits so far, such as managing group study schedules, asking lecturers if there are things that have not been understood, don't like to sit behind and read the material before lectures begin.

4. Conclusion
From the results of the analysis and discussion of the research, it can be concluded:
1. The learning habits of students in Elementary Linear Algebra courses are generally in the good category
2. The learning habits of students in the high group are higher than the learning habits of students in the middle and lower groups.
3. There is an effect of study habits with learning outcomes of 30.4%, which is explained by the regression equation: Y = -13.4 + 26.2 X in Elementary Linear Algebra courses.
4. There is a significant relationship between study habits and learning outcomes by 55%.

5. Suggestion
To improve student learning outcomes in Elementary Linear Algebra courses, students must improve their study habits. In addition, it is necessary to look for strategies/factors besides study habits to improve student learning outcomes, such as teaching materials that can improve student understanding of concepts as well as be able to see the relationship between concepts.

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