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Use of Peer Assessment and Self-Assessment in Class Discussions to Assess Concept Understanding Ability of Prospective Biology Educators

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ABSTRACT

The ability of understanding important concepts held by educators and learners. This ability is fundamental in achieving one of the outcomes of learning. Their understanding of the concept of ownership is the ability of a person can use in solving a problem that is related to the concept in everyday life. This descriptive study aims to obtain a description of the conceptual understanding of prospective biology educator students through the use of peer and self-assessment in class discussions. The research subjects were 26 prospective Biology educator students of the 2019/2020 academic year who contracted the human body anatomy physiology course. The instruments used consisted of peer and self assessment sheets, lecturer observation sheets and conceptual understanding questions. Data analysis was carried out quantitatively and qualitatively. The results showed that the average peer assessment score was greater than the self assessment, where the peer assessment was in the moderate category (49%) and the self assessmet was in the poor category (34%). There were only 10 students (38.46%) who were in conformity between peer and self assessment with adequate and insufficient categories. The discrepancy was found in 16 students (61.54%) with the category enough, less and very less. The ability to understand the concept of students on each indicator shows different percentage mean. The highest percentage of concept understanding ability indicators is found in the indicators of explaining the concept with its own sentence structure about something that is read or heard clearly / concretely by 64% (Good), while the lowest percentage of indicators of concept comprehension ability is found in the indicators able to connect symbolic forms (pictures, tables, concept maps, diagrams, graphs, mathematical equations, and other formulas) in concepts with other concepts of 51% (Enough).

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INTRODUCTION

The learning process is an activity that can be used by educators to transfer and construct the knowledge of their students. Lecturers as educators should not serve as the only main source of knowledge in learning activities. However, their presence in these activities is still essential. Students have varied academic abilities from one another. The existence of this academic ability will be one of the important factors that can affect students' understanding of concepts. Concept is a link between related facts (Adhani & Rupa, 2020). Furthermore, (Arends, 2015) explained that concepts form the foundation for the network of ideas that guide one's thinking.

The ability to understand concepts is very important for students to have. Hamdani *et al.* (2012) found that the importance of understanding concepts for students who have experienced the learning process. Understanding this concept has a good basic stock to achieve other basic skills such as reasoning, communication, connection and problem solving. Besides, Tendrita (2017) argues that the understanding of concepts possessed by students can be used to solve a problem that has to do with problems in everyday life.

Benjamin Bloom classifies learning outcomes into three categories, one of which is the cognitive domain, which is the ability to restate concepts or principles that have been learned and intellectual abilities. This cognitive domain consists of six levels, namely remember, understand, apply, analyze, evaluate and create (Anderson *et al.*, 2001). If students cannot understand or in the sense of understanding the concept is lacking, they will find it difficult to move up to continue to the next stage. The main premise in Bloom's taxonomy is that each category must be mastered by students completely before moving on to the next category (Suyono and Hariyanto, 2012).

Based on the results of observations in the field, it was found that students' understanding of concepts was only captured using an assessment that was only a test, namely by using questions. In addition, learning is also more student-centered, causing them to learn to be "teacher center" and not actively involved in building knowledge, attitudes and learning behavior. In fact, Purwanto (2008) suggests that the learning outcome test is an evaluation tool that has been commonly used to assess the results of lessons that have been given by teachers to their students. Meanwhile, in the student-centred learning process, students can get opportunities and facilities to build their own knowledge so that they will gain a deep understanding, and in the end can improve the quality of student quality. Meanwhile, the learning method that can develop such activities is in a class discussion.

Class discussion is a learning method that confronts students with a problem (Afiefah, 2014). This method is commonly called group discussion. The discussion method generates student engagement because it asks to interpret the lesson. Therefore, it can be interpreted that the knowledge that they have comes from their own minds. Students and educators do not just ask questions. Instead, the whole class tries to reach an understanding in a subject area, find a solution to a problem, explain an idea or determine what action to take.

In class discussions, students often respond to each other's answers or comment on answers submitted by other students. Likewise, they sometimes invite other group members to speak their minds. When exchanging opinions, students can show their ability to understand concepts.

Zulharman (Juhanda, 2017) states that the change in the educational paradigm from teacher-centred to student-centred does not only have an impact on learning methods and activities, but also on how to assess learning outcomes. Meanwhile, Firman (2000) suggests that in terms of education, experience, interaction with students in the classroom, the lecturer occupies an important position to assess the effectiveness of the teaching program they manage. The existence of reforms in the field of education makes lecturers have to evaluate and rearrange the way they carry out the educational process. The shift in the focus of learning from teacher to student (learner-centered) and lifelong learning is a change in the nature of today's learning goals. Peer assessment and self-assessment respond to this change very well.

Self-assessment is an assessment made by students themselves on their work, while peer assessment is an assessment made by students on their friends or colleagues. (Alias *et al.,* 2015). With these two assessments in class discussion activities, students are expected to have the ability to assess and evaluate themselves, which is usually done by lecturers, so of course the focus is no longer on the lecturer, but on the students themselves.

Peer assessment and self-assessment are ways of assessing student-centered learning outcomes. This assessment method can be applied to assess students' cognitive abilities and non-cognitive abilities in terms of the abilities to be tested and as a formative and summative assessment tool when viewed from the purpose of the assessment. According to Hairida (2018), The advantages of self-assessment and peer-assessment in the classroom include being able to grow students' self-confidence, because they are given the trust to evaluate and assess themselves and their colleagues. Self-assessment and peer assessment can encourage, familiarize, and train students to be honest, because they are required to be objective in conducting assessments. The purpose of this study is to describe the ability to understand concepts of prospective biology educators through the use of peer and self-assessment in class discussions.

METHOD

This research uses a descriptive method. The subjects used in this study were 26 students of Biology education in the 6th semester of the 2019/2020 academic year who took the human body anatomy and physiology course. Subject selection was carried out using purposive sampling technique. This research was conducted for 4 months, from March until July 2019.

To assess the ability to understand this concept, in addition to using peer and self-assessment, observation sheets are also used by lecturers in charge of the course (teacher assessment) and giving questions at the beginning of the lecture (Pre-test) and at the end of the lecture (Post-test). The peer assessment sheet is used by students to assess the presentation activities made by their friends. The self-assessment sheet is used by students who have carried out presentation. The purpose of this self-assessment sheet is to validate the findings against the results of the assessment conducted by their friends through peer assessment. The data processing of the peer assessment and self-assessment sheet data uses the Purwanto (2009) formula as follows.

$$NP = R/SM \times 100\%$$

Notes:
NP: Expected percentage value
R: Score obtained
SM: Ideal maximum score of the test

The next stage is categorization based on the Arikunto (2010) formula as follows.

Table 1. Category Percentage of Peer Assessment and Self Assessment

Persentage	Predicate
81 – 100 %	Very Good
61 – 80 %	Good
41 – 60 %	Adequate
21 – 40 %	Poor
≤ 21 %	Very Poor

The self-assessment data obtained is then used to validate the findings of student scores in the peer assessment. The percentage value for each indicator of a student's oral communication ability is the average result of the percentage value contained in the peer assessment and self-assessment. In addition, the processing of the results obtained from the pre-test and post-test were analyzed by comparing the scores of the initial and final tests. The improvement of students' concept mastery is identified through N-Gain analysis (Meltzer, 2002) as follows:

$$N-Gain = \left(\frac{N_B - N_A}{N_{MAX} - N_A} \right)$$

Notes:
N_B: student post-test scores
N_A: student pre-test scores
N_{Max}: student ideal scores

The normalized gain criteria (N-Gain) are shown in Table 2 below.

Table 2. Normalized Gain Criteria

N-Gain	Criteria
0 – 0.30	Low
0.31– 0.69	Medium
0.70-1.00	High

RESULTS AND DISCUSSION

In this study, the ability to understand the concepts of prospective biology educator students is facilitated by using the class discussion method through presentations. The ability to understand this concept is measured using six indicators of concept understanding based on Revised Bloom (Anderson *et al.*, 2001). The results of the percentage percentage and conformity of the measured peer and self-assessment can be seen as follows.

Table 3. Conformity of Peer Assessment and Self-Assessment of Students' Concept Understanding Ability

No. Student	Concept	*Peer Assessment* Concept Understanding		*Self Assessment* Concept Understanding		Desc.
		Persentage	Category	Persentage	Category	
1	Respiratory system	64	Good	28	Poor	Incompatible
2		50	Adequate	67	Good	Incompatible
3		52	Adequate	28	Poor	Incompatible
4		74	Good	22	Poor	Incompatible
5	Nervous System	40	Poor	39	Poor	Compatible
6		43	Adequate	50	Adequate	Compatible
7		36	Poor	50	Adequate	Incompatible
8		45	Adequate	50	Adequate	Compatible
9		45	Adequate	39	Poor	Incompatible
10	Digestive System	51	Adequate	28	Poor	Incompatible
11		53	Adequate	28	Poor	Incompatible
12		50	Adequate	39	Poor	Incompatible
13		51	Adequate	33	Adequate	Compatible
14		42	Adequate	44	Adequate	Compatible
15	Urinary System	51	Adequate	39	Poor	Incompatible
16		44	Adequate	28	Poor	Incompatible
17		48	Adequate	17	Very Poor	Incompatible
18		44	Adequate	28	Poor	Incompatible
19		41	Adequate	33	Adequate	Compatible
20		39	Adequate	17	Very Poor	Incompatible
21	Endocrine System	49	Adequate	33	Adequate	Compatible
22		54	Adequate	22	Poor	Incompatible
23		48	Adequate	22	Poor	Incompatible
24		49	Adequate	33	Adequate	Compatible
25		60	Adequate	33	Adequate	Compatible
26		47	Adequate	33	Adequate	Compatible
Mean		49	Adequate	34	Poor	Incompatible

Table 3 shows that the results of peer and self-assessment are related to students' ability to understand concepts, which shows that the average value of peer assessment is greater than self-assessment. The difference in the average value affects the category obtained, where the peer assessment is in the adequate category and the self assessment is in the poor category. Furthermore, it was also found that the compatibility between peer and self-assessment was only found in 10 students (38.46%) in adequate and poor categories. Meanwhile, incompatibilities were found in 16 students (61.54%) in adequate, poor and very poor categories (Figure 1).

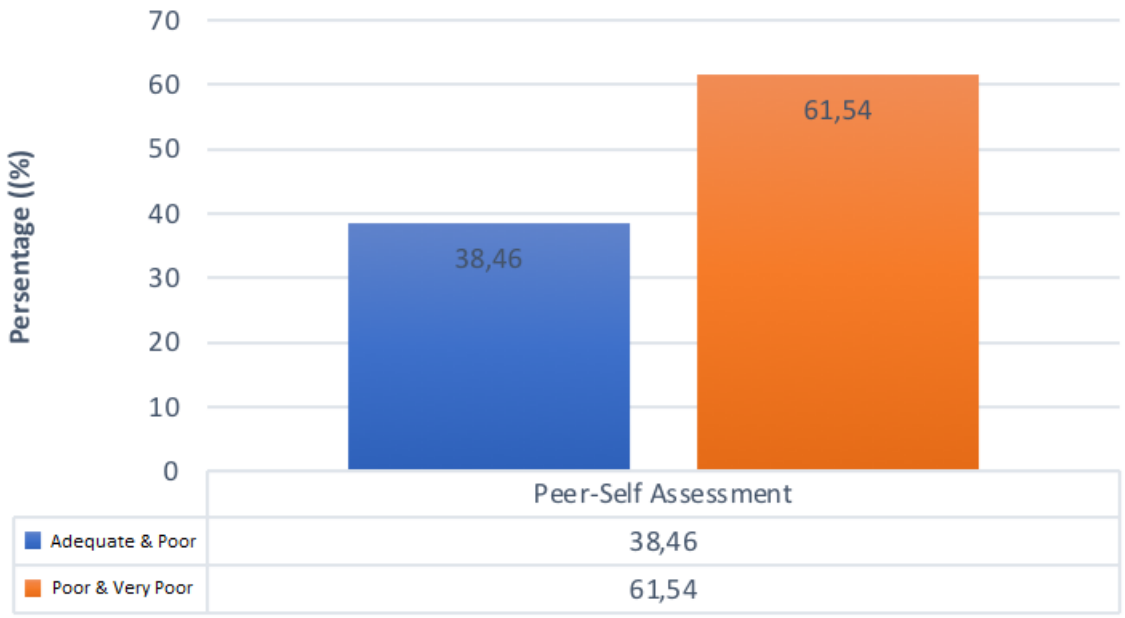

Figure 1. Incompatibility of Peer-Self Assessment in Concept Understanding

The achievement of each indicator of the concept understanding ability by prospective teachers is the average result of the percentage value of the peer and self-assessment. The average achievement contains six indicators of concept understanding as shown in Figure 2.

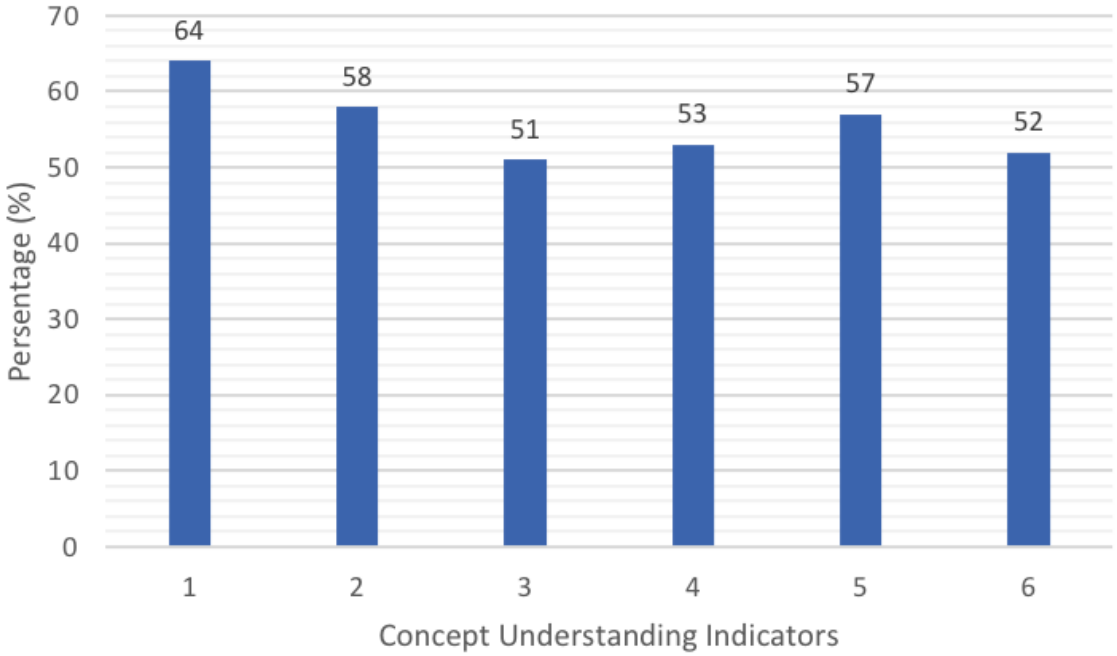

Figure 2. Average Percentage of Student Concept Understanding Indicators Based on Peer-Self Assessment

Description : (1) Explain the concept with its own sentence structure about something that is read or heard clearly/concretely, (2) Able to explain symbolic forms (pictures, tables, concept maps, diagrams, graphs, mathematical equations, and other formulas) in concepts verbally, (3) able to connect symbolic forms (pictures, tables, concept maps, diagrams, graphs, mathematical equations, and other formulas) in concepts with other concepts, (4) Able to unite previous concepts with the concept being studied, (5) Can express predictions related to the data contained in the concept, (6) Give other examples of those that have been exemplified in the concepts being studied.

Figure 2 shows that the students' ability to understand concepts on each indicator shows a different average percentage. The 1st indicator is the indicator that gets the highest average percentage, which is 64% (Good). Meanwhile, the lowest indicator is the 3rd indicator, which is 51% (Adequate).

The assessment of the observation sheet (teacher assessment) and pre-test / post-test aims to validate the findings obtained from peer assessments and self-assessments that have been carried out during lectures. The results of the assessment of the observation sheet (teacher assessment) on the ability to understand the concept of prospective biology teachers are as follows.

Based on Figure 3, the highest teacher assessment sheet is found only in the 1st indicator, namely 69% (Good). The lowest indicator is the 4th indicator with a value of 11% (Very Poor). Meanwhile, the 2nd indicator is 60% (Adequate), the 5th and 6th indicators are 25% (Poor), and the 3rd indicator is 13% (Very Poor). If you look at the findings of the ability to understand concepts in peer and self-assessment (Figure 2), the result is very different from the findings. The similarity of the assessment between the results of the average percentage of the peer-self assessment and the observation sheet (teacher assessment) was only found in the indicators of the ability to understand concepts 1 and 2, which were both in the good and adequate categories. While the 3rd, 4th, 5th, and 6th indicators show differences, where the peer-self assessment is in the sufficient category, and the observation sheet (teacher assessment) is in the poor category (indicators 5 and 6), or even very poor category (Indicators 3 and 4). This finding is also supported by the validation of the data obtained through pre-test and post-test to assess students' conceptual understanding. The existence of the pre-test and post-test aims to obtain the value of N-Gain. Based on the calculations, the N-Gain values obtained by students related to understanding concepts in five different concepts can be seen in Table 4 below.

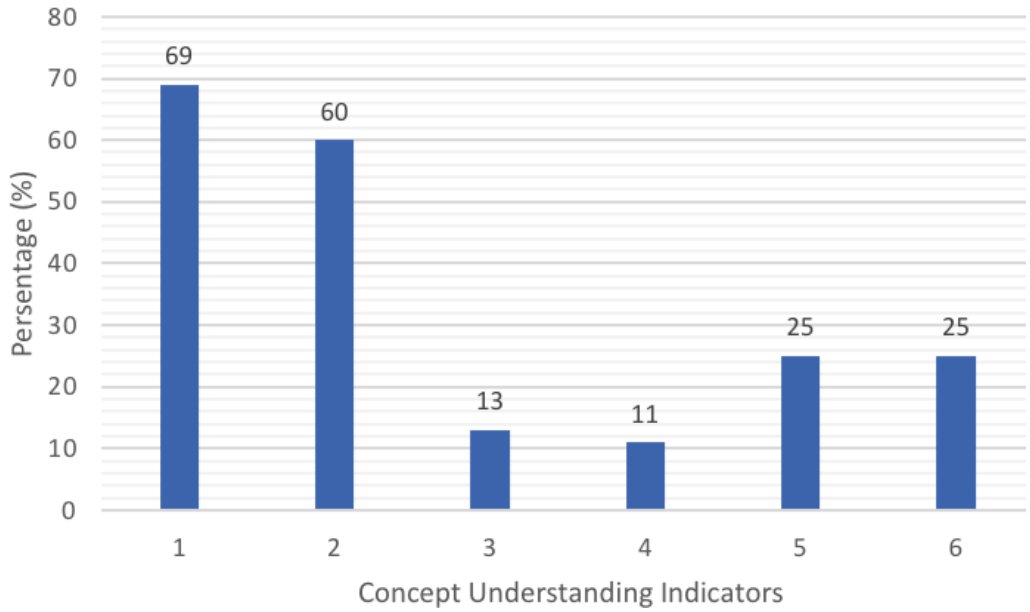

Figure 3. Percentage of Student Concept Understanding Ability Indicators Based on the Assessment of the Observation Sheet (teacher assessment)

Description : (1) Explain the concept with its own sentence structure about something that is read or heard clearly/concretely, (2) Able to explain symbolic forms (pictures, tables, concept maps, diagrams, graphs, mathematical equations, and other formulas) in concepts verbally, (3) able to connect symbolic forms (pictures, tables, concept maps, diagrams, graphs, mathematical equations, and other formulas) in concepts with other concepts, (4) Able to unite previous concepts with the concept being studied, (5) Can express predictions related to the data contained in the concept, (6) Give other examples of those that have been exemplified in the concepts being studied.

Table 4. N-Gain Value of Student Concept Understanding Ability

No	Concept	Pre-test	Post-test	Max. Score	*Gain*	*N-Gain*	Desc.
1	Respiratory system	40	43	100	3	0.05	Low
2		60	61	100	1	0.03	Low
3		40	47	100	7	0.12	Low
4		53	55	100	2	0.04	Low
5		47	50	100	3	0.06	Low
6	Nervous System	20	40	100	20	0.25	Low
7		40	53	100	13	0.22	Low
8		27	40	100	13	0.18	Low
9		47	53	100	6	0.11	Low
10	Digestive System	40	58	100	18	0.30	Medium
11		40	43	100	3	0.05	Low
12		33	47	100	14	0.21	Low
13		33	58	100	25	0.37	Medium
14		33	60	100	27	0.40	Medium
15	Urinary System	53	55	100	2	0.04	Low
16		60	62	100	2	0.05	Low
17		40	45	100	5	0.08	Low
18		67	68	100	1	0.03	Low
19		33	38	100	5	0.07	Low
20		53	58	100	5	0.11	Low
21	Endocrine System	53	55	100	2	0.04	Low
22		40	45	100	5	0.08	Low
23		40	47	100	7	0.12	Low
24		27	40	100	13	0.18	Low
25		53	55	100	2	0.04	Low
26		47	48	100	1	0.02	Low
	Mean	**43**	**51**	**100**	**8**	**0.13**	**Low**

In Table 4, it is known that in general the average N-Gain value for students' conceptual understanding abilities is in the low category. Only a small percentage (11.54%) of students received the medium category, namely 3 people. The existence of this N-Gain value validates the findings contained in the results of the self-assessment, which is in the Poor category with an average percentage value of 34%.

DISCUSSION

In general, the results of the average percentage of student teacher concept understanding abilities show that peer assessment and self-assessment are different, where the average value of peer assessment is in the Adequate category and self-assessment, which is in the Poor category. This finding indicates that student teacher candidates are still doubtful about the ability of their colleagues to make assessments. In addition, they may not be used to using peer assessment and self-assessment. Siswaningsih *et al*. (2013) argues that there are several obstacles in the implementation of self-assessment, for example the problem of the level of honesty of students who are still lacking, and students who feel less confident in assessing their work. Likewise with the peer assessment, Hairida (2018) stated that the peer assessment carried out was still influenced by the attitude towards his friends so far. If his friend is considered good, the value given to his friend becomes high. On the other hand, if his friend is considered less good towards him, the value given will also be low. Therefore, in applying these two assessments, educators need to provide direction on self-assessment and peer assessment before the assessment process in learning is carried out. This aims to reduce the value of bias from the results of the assessment carried out by students.

In fact, peer assessment and self-assessment are part of the assessment for learning that is carried out during learning and serves to improve students' cognitive learning outcomes (Black *et al*, 2004). Furthermore, Karimah *et al.* (2020) revealed that students' cognitive learning would be included in the very good and complete category after learning using assessment for

learning. The findings above also indicate that this assessment must continue to be carried out in learning. Shofiyah & Wasis (2013) stated that peer assessment and self-assessment should be used in continuous learning. This habituation aims so that students are trained in conducting assessments and minimize students' dishonesty in assessing.

In the achievement of each indicator of the ability to understand concepts possessed by prospective teachers through peer assessment and self-assessment, different results are obtained from the achievements on the observation sheet conducted by lecturers (teacher assessment). Teacher assessment in this study is used as a comparison between self-assessment and peer-assessment which is used to check students' honesty in making assessments. There is a match between the results of teacher assessment and self-assessment on the 1st indicator (Explaining the concept with its own sentence structure about something that is read or heard clearly/concretely) and the 2nd indicator (Able to explain symbolic forms such as pictures, tables, concept maps, diagrams), graphs, mathematical equations, and other

sheet it is in the Poor category (indicators 5 and 6), even Very Poor (Indicators 3 and 4). This may happen because the student teacher candidates do not yet have the ability to translate, interpret, and extrapolate which still requires improvement. According to Subiyanto (1988), translational understanding is the ability to understand an idea expressed in another way from a previously known origin statement, interpretational understanding is the ability to understand materials or ideas that are recorded, modified, or arranged in other forms, and Extrapolated understanding is the ability to to predict trends that exist according to certain data by expressing consequences and implications that are in line with the conditions described.

The results also show a positive correlation between the average N-Gain obtained by students through pre-test and post-test, which is low, with self-assessment in understanding concepts that are categorized as poor, which indicates that students have not fully understood the concepts presented in class discussions. One of the factors that make it possible for formulas in verbal concepts) which are both in the good category and enough to show that students have been effective in making assessments and have the same understanding of the concepts contained in these indicators. The effectiveness of these findings indicates that the benefits of peer assessment and self-assessment are embedded in students, as are honesty and collaborative learning from peers. In line with Wijayanti (2017) said that self-assessment can build honest character in students and peer assessment can increase learning collaboration through feedback from peers to understand a material.

In addition, the inequality contained in the 3rd indicator (Able to connect symbolic forms (pictures, tables, concept maps, diagrams, graphs, mathematical equations, and other formulas in concepts with other concepts), 4th indicator (Able to integrate previous concepts with the concept being studied), the 5th indicator (Can express predictions related to the data contained in the concept), and the 6th indicator (Giving other examples from those that have been exemplified in the concepts being studied) peer-self assessment is in the higher category, namely adequate, while on the observation educators to forget to provide reinforcement and feedback related to concepts for students. As stated by Yanti (2019), that reinforcement and feedback on students' understanding of the subject matter provided will result in students' tendency to make the same mistakes, repetitive and incorrigible. Therefore, the role of the lecturer is still very important in this case in order to optimize the concept construction that will be obtained by students.

CONCLUSION

The ability to understand the concepts of prospective biology educator students can be revealed, both through peer assessment and self-assessment. It's just that the achievement of the N-Gain value obtained is still in the low category. There is a match between the average N-Gain and the average self-assessment in the achievement of concept understanding, which is classified as low and poor. Therefore, reinforcement and feedback on students' understanding of the concepts being studied is needed to improve student concept construction.

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