



Students' Analytical Thinking Ability through the Strategy of Giving Feedback on Excretion System Learning

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ABSTRACT

Background: The ability to think analytically is one part of higher-order thinking skills, which students should own according to the reference in the curriculum. Giving feedback is one of the efforts to support students' analytical thinking skills. **Methods:** The research used is Quasi-Experimental, with a Posttest-Only Control Design. The sampling technique used was Cluster Random Sampling. The research instrument was used through a test describing six questions integrated into three indicators of analytical thinking ability (Differentiating, Attributing and Organizing). **Results:** The average value of post-test analytical thinking ability in the experimental class was 63.67, more significant than the control class, 56.63. Hypothesis testing through t-test at the 5% significance level obtained the value of $t_{count} = 2.13$ while $t_{table} = 2.00$, its mean that $t_{count} > t_{table}$ then H_0 is rejected. **Conclusions:** The conclusion that can be formulated is that giving feedback significantly affects students' analytical thinking skills on the excretory system material, with the highest achievement indicator of analytical thinking ability achieved by indicators attributing.

Kemampuan Berpikir Analisis Siswa melalui Strategi Pemberian Feedback Pembelajaran Sistem Ekskresi

ABSTRAK

Background: Kemampuan berpikir analisis merupakan salah satu bagian dari kemampuan berpikir tingkat tinggi yang idealnya dimiliki siswa berdasarkan acuan kurikulum. Pemberian feedback (umpan balik) menjadi salah satu upaya melatih kemampuan berpikir analisis siswa. **Metode:** Penelitian *Quasi Experimental* dengan desain *Posttest-Only Control Design*. Teknik pengambilan sampel menggunakan *Cluster Random Sampling*. Instrumen penelitian berupa tes berbentuk soal uraian yang terintegrasi ke dalam tiga indikator kemampuan berpikir analisis (*Differentiating, Attributing dan Organizing*). **Hasil:** Hasil penelitian menunjukkan bahwa nilai rata-rata kemampuan berpikir analisis kelas eksperimen sebesar 63,67 lebih besar dari kelas kontrol yakni 56,63. Uji hipotesis melalui uji t pada taraf signifikansi 5% diperoleh nilai $t_{hitung} = 2,13$ sedangkan $t_{tabel} = 2,00$, artinya $t_{hitung} > t_{tabel}$ maka H_0 ditolak. **Kesimpulan:** Simpulan yang dapat dirumuskan yakni pemberian feedback berpengaruh signifikan terhadap kemampuan berpikir analisis siswa pada materi sistem ekskresi, dengan pencapaian indikator kemampuan berpikir analisis tertinggi pada indikator attributing (menghubungkan).



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Introduction

The ability to think an analysis of students in the learning process in the 21st century, as stated in the purpose of high school biology learning in the Regulation of the Minister of National Education No. 22 of 2006, which regulates the Standard of Educational Content one of them regarding the development of analytical, inductive and deductive thinking skills to problem-solving efforts related

to an environmental phenomenon. Analytical thinking is an ability that students need (Marini, 2014). Students' habituation thinking analysis can facilitate a logical way of thinking in connecting a concept and the situation he faces (Purbaningrum, 2017). This contextual thing can familiarize students to analyze problems in the surrounding environment.

Indicators of analytical thinking skills include cognitive processes (distinguishing, organizing, and connecting)

(Anderson et al., 2001). The ability to determine (differentiating) involves sorting out relevant and important parts about a thing. Organizing identifies features or elements to become a structured and coherent entity. Attributing includes the operation of deconstruction to achieve a goal based on viewpoints, opinions, values and goals themselves.

Teachers' implementation of the 2013 curriculum improves students' analytical thinking in mastering complex materials and problem-solving (Suryanda et al., 2016). To realize this, teachers can apply analytical thinking skills as a prefix stage in high-level thinking (HOTS) before the evaluation and creation stage (Irawati & Mahmudah, 2018). Analytical thinking skills can distinguish various elements in finding (Nisa, Hayati; Disman; Dahlan, 2018). The PISA assessment competition (Program for International Student Assessment) showed that Indonesia was ranked 36 out of 49 globally. This fact indicates that students' analytical thinking skills in Indonesian are still shallow in solving problems (Annisa, 2016).

According to (Hamid et al., 2013), through feedback, students can evaluate and find out the mistakes that occur when solving problems to improve the ability to analyze material concepts. Astuti et al., (2019) direct feedback are one of the teachers' strategies in training the ability to analyze to solve complex problems. Teachers need to pay attention to feedback guidelines for achieving learning goals in providing feedback. Feedback is done based on an agreement between teachers and students; the appropriateness of providing feedback simultaneously on time; Feedback should provide subjective data on. (Wungouw & Doda, 2012).

The results of interviews with teachers at the school showed that the feedback that had been given to student assignments was only limited to grades so that students did not know the advantages and disadvantages of their work. Thus, further research focused on providing feedback on student work results in the form of values added with a record of advantages and disadvantages is expected to positively impact developing the thinking skills of the learning analysis of excretory systems.

Methods

The study uses a quantitative quasi-experimental approach with post-test only control group design (Sugiyono, 2015). The population involves class XI IPA (144 students). The cluster random sampling technique selected experimental class (XI IPA 4) and control class (XI IPA 1).

Applying feedback strategies in the form of values and notes about the advantages and disadvantages in the Student Worksheet (LKS) becomes a differentiator with control classes that are only given valuable feedback. The discovery learning model is applied to both categories.

The data collection technique used is a test in describing analytical thinking skills in the excretion system material. Problems are developed based on indicators of analytical thinking skills, namely: differentiating, organizing (organizing), and linking (attributing). Before use, a quality analysis of the problem is carried out with validity, reliability, difficulty level, and differentiating power tests. Data collection is done after the sample is given feedback on the results of LKS. The normality test used is Chi-Squared. The formula used is as follows (Sugiyono, 2015):

$$\chi^2 = \sum \frac{(f_o - f_h)^2}{f_h}$$

The acquisition of the experimental class normality test amounted to χ^2_{hitung} (4.2) < χ^2_{tabel} (4.55), meaning customarily distributed data. After the normality test, it continued with the homogeneity test of variance with the Fisher test with the following formula The acquisition of the experimental class normality test amounted to χ^2_{hitung} (4,2) < χ^2_{tabel} (4.55), meaning customarily distributed data. After the normality test, it continues with the homogeneity test of variance with the Fisher test with the following formula (Sugiyono, 2015):

$$F = \frac{Vb}{Vk}$$

The acquisition of the homogeneity test shows the value of f_{count} (1.45) < f_{table} (2.38), meaning homogeneous data. The results of the normality and homogeneity test are met, so the next step is hypothesis testing (t-test) using the formula pooled variance according to (Sugiyono 2015):

$$t = \frac{X1 - X2}{\sqrt{\frac{(n1 - 1)S1^2 + (n2 - 1)S2^2}{n1 + n2 - 2} \left(\frac{1}{n1} + \frac{1}{n2} \right)}}$$

Result

The study results are the ability to think of students' analysis in experimental and control classes and the power of each indicator to think of student analysis on the material of the excretion system. The results of the t (Table 1) test showed that t count (2,13) > (2.00), meaning that the provision of feedback had a significant effect on the thinking skills of student analysis in the excretory system. The average grade of the student's analytical thinking skills in the experimental class (63.67) was considered good, while the control class (56.63) belonged to the excellent category. Giving feedback to practical classes helps students find solutions based on information from a reading associated with excretory system abnormalities. While the ability to think an analysis of students in the control class only to identify the cause of abnormalities in the excretory organs based on the source of reading.

Table 1. Test results t in experimental and control classes

Research	t-Test Result
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Sample	Average	SD	t _{count}	t _{table}
Control	63,67	14,27	2,13	2,00
Experiment	56,63	11,84		

The average percentage of thinking percentages of students analyzing each indicator of differentiating, organizing (organizing), and attributing (linking) in the experimental class showed differences in ability after being given feedback about the hand (Figure 1).

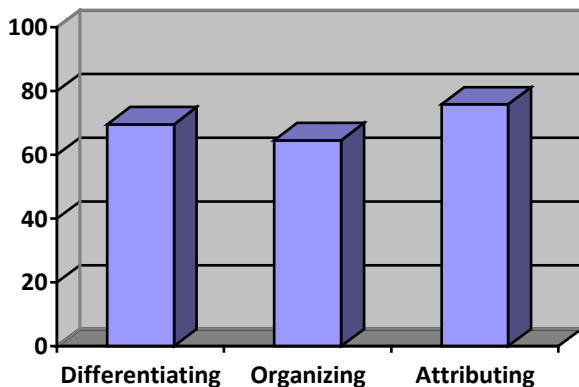


Figure 1. The ability to think the analysis of each indicator

The average percentage of analytical thinking skills of each hand is differentiating (69.58), organizing (64.58) and attributing (75.83), all three of which are well categorized. Attributing ability is the highest analytical thinking ability achieved by students.

Discussion

The t-test results (Table 1) show that giving feedback in grades and notes on LKS results significantly influences students' analytical thinking skills. The average rate of experimental analysis skills is higher (good criteria) than the control class (sufficient), as seen in Table 1. This shows that practical classroom students pay attention to the feedback provided by teachers so that students know the advantages and disadvantages of the concept of excretion systems. As in the research Astuti et al., (2019), they were giving feedback can improve the thinking skills of students analysis. Inline to provide feedback to direct students to achieve maximum results while evaluating the extent to which students master the material delivered (Windarsih, 2016).

The improvement in the results of the thinking skills of student analysis in the experimental class is seen in the development of answers of students who were initially less good at determining the variables in the table. Students are directed to how to make diagrams and tables well to convert the contents of the table into charts following the direction given by the teacher. With this, giving feedback can form the student's analytical thinking skills (Marini, 2014). While the answer of students in the control class there is an error in determining variables so that the

diagram results do not fit the criteria. This can be due to students' unfamiliarity with the problem that hones analytical thinking skills (HOTS) (Sartono et al., 2017). Setiawati (2018) stated that students' analytical thinking skills improved after learning habituation and asking questions for analytical thinking.

The experimental class's analytical thinking ability test results resulted in achieving the highest indicators in sequence, namely: attributing, differentiating and organizing aspects. In linking hands, students can associate bilirubin contribution in "jaundice" with the excretion process in the liver. This process starts from the destruction of red blood cells, the buildup of bilirubin substances in the blood, inflammation of the pancreatic ducts, and the fourth stage, resulting from stored blood flow. This is a significant achievement with habituation in analytical thinking through consistent feedback on student LKS. Teacher guidance is undoubtedly the ability to think the analysis is more well-honed (Hasyim, 2018). Attributing indicators as the most complicated indicators students achieve without habituation hones analytical thinking skills (Winarti, 2015).

In the organizing aspect, the results of experimental class answers that follow the instructions directed by the teacher on the previous LKS results related to the process of excretion income in each excretory organ. Teachers provide feedback through notes on previous LKS results so that on the test of analytical thinking skills, the results of students' answers begin to be directed from the original only at the stage of discovery of relevant information (Wasiran, 2017). The organizing indicator became the lowest indicator in the experimental class (Figure 1). Following the interview results (Nilah & Roza, 2020) mentions that in organizing indicators, students find it challenging to detect and process information in a structured manner. The final result is not following the request for the problem. The interview aims to identify students' ideas and steps in dealing with issues and solving student analysis (Ilma et al., 2017).

While in the differentiating aspect, the provision of feedback has no qualified effect due to the percentage of achievement in the experimental class in the excellent category. In line with learning outcomes, the most accessible level of indicators of analytical thinking skills is differentiating then organizing, and the hardest is attributing (Rasagama et al., 2013). Based on the answers, students showed that most experiments could distinguish essential and relevant parts of interpreting information on tables and figures to distinguish well metabolic processes in ordinary people with diabetics. As in the study, Astriani et al. (2017) found that differentiating indicators as indicators is easier to achieve than aspects of organizing and attributing.

Overall, the development of analytical thinking skills in experimental classroom students is based on how feedback

is provided. The provision of positive feedback can improve student morale, as evidenced by the enthusiasm of "experimental classroom students" in waiting for LKS results and asking further questions related to the intent of the feedback provided just as constructive and positive forms of comment in writing on student worksheets can guide students in honing their analytical thinking skills (Zulva, 2016). On the other hand, informing the location of errors and directing the correct concepts on the test sheet can make students feel appreciated for their hard work to explore knowledge and improve it (Astuti et al., 2019). Students who pay attention to teacher feedback can use the input to correct and not repeat errors in the subsequent worksheet work.

Conclusion

The conclusion that can be formulated in this study is that the strategy of providing feedback on the learning of excretion systems has a significant influence on the increasing thinking skills of students' analysis. Once trained, attributing is an indicator of students' highest analytical thinking skills

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Declaration statement

The authors reported no potential conflict of interest.

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