Procedural Fluency from the View of Students of Mathematical Disposition Level through Google Classroom Assisted Learning

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Abstract

This study aims to describe procedural fluency in solving problems for students of the Mathematics Education department at STKIP Pamane Talino who obtain high and low mathematical dispositions through learning assisted by Google Classroom. This research was a qualitative research. The research subjects were two students in the third semester. Subjects were selected by purposive sampling. The research data was obtained by tests and interviews, and the validity of the data was obtained by using the triangulation method. The techniques of data analysis were through: 1) classifying data into three indicators of the smoothness of the procedure, namely: implementing procedures appropriately, selecting and utilizing procedures, modifying procedures, then reducing data that are not included in the 3 indicators; 2) presenting data in a narrative; and 3) concluding the procedural fluency obtained from the indicators of procedural fluency in problem-solving steps. The results of the high mathematical disposition analysis show that students have excellent procedural skills because they could apply procedures appropriately. They are able to select and to utilize procedures accurately as well as to apply procedures properly and flexibly. In the other side, the students with low mathematical disposition, they have poor procedural skills because even though they are able to apply the procedure, to choose and to use the procedure appropriately, they still could not comply with the procedure appropriately and accurately for they answer all the questions incorrectly.

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INTRODUCTION

During the COVID-19 pandemic, the learning process has shifted from conventional face-to-face to online-based mode. This is related to the policies that instruct the implementation of learning from home through online or online learning to prevent the spread of COVID-19. The emergence of the COVID-19 pandemic requires face-to-face learning be transformed into distant learning using technological assistance (Ramadhani and Fitri, 2021) STKIP Pamane Talino, one of the private universities that follows the policy, changes learning mode from face-to-face to online-based. Many applications are used to assist the implementation of online learning. One of the applications being used by the STKIP Pamane Talino Mathematics Education department is Google Classroom.

Google Classroom is a free service developed by Google that aims to create, to distribute and to grade assignments without having to meet face to face. Muslik (2019)

explains that Google Classroom is a medium that can be used by educators and students to create online classes which enables educators managing classes, assignments, grades, and reviews in real-time class. The use of Google Classroom is to make it easier for students to carry out online learning because of the additional features that are easy to learn and to apply. The use of Google Classroom also does not consume a lot of internet quota so it is affordable for students. In addition, according to Kusumaningrum and Wijayanto (2020), the result of their research states that Google Classroom is the most familiar application compared to other applications and it does not consume a lot of quota. Moreover, materials being uploaded to Google Classroom can be downloaded easily. Therefore, Google Classroom is used in online learning in the Mathematics Education students at STKIP Pamane Talino.

Mathematics Education students at STKIP Pamane Talino in their curriculum receive Inferential Statistics courses in which there is a Hypothesis Test material inside. To perform a correct hypothesis test, students must be able to master the hypothesis testing procedure. Therefore, procedural fluency in hypothesis testing is an ability that must be possessed by students in conducting hypothesis testing. Procedural fluency is one of the mathematical skills which is interconnected, related to and cannot be separated from other mathematics skills. According to Kilpatrick and Swafford, the five mathematical skills are: 1) understanding of the concept or problem, 2) procedural fluency, 3) strategic competence, 4) adaptive reasoning, and 5) productive disposition (Bautista, 2013). As previously explained, these five skills are interrelated so that procedural fluency is very important for students to master for supporting other mathematical skills.

According to Watson and Sullivan, fluency involves carrying out procedures flexibly, accurately, efficiently, and appropriately as well as having "factual knowledge and concepts that come to mind readily" (p. 112). Their definition combines both the ability to readily perform the mechanics of mathematics (procedures) and the understanding of the mathematics being learned (concepts) providing a wider scope to focus on various aspects of fluency (Cartwright, 2018). Kilpatrick, Swafford and Findell in Kusumaningtyas and Yunianta (2019) define procedural fluency with the skills and abilities to carry out the knowledge held regarding procedures and also the ability to develop flexible, accurate and efficient behavior in problem solving. From this definition, a person has good procedural fluency when that person can choose and apply the appropriate and correct procedures when solving problems. NCTM (2014) states that analyzing students' procedures often reveals insights and misunderstandings that help teachers in planning the next steps in instruction so that analyzing students' procedures helps to better understanding of students' abilities.

There are three indicators to measure procedural fluency: 1) applying the procedure appropriately, namely, how far and how deep the students can understand the problem, then link the known information with the objectives to be achieved from the problem to make and can implement plans in order to solve the problem; 2) choosing and utilizing procedures, that is, students can choose appropriate and appropriate procedures and can use them in problem solving, and 3) modifying the procedure, namely, students can solve problems using selected and appropriate procedures according to the objectives of the problem to be solved. Procedural knowledge can also be seen from the steps taken to solve problems, computational mastery, and knowledge to identify mathematical objects. Therefore, procedural knowledge is not only seen from the steps to solve problems but also when choosing and applying the correct procedure and verifying the correctness of the procedure using a mathematical model in solving problems (Badjeber and Maılili, 2018).

The flexible, accurate, and efficient attribute that is required of procedural fluency is, of course, in line with mathematical dispositions. Mathematical disposition is closely related to how a person views and resolves problems, whether confident, diligent, interested in thinking flexibly to explore all alternative possibilities in solving problems (Hamidah and Prabawati, 2019). According to Kilpatrick, mathematical disposition is a productive attitude or a positive habit that sees Mathematics as something logical and useful (Yulianti, et. al., 2013). Sumarmo added that mathematical disposition contains many positive traits such as critical, creative, and careful in thinking, being objective, confident, flexible, and curious when facing problems, has a high interest in learning, all of which these positive attitudes can certainly achieve learning success (Friantini and Winata, 2020).

NCTM suggested that mathematical dispositions show self-confidence, expectations and meta cognition, serious passion and attention in learning Mathematics, persistence in dealing with and solving problems, high curiosity, and the ability to share opinions with others (Yaniawati, et. al., 2019). Through students' mathematical disposition we can see their confidence, expectations and metacognition, passion and serious attention in learning Mathematics, persistence in facing and solving problems, high curiosity, and the ability to share opinions with other people.

In this research context, the study analyzes the procedural fluency of the third semester students of the Mathematics Education department of STKIP Pamane Talino in carrying out hypothesis testing by looking at the level of their mathematical disposition in Google Classroom assisted learning. The purpose of this study is to see how the students' procedural fluency in hypothesis testing viewed from the level of their mathematical disposition so we can see how the procedural fluency of each level of mathematical disposition in the hypothesis testing procedure in the inferential statistics course. By knowing the student's procedural fluency in hypothesis testing, it can lead to the comprehension of the student's ability to test the hypothesis and to what extent the students' understanding on the hypothesis testing procedure based on the level of mathematical disposition. This is important to prepare students before entering into the research activities which they will certainly do later.

METHODS

The method in this study used qualitative research. The result of this study is presented in a descriptive form about the student's procedural fluency in the hypothesis test. This research is held to the Mathematic students in the third semester of STKIP Pamane Talino. The sampling technique used in this research was purposive sampling. The subject of this research was two students divided into two groups with a category of high and low mathematical disposition based on the results of a mathematical disposition questionnaire. The indicators used to measure mathematical disposition are: 1) Self-confidence, 2) Flexibility, 3) Perseverance, 4) Interest, 5) Reflection, 6) Value of Mathematics applications, and 7) Appreciation of the role of Mathematics (Lestari and Yudhanegara, 2017). For the high and low categorization of the questionnaire results based on the median score. If the score obtained by the student is smaller than the median score (< median), it is classified as low, and if the score obtained by the student is greater than or equal to the median score ($\geq$ median), it is classified as high (Anggraini and Mukhadis, 2013). The consideration of subject is selected based on questionnaire and complete answer. Researchers are the main instruments who collect themselves the data needed by using assistant instrument tests and interview guidelines. The test was used to measure the procedural fluency of students in testing hypotheses and interviews are used

to dig deeper information about students' procedural fluency when doing hypothesis tests. The technique of data validity testing used triangulation technique to check the trustworthy level of research findings. Some techniques of data collection used were test and interview until the data was saturated.

RESULTS & DISCUSSION

The Google Classroom application in this study is used to assist in delivering material to students through online learning. The material uploaded to the Google Classroom is in the form of PDF and learning videos delivered by the lecturer while explaining the material regarding hypothesis testing. The following figure is a screenshot of the Google Classroom application when providing hypothesis testing material.
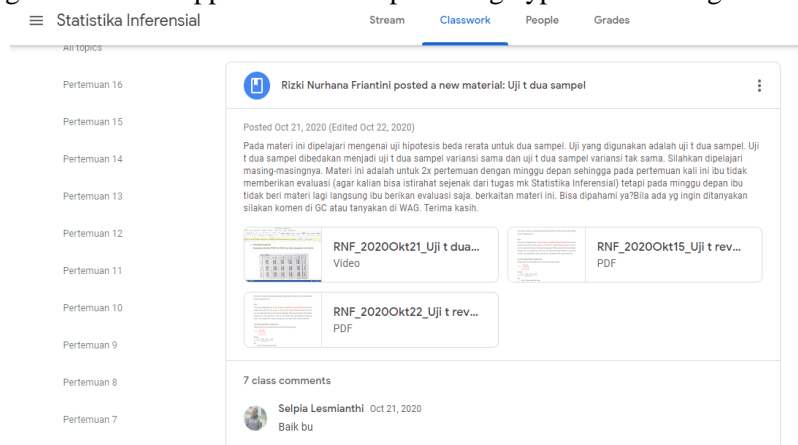
Figure 1. Screenshot of an example of learning with Google Classroom

Furthermore, from the results of the mathematical disposition questionnaire given to the third semester students of Mathematics Education department, the followings are the obtained results:

Table 1. Results of the mathematical disposition questionnaire

Mathematical Disposition Level	Score	Number of Students
High Mathematical Disposition	≥ 89	7
Low Mathematical Disposition	< 89	8

From each category, one student with complete answer is taken in order to provide maximum result.

The procedure used to solve the problem is a hypothesis testing procedure referring to Budiyono (2009) which consists of 1) formulating H0 and H1, 2) determining the level of significance, 3) selecting the test statistic to be used for hypothesis testing, 4) calculating the value of the test statistic based on observation data (observations) obtained from the sample, 5) determining the critical value and critical area based on the significance level that has been set, 6) determining the test decision, 7) drawing a conclusion based on the test decision obtained. The questions are given as follows.

Seorang peneliti ingin menunjukkan bahwa siswa perempuan dan laki-laki tidak sama kemampuannya pada pembelajaran matematika. Kemudian diambil 17 siswa perempuan dan 20 siswa laki-laki sebagai sampel dan diberi tes. Nilai dari siswa tersebut adalah:

Perempuan:

50 70 75 80 65 80 70 85 70 55 65 60 70 85 70 65 90

Laki-laki:

65 70 75 75 80 80 65 70 85 90 60 75 85 90 50 55 65 50 80 75

Jika diasumsikan bahwa sampel-sampel diambil dari populasi-populasi normal yang variansi-variansinya sama tetapi tidak diketahui, dan dengan $\alpha = 5\%$, bagaimana kesimpulan penelitian tersebut?

Figure 2. Hypothesis test questions are given to be done by the subject

The student's procedural fluency in terms of the level of mathematical disposition at solving problems regarding hypothesis testing is presented as follows.

High Mathematical Disposition

Job descriptions for subjects with the high mathematical disposition (HMD) when working on the questions are given as follows.

Implement procedures appropriately

The appropriate procedure application can be viewed from how far and how deep the students can understand the problem, then is linked the recognized information with the objectives to be achieved from the problem. When applying the proper procedure to test this hypothesis, it is related to the steps to formulate hypotheses and to determine the level of significance. For the first procedure, namely, formulating H0 and H1, the subject made a hypothesis using mathematical symbols is as follows.
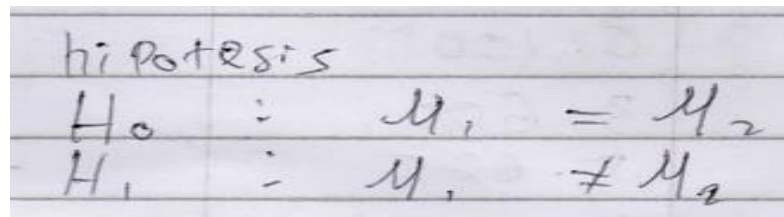

Figure 3. The HMD subjects formulate H0 and H1 from the questions

Subjects describe that the female sample is the first class while the male sample is the second class. For the null hypothesis (H0), the subject states that the mean of the first class is the same as the mean of the second class ($\mu_1 = \mu_2$) and for the alternative hypothesis (H1) the subject states that the first class means is not the same as the second class average ($\mu_1 \neq \mu_2$). The hypothesis formulated by the subject is correct. The questions being asked are to show that male and female students are not the same ability in learning Mathematics so that the hypothesis used is the type A hypothesis or called the formulation of the two-tailed hypothesis (Budiyono, 2009) as mentioned by the subject.

For the second step, namely, determining the level of significance, the subject points out and mentions that α = 5% is correct according to what was known from the

questions. The following is the level of significance that the subject wrote on the answer sheet.

Figure 4. The HMD subjects determine the level of significance

From the above discussion, it can be seen that the subject in testing the hypothesis can formulate H0 and H1 well and can determine the level of significance in accordance with the questions. Therefore, HMD subjects can apply the procedure appropriately.

Choose and utilize procedures

Choosing and utilizing procedures means that students can choose the appropriate procedures and can use them in problem solving. The activities of carrying out hypothesis testing, selecting and utilizing procedures are related to the third step, namely, selecting the statistics test to be used for hypothesis testing. When choosing the test statistic to be used to test the hypothesis, the high disposition subject points out and mentions the formula as follows.

Figure 5. The HMD subject chooses the test statistics to be used

The subject presents that the subject used the t-test statistic because the population is normal and homogeneous, and the population variance is the same and unknown. These requirements are in accordance with the conditions in the questions so that the test statistics used by this subject are correct and written completely. From the subject's answer, it can be seen that in the hypothesis test the subject can choose and can utilize the procedure appropriately because the subject chooses the test statistics used to test the hypothesis appropriately and accordingly in solving the questions.

Modify procedures

In modifying the procedure, it shows how students can solve problems using selected and appropriate procedures according to the objectives of the problem to be achieved. In hypothesis testing, modifying the procedure is in the fourth to the final step, from calculating the test statistic value to making conclusions.

The fourth step is calculating the value of the test statistic based on the observational data obtained from the sample. The subject performs calculations according to the formula used. In the initial step, the subject calculates the variance value in the first and second classes by firstly calculating the number of squares of each data in the first and second classes and calculating the square value of the sum of the data for each class.

Figure 6. The HMD subject calculates the number of squares
for each of the first and the second class data

The subjects calculate the first class variance (s_1^2) using the population variance formula and the first class variance is obtained for 116.360. Then it is continued to calculate the second class variance (s_2^2) and the result is 145.7894. The formula used to calculate the variance is correct, the numbers substituted in the formula also match to what is known in the problem.

Figure 7. The HMD subject calculates the variance of the first and the second classes

After the variance of each class is obtained, then the subject looks for the mean value of each class as a condition for finding the value of the combined variance (s_p^2).

Figure 8. The HMD subject writes the results of the variance calculation and the mean of the first and the second classes

After the requirements for calculating the combined variance have been obtained, then the subject calculates the combined variance value (s_p^2) as follows.

Figure 9. The HMD subject calculates the combined variance value (s_p^2).

In calculating the combined variance, the subject writes the formula correctly and substitutes the numbers in the formula correctly as well. But from the subject's work above, it can be seen that the subject makes an error calculation. The error is in the result of calculating (17-1) 116,360 = 1860.76 which should have returned to 1861.76. Actually, the mistakes made by the subject are very trivial, but these trivial errors make the calculation results inaccurate and show that the subject is not careful in calculation. When that is confirmed with the subject, the subject admits his mistake and realizes that he is not careful when writing the calculation results so that the error is occurred. For the final result, due to a small error made by the subject, the combined variance value obtained is 132.3074 which should have been 132.3360. The results of the calculation of this subject could still be considered correct because the difference with the correct answer is not too far.

After obtaining the combined variance value, it is followed by calculating the t value or performing the t-statistical test. The formula written by the subject is correct, the numbers substituted in the formula are also correct according to the results of the calculation of the subject. The following figure is the process of calculating the subject looking for the t value.

Figure 10. The HMD subject looks for the calculated t value

It can be seen from the results of the subject's work; in this step the subject also releases some mistakes. The error is in the calculation $\sqrt{0.0589 + 0.05} = 0.292$ while the correct result should have been 0.33. When it is confirmed to the subject and the subject is recalculated, it turns out that an error had been occurred. Because the results in

the calculation process are wrong, the final result of the calculation would also be wrong, the result of the t count for the subject is -0.02893 while the correct answer should have been -0.0256. The t value generated by the subject is wrong, but the subject's answer can be considered correct because the rounded values are the same.

Furthermore, the fifth step is to determine the critical value and critical area based on a predetermined level of significance. The following is the answer that the subject written for step five.
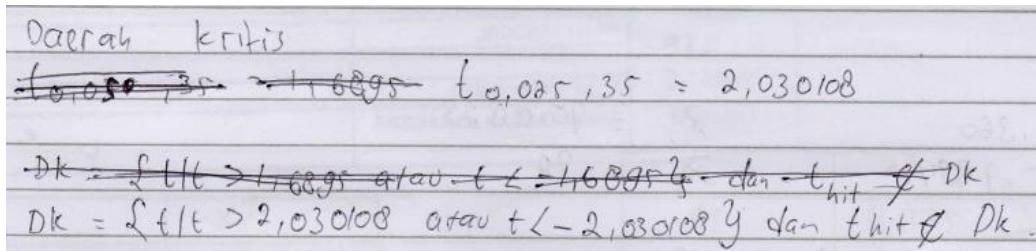

Figure 11. The HMD subject determines the critical values and areas based on the level of significance

It can be seen in the subject's answer that the subject has time to change the answer. The first answer to the t table value written by the subject is 1.6895 ($t_{0,05;35}$= 1.6895) then the subject changes the t table value to 2.030108 ($t_{0,025;35}$= 2.030108) and from DK = {t $|$ t > 1.6895 or t < -1.6895} to become DK = {t $|$ t > 2.030108 or t < -2.030108}. When it is confirmed to the subject about the change in this answer, the reason behind is that because the value α = 0.05 is in accordance with the question, then the t table with the α value is used, but after looking back at the hypothesis makes it turns out that the hypothesis used for the two-tailed test so that the t table fixed by taking α = $\frac{0.05}{2}$= 0.025 as well as the critical area. Substitution of answers made by the subject is correct, this also concludes that the subject understands the use of hypotheses and determines critical values and critical areas.

In this step, the subject should also compare between the calculated t value that has been obtained and the t table to be able to determine the test decision in the next step. The subject should write like this, for example, t count = -0.02893 > t table = -2.0301 and it does not meet the critical area (t count $\notin$ DK). But the subject immediately mentions that t count $\notin$ DK without explaining where it comes from. When confirmed, the subject says that the step is carried out in his mind only and is only written down his final conclusion. Even so, the subject realizes his mistake and thought that it is better to write down the steps coherently and systematically manner.

From the results in the fifth step, it can be used for the sixth step, namely, determining the test decision. In this step, the subject only writes the answers as follows.
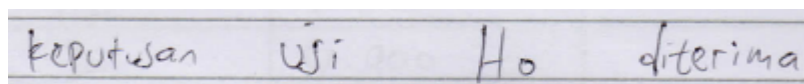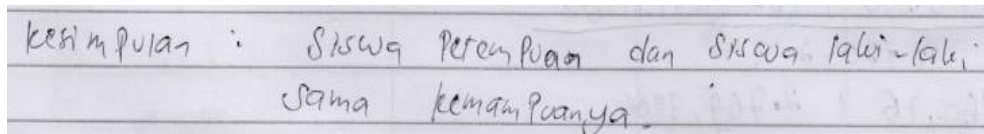

Figure 12. HMD subjects determine the test decision

When it is asked why the subject determines the test decision that H0 is accepted, the subject explained that because t arithmetic is not a member of the critical area so it accepts H0. The subject's answer is correct and the reason is appropriate.

For the final step, namely drawing a conclusion based on the test decisions obtained, the subject writes the answer as follows.

Figure 13. HMD subject writes conclusions based on test decisions

The reason the subject draws the conclusion as above is that the decision to test H0 is accepted, the correct hypothesis should have been H0: $\mu_1 = \mu_2$ so that female and male students have the same ability. The conclusion of the subject's answer is correct, but it is more appropriate if the conclusion sentences such as female students and male students have the same ability in learning Mathematics as same as stated in question sentence.

From the subject's answer, it can be seen that subject can modify the procedure properly. When the subject performs the hypothesis testing procedure, the subject could apply the test statistics and could produce statistical values even though there are still some error calculations made by the subject due to lack of accuracy. Subjects could determine the critical value and area based on the level of significance correctly. The subject could also determine the test decisions correctly and draws conclusions based on the test decisions obtained correctly.

From the description above, it is found that students with high dispositions have excellent procedural skills because they can apply procedures appropriately, can select and can utilize procedures accurately, as well as can modify procedures properly and flexibly. Besides, all the steps or hypothesis testing procedures are carried out coherently and systematically so that students can produce correct answers to the questions.
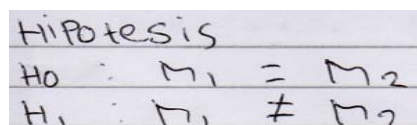
This result is in line with the research of Setyansah and Masfingatin (2017) who conclude that high-ability students have a good ability to recognize the right strategy or procedure and implement procedures accurately, efficiently, and flexibly. Mahmudi also concludes that someone who has a high mathematical disposition tends to have the ability to solve mathematical problems higher than those who have a low mathematical disposition so that it also affects learning outcomes (Herutomo and Masrianingsih, 2019). Some of these statements support the results that students with high dispositions have excellent procedural skills in conducting hypothesis testing to solve problems.

Low Mathematical Disposition

Job descriptions for subjects with low mathematical disposition (LMD) when working on the questions are given as follows.

Implement procedures appropriately

When looking at the steps to formulate the hypothesis and determine the level of significance when testing the hypothesis to determine how to apply the procedure appropriately, the following results are obtained. In the first step, namely formulating H0 and H1, the subject writes a hypothesis using mathematical symbols as follows.

Figure 14. The LMD subjects formulate H0 and H1

When the subject is asked about the hypothesis in this problem, the subject explains that the hypothesis for this problem is that the first class means is the same as the second class mean for the null hypothesis, while the other hypothesis is that the first class mean is not the same as the second class means. Furthermore, what being called is as the first class is a class for female students while the second class is a class for male students on the questions. From the subject's answer, it can be concluded that the subject understands how to formulate a hypothesis in a hypothesis test.

For the second step, namely determining the level of significance, the subject states that the value of α = 5%. When being asked where the significance level value is obtained, the subject explains that this value is already known from the questions. The subject understands the problem well and can determine the level of significance well. The following is the subject's written answers regarding the significance level value.
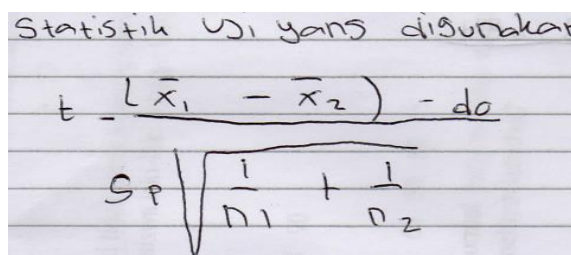

Figure 15. The LMD subject determines the level of significance

From the above discussion, it can be seen that the subject when testing the hypothesis can formulate H0 and H1 well and can determine the level of significance in accordance with the questions. Therefore, the DMR subject can also apply the procedure appropriately.

Choose and utilize procedures

For indicators of choosing and utilizing procedures, which means that students can choose appropriate and appropriate procedures and can use them in solving problems seen from the third step, namely selecting test statistics to be used for hypothesis testing. The third step is choosing the test statistic that will be used to test the hypothesis, along with the subject's answer.

Figure 16. The LMD subject chooses the test statistics to be used

Subject writes down the t-test formula for the same and unknown population variance. The t-test formula written by the subject is correct and appropriate to solve this problem, but the formula is not written completely by the subject because to find the combined variance value (s_p^2) it is necessary to write a description of the formula so that it could be found. When that is confirmed, the subject explains that he only writes the core of the t-test formula so that the formula for searching s_p^2 is not written, but in the calculation process, it is written to look for the s_p^2.

From the subject's answer, it can be seen that in the hypothesis test the subject can choose and can utilize the procedure appropriately because the subject chooses the test statistics used to test the hypothesis appropriately but the subject does not write it

down completely. Therefore, it can be concluded, the subject can choose and can take advantage of the procedure but it is incomplete in writing it.

Modify procedures

The indicator modifies the procedure in hypothesis testing, seen from the fourth to the final step, from calculating the test statistic value to draw conclusions. From this process, it can be seen that students solve problems using selected and appropriate procedures in accordance to the objectives of the problem to be achieved.

For the fourth step, calculating the value of the test statistic, the subject calculates using the t-test formula above, by first looking for the first (s_1^2) and second (s_2^2) class variance values. Here are the steps for the subject when looking for the first and second class variance.

Figure 17. The LMD subjects look for first (left) and second (right) class variance

When calculating variance, the subject does not write down the formula for variance first but goes straight to the calculation process. The numbers forming the formula are correct and the process of calculating the variance of the first class is also correct so that the first class variance $s_1^2 = 116,360$ is obtained. But in the process of calculation the class variance of the two subjects make a mistake. The subject's error is in the sum of the squared and squared values of the sum of values. Because this input value is wrong so that the calculation result for the variance of the second class is also wrong. The result of the class variance of the two subjects is $s_2^2 = -778,684$ while the correct result should have been $s_2^2 = 145,789$. That shows the inaccuracy of the subject when performing the calculation process. When that is confirmed, the subject only answers that he feels confused in counting because of the large numbers that caused the calculation error.

Figure 18. The LMD subject writes the results of calculating the variance and the mean of the first and the second classes

Before the subject continues to calculate the s_p, the subject writes the results of the first and the second variance calculations, as well as the results of the first and the second class averages. From the results written by the subject, it can be seen that the subject is wrong in calculating the variance of the second class as previously explained. With an error in the second class variance value, surely the subject produces the wrong value for s_p^2. The following is the process of calculating the s_p^2 subject of low mathematical disposition.

Figure 19. The LMD subject calculates the combined variance value (s_p^2)

From the process of calculating the variance of the combined subjects, the result is s_p^2 = -369.5210. This result is false and much different from the correct result, namely s_p^2 = 132,336. The next process continues to the calculation of the t value. The t value calculation performed by the subject is presented as follows.

Figure 20. The subject of LMD looks for the t value

In Figure 18, in addition to the wrong second class variance value, the subject is also wrong in producing the second class mean value. The subject produced a second class mean value of 76 ($\overline{x_2}$ = 76), the result is wrong where it should have been the second class averages of 72. Therefore, in calculating the t value, the second class mean value and the s_p value entered in the formula are wrong then the value of the resulting t becomes wrong. The result of the t counts in the calculation made by the subject is 0.1282 while the correct value of t was -0.0256. It can be concluded that the subject made many mistakes in calculations or in performing the t-test. When that is confirmed, the subject assumes that he does not really understand the correct t-test process so that when calculating the subject, that process confuses himself. The subject's lack of understanding of the t-test formula and calculations can also be seen from the subject's answer because in the calculation process the subject could not distinguish between the s_p^2 and s_p values.

The fifth step is determining the critical value and area based on the level of significance that has been set. The subject's answers in determining critical areas are presented as follows.

Figure 21. The LMD subject determines the critical value and area

From the subject's answer, it can be seen that the subject has not been able to determine the critical value and area based on the level of significance. The subject

knows that the significance level of this question is 5% but the subject could not transform this significance level into a critical value and a critical area for the test being carried out. This is recognized by the subject, the subject says that he does not fully understand how to find critical values and areas so he only writes any answers.

The next step is to determine the test decision. Because in the previous step the subject could not determine the critical value and critical area, so in this step, the subject could not be either able to determine the test decision. But in this step, the subject writes the answer as shown in the following figure.

Figure 22. The LMD subject determines the test decision

The subject writes that the test decision of this question is H0 not accepted. The test decision written by this subject is the wrong answer. When the subject is being asked why the subject writes a test decision that way, the subject admits that he actually does not know what the test decision should have been because he does not understand how to determine the test decision from this question so he writes the test decision arbitrarily just to complete the answer.

For the final step, namely writing a conclusion based on the test decisions obtained. The subject writes the answer as follows.
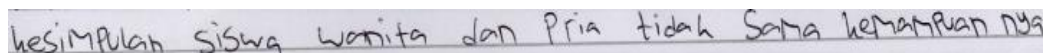

Figure 23. The LMD subjects write conclusions based on test decisions

When subject is confirmed about the conclusions having been made, the subject answers that because in the test decision he chose H0 is not accepted, at the conclusion he writes the statement from H1, namely female and male students are not the same inability. The subject could understand the relationship between the conclusion and the test decision, but because the test decision made by the subject is wrong, the conclusion written by the subject is also wrong.

From the subject's answer, it can be seen that the subject is less able to modify the procedure properly. When the subject performs the hypothesis testing procedure, the subject is unable to do the calculation correctly in applying the selected test statistics so that the results of the t test performed are wrong. Subjects cannot correctly determine the critical value and critical area based on the level of significance. The subject cannot determine the test decision correctly so that the subject cannot conclude correctly.

From the description above, it is found that students with low dispositions have poor procedural skills. Students can indeed implement procedures appropriately and can select and utilize procedures quite well, but cannot modify procedures appropriately and accurately. The hypothesis testing steps carried out are coherent and systematic but the results of the procedures carried out are wrong due to a lack of understanding of the material. Therefore, students with low disposition have poor procedural skills.

For the discussion, according to Haryandika, et. al. (2017) with sufficient procedural fluency, it can help to understand or solve mathematical problems. When solving a problem, it demands not only on the correct result but also creatively use skills in applying the correct steps or procedures to find the final result that is also correct. This ability is not possessed by students with low dispositions because they already know the hypothesis testing procedure but the skills in using procedures and calculating skills have

not been mastered correctly. This is possible because mathematical dispositions affect one's performance and the ability to motivate oneself to overcome learning difficulties (Herutomo and Masrianingsih, 2019) which is certainly not found in students with low dispositions.

CONCLUSION

Based on data analysis and discussion, it is concluded that students with high mathematical dispositions have excellent procedural skills because they can apply procedures appropriately, select and use procedures accurately, and modify procedures properly and flexibly when testing hypotheses. Meanwhile, students with low disposition have poor procedural skills because even though they have been able to apply the procedure appropriately and can choose and use the procedure quite well, they cannot modify the procedure appropriately and accurately so that the answer becomes wrong when testing the hypothesis.

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