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ANALYSIS OF STUDENTS' THINKING SKILLS IN BIOLOGY LEARNING: STUDY AT A SCHOOL IN PADANG, INDONESIA

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ABSTRACT

There are several skills used to face the challenges of 21st century development which are abbreviated as 4C, namely critical thinking, collaboration, creativity and communication skills. The concept of 21st century learning, in its development, provides global challenges to the current generation that is developing and this needs to be considered. However, those 21st century skills have not been fully implemented in the learning process, especially in the senior high schools in Padang. The purpose of this study was to determine the 21st Century Skills of Class XII MIPA Students in Biology Learning at Adabiah Padang Private High School. This type of research is descriptive research. The population was all class XII MIPA students at Adabiah Padang Private High School totaling 162 students. The sample taken was 40 students using random sampling technique. The instrument used in collecting data in this study was a test in the form of multiple-choice objectives totaling 17 questions to assess critical thinking skills and observation sheets for creativity, collaboration and communication. The questions used in this study were questions that had been tested for validity and reliability. The results showed that the value of 21st century skills of class XII MIPA students at Adabiah Padang Private High School was 69.57 with high criteria. In detail, students' 21st century skills in critical thinking skills, creativity, collaboration and communication were respectively 73.21; 65.10; 69.64 and 70.31 with high criteria. Therefore, it can be concluded that students' 21st Century skills in biology learning at Adabiah Padang Private High School with high criteria.

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Introduction

The 21st century learning explains a real picture of how to condition a situation as a form of a learning process that can be said to be ideal. It can be said that the ideal in question is to provide a meaning that the learning process carried out at this time is a representation of the valuable experience of the students themselves where when they will face reality in the future. The concept of 21st century learning, in its development, provides global challenges to the current generation that is developing and this needs to be considered. One of them is what kind of learning needs will be needed by the current generation for life in the future (Fajri, 2017). There are several skills used to face the challenges of 21st century development which are abbreviated as 4C, namely critical thinking, collaboration, creativity and communication (Mahanal, 2009).

Based on interviews conducted by the author with class XI biology teachers at Adabiah Padang Private High School in February 2023, where in the learning process the teacher has directed students in 21st century skills in 4C, namely critical thinking skills, creativity, collaboration and communication, where in the learning process the teacher has used lecture and discussion methods. However, in the learning process the teacher has not used critical thinking skills questions in student test questions. While creativity skills in the classroom, only a few students are able to express creative ideas in learning. In collaboration skills in group discussions, only a few students are active while the other students are mostly silent, and just wait for answers from the teacher. And in communication skills, students have not been able to communicate well, seen when presenting the results of group discussions, there are still students who have not given the right answers.

Based on the analysis of daily test questions conducted by the researcher, it was found that in the test questions on cell material, 14 questions were included in the critical thinking indicator with a percentage of 14.28%. While in the daily test questions on plant tissue material, 15 questions were included in the critical thinking indicator, namely with a percentage of 26.67%. Based on the description of the problems above, the research should be conducted entitled, analysis of students' thinking skills in biology learning: study at a school in Padang, Indonesia.

Method

This research is a qualitative descriptive study, where in this study aims to determine the ability of 21st century skills of students. The steps taken in this study are first, the preparation stage. At this stage, interviews were conducted with biology teachers. The second stage of implementation, the researcher gave questions (tests) to students according to the indicators of 21st century skills to measure critical thinking skills and filled out observation sheets in accordance with the indicators of 21st century skills, namely creativity, collaboration and communication. This observation sheet was filled out by the observer who would conduct the research. This observation was carried out 3 times. The third stage of completion where the researcher corrected and analyzed the answers to the students' test questions and analyzed the assessment of the students' observation sheets.

The research instrument uses questions and observation sheets, in the question instrument the indicators used in making these questions according to (Sani, 2019) consist of 5 indicators, namely: 1) providing a simple explanation (elementary clarification), 2) building basic skills (basis support), 3) making inferences (inference), 4) providing further explanations (advance clarification), and 5) arranging strategies and tactics (strategy and tactics). The questions that have been tested are then reviewed to determine validity and reliability. This observation sheet instrument is used to determine students' responses in creativity, collaboration skills, and communication skills in the learning process.

There are 4 aspects of assessment for creativity skills, namely 1) Fluency, 2) Flexibility, 3) Originality, 4) Elaboration (Detailedness) (Greenstein, 2012). Collaboration skills have 4 aspects of assessment, namely 1) Working productively, 2) Showing respect, 3) Compromise, 4) Shared responsibility, everyone contributes (Greenstein, 2012). Communication skills have 6 aspects of assessment, namely 1) Oral communication, 2) Receptive communication: listening, reading and seeing, 3) Distinguishing intentions, 4) Using communication strategies, 5) Communicating clearly for one purpose, 6) Presentation skills (Greenstein, 2012).

Test data analysis was carried out using the following formula:

$$S = \frac{R}{N} \times 100$$

Note:

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S : Expected value
R: Total score from correct answers
N : Maximum score

Test data analysis was carried out using the following formula:

$$X = \frac{\sum x}{N}$$

Note:
$\sum x$= achievement of creativity, collaboration and communication skills
X= total scores obtained by students
N= number of students

To see the percentage intervals on the critical thinking skills test and the creativity, collaboration and communication skills observation sheet, see Table 1.

Table 1. Guidelines for converting percentage intervals to categories

Interval	Criteria
81-100	Very high
61-80	Tall
41-60	Enough
21-40	Low
0-20	Very low

(Arikunto, 2016)

After the questions were tested with one class of 25 students, the researcher validated the questions as follows:

No	Nomor Soal								
	1	2	3	4	5	6	7	8	9
1	1	1	1	1	0	1	0	1	1
2	1	1	0	0	1	1	1	1	1
3	1	0	1	1	1	1	1	1	1
4	1	0	1	1	0	1	1	1	1
5	1	0	1	1	1	1	1	1	1
6	1	0	1	1	0	1	1	1	1
7	1	1	1	1	1	1	1	1	1
8	1	1	1	0	0	0	1	1	0
9	1	0	0	1	0	1	1	1	1
10	1	0	1	0	0	0	1	1	0
11	1	1	1	0	0	0	1	0	1
12	1	1	1	0	1	1	1	0	1
13	1	0	1	1	1	0	1	1	0
14	0	0	1	1	0	0	0	0	0
15	1	0	0	1	0	1	1	0	0
16	0	0	0	0	0	1	1	1	0
17	1	1	0	0	0	1	1	1	0
18	0	0	1	0	0	1	0	0	0
19	1	1	1	1	0	0	0	1	1
20	0	1	0	1	0	0	0	0	0
21	0	0	1	0	0	0	0	0	0
22	0	0	1	1	0	0	0	0	0
23	1	1	1	1	0	1	0	0	0
24	0	0	1	0	1	0	0	0	0
25	0	0	0	0	0	0	0	0	0
∑x	17	10	18	14	7	14	15	14	11
∑xy	270	141	251	203	110	222	243	236	195
rxy	0,67	0,11	0,16	0,63	0,26	0,51	0,63	0,72	0,70
Kriteria	T	SR	SR	T	R	CT	T	T	T
	V	TV	TV	V	TV	V	V	V	V

The table above shows that there are only 17 valid questions.

RESULTS AND DISCUSSION

The average value of students' 21st entury skills obtained overall was 69.57 with high criteria. The value of each skill can be seen in Figure 1.

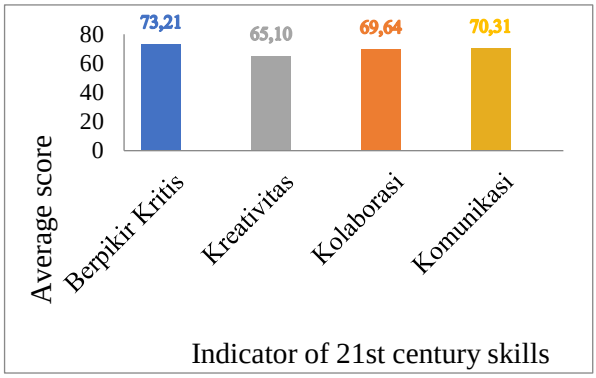

Figure 1. Average 21st century skills scores of students at Adabiah Private High School in Padang

Figure 1 shows thatIn critical thinking skills, a score of 73.21 was obtained with high criteria, creativity obtained a score of 65.10 with high criteria, collaboration skills obtained a score of 69.64 with high criteria and communication skills obtained a score of 70.31 with high criteria. Of the 21st century skills, the lowest is creativity.

1. Critical thinking skills

The average value of students' critical thinking skills was 73.21 with high criteria. The values for each indicator of critical thinking skills can be seen in Figure 2.

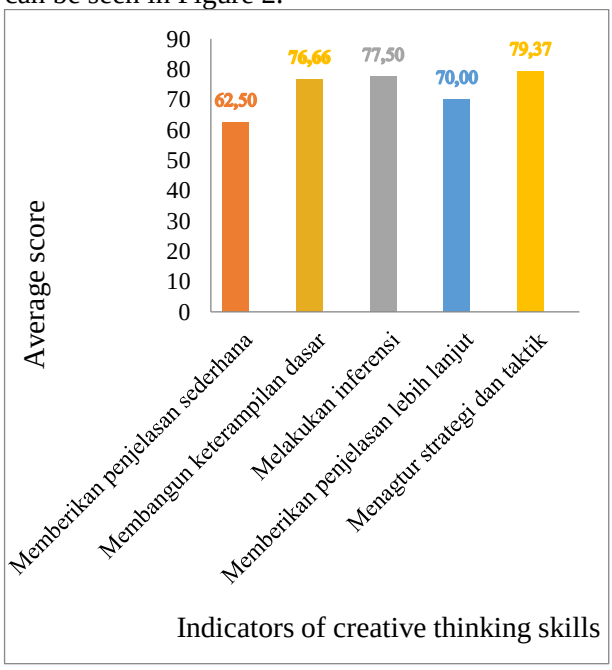

Figure 2. Average value of students' critical thinking skills based on indicators

Figure 2 shows that in the first indicator,

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providing a simple explanation obtained a value of 62.50 with high criteria. The second indicator, namely building basic skills, obtained a value of 76.66 with high criteria. The third indicator, namely making inferences, obtained a value of 77.50 with high criteria. The fourth indicator, namely providing further explanations, obtained a value of 70.00 with high criteria. The fifth indicator, namely arranging strategies and tactics, obtained a value of 79.37 with high criteria. Of the critical thinking indicators, the lowest is the indicator providing a simple explanation.

2. Creativity

The average value of student creativity was 65.10 with high criteria. The values for each aspect of creativity assessment can be seen in Figure 3.

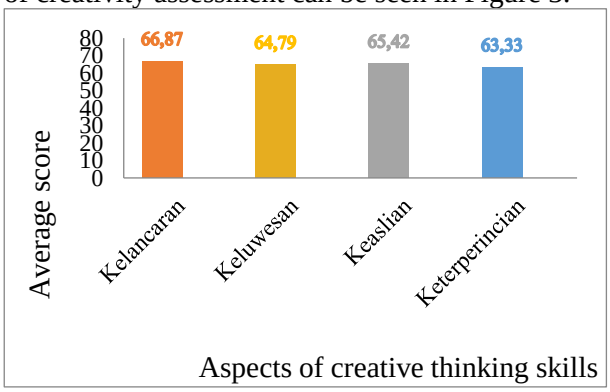

Figure 3. Average student creativity scores based on assessment aspects

Figure 3 shows that in creativity, the first assessment aspect, namely fluency, obtained a value of 66.87 with high criteria. The second assessment aspect, namely flexibility, obtained a value of 64.79 with high criteria. The third assessment aspect, namely originality, obtained a value of 65.42 with high criteria. The fourth assessment aspect, namely detail, obtained a value of 63.33 with high criteria. Of the aspects of creativity assessment, the lowest is in the aspect of detail assessment.

3. Collaboration skills

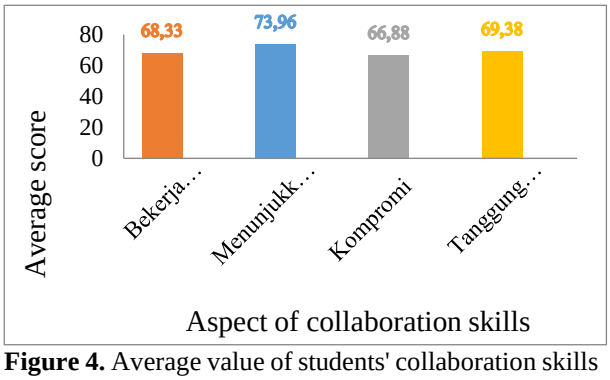

Figure 4. Average value of students' collaboration skills

The average value of students' collaboration skills was 69.64 with high criteria. The values for each aspect of creativity assessment can be seen in Figure 4. Figure 4 shows that In collaboration skills, the first assessment aspect, namely working productively, obtained a value of 68.33 with high criteria. The second assessment aspect, namely showing respect, obtained a value of 73.96 with high criteria. The third assessment aspect, namely compromise, obtained a value of 66.88 with high criteria. The fourth assessment aspect, namely shared responsibility, obtained a value of 69.38 with high criteria. Of the collaboration assessment aspects, the lowest is the compromise assessment aspect.

4. Communication skills

The average value of students' communication skills was 70.31 with high criteria. The values for each aspect of communication skills assessment can be seen in Figure 5.

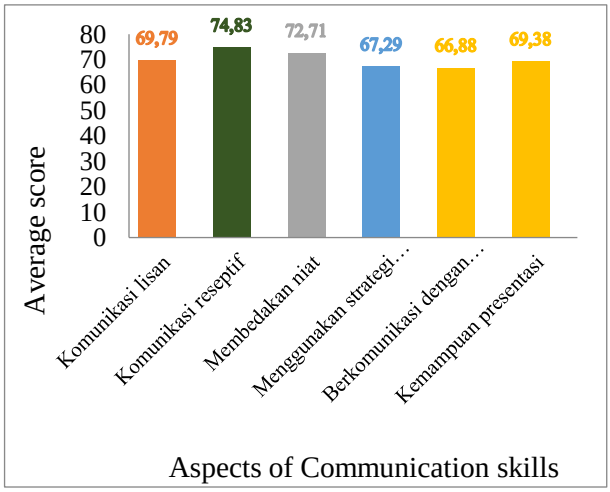

Figure 5. Average value of students' communication skills based on assessment aspects.

Figure 5 shows that In communication skills, the first assessment aspect, namely oral communication, obtained a value of 69.79 with high criteria. The second assessment aspect, namely receptive communication, obtained a value of 74.83 with high criteria. The third assessment aspect, namely distinguishing intentions, obtained a value of 72.71 with high criteria. The fourth assessment aspect, namely using communication strategies, obtained a value of 67.29 with high criteria. The fifth assessment aspect, namely communicating clearly, obtained a value of 66.88 with high criteria. The sixth assessment aspect, namely presentation skills, obtained a value of 69.38 with high criteria. Of the communication assessment aspects, the lowest is in the assessment

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aspect of communicating clearly.

Based on research conducted at Adabiah Padang Private High School, it can be seen that students' 21st Century Skills in biology learning are obtained on average with high criteria. This shows that the learning environment also affects student learning, there needs to be new innovation with teachers and learning media able to keep up with the increasingly sophisticated developments of the era, this can be done by utilizing the use of technology in the learning process. 21st century skills in schools have been implemented optimally, because in the learning process teachers have used technology such as infocus laptops and cellphones to support the student learning process and teachers have involved student learning with everyday life.

This is in line with research conducted by Septikasari, (2018) This requires the role of educators to develop skills, both hard skills (expertise) and soft skills (abilities) in students in developing 21st century skills in learning, it is hoped that each individual has the skills to live in the 21st century with various opportunities and challenges that will be faced in the era of technological and information advancement. This is in line with research that has been conducted by Guidance, (2015) Higher-order thinking skills require clarity of communication to reduce confusion, but can improve students' attitudes about the task. Lesson plans should include modeling of thinking skills, examples of applied thinking, and adaptations to the needs of diverse learners. Creative thinking is a must for 21st century individuals.

However, of all the 21st century skills, the lowest skill is creativity skills. This is because students are still lacking in seeing problems from different perspectives, lacking in finding ideas about the material given and less able to adapt and see new situations well. Teachers should train students' creativity skills more by asking questions. The value of 21st century skills for boys is lower than for girls. This is in line with research conducted by Pratiwi et al., (2019) One of the factors causing low creativity is the lack of utilization of real problem solving around students, so students tend to be passive.

Students' critical thinking skills are obtained with high criteria. Students' critical thinking skills are high because the learning process of the teacher gives questions about the material being studied then students are asked to come forward to create or convey answers to the questions, if the answer given by one of the students is wrong, the teacher asks other students to participate until the question is answered correctly. At the beginning or end of learning, teachers often give quizzes on previously studied material to measure the level of students' understanding of the material given. This is in line with research conducted by Hidayat et al. (2022) stating that students' high critical thinking skills are able to define terms in learning, especially at the current learning process which means that students have the freedom to manage learning resources from anywhere, one of which is through internet access.

Student creativity is obtained with high criteria. Student creativity is high because in the learning process students are able to convey questions about the ongoing learning material, the teacher asks the questions to other students so that there are several students who convey their responses then the teacher reaffirms the answers given by the students. This is in line with research conducted by Budiman, (2011) where creative thinking is related to the level of intelligence (IQ) of students, if a person's level of intelligence is higher then their creativity will be high in the process, the results of creativity include new ideas, different perspectives, solving chains of problems, recombining ideas.

Students' collaboration skills are obtained with high criteria. Students' collaboration skills are high because in the learning process the teacher has carried out group discussions, where the teacher gives each of them the same questions or problems regarding the material being studied. After each group discusses finding answers, the teacher asks one of the groups to present the results of the discussion from the group, then the other groups listen and provide responses if there are differences in the answers given. This is in line with research conducted by Kholifah and Hariastuti, (2022) that students are very capable of exchanging ideas or ideas and also feelings when they are in a group in order to solve problems together. Students are very capable of working effectively in a group, because students are aware that being on time when completing tasks as a group is necessary.

Students are able to respect diverse teams, because students are aware that by respecting each team member, discussions in groups will be easier and can avoid divisions between group members. This is also in accordance with research that has been conducted by Jonah (2023)that in the learning process is already high because there are two activities that are interrelated and cannot be separated, namely teachers teaching and students learning. Teachers as facilitators must be able to stimulate an effective learning process by

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providing opportunities for students to develop their competencies.

Students' communication skills are obtained with high criteria. Students' communication skills are high because in the learning process, the students' intonation in conveying answers to questions given by the teacher is clear, easy to understand by other students, but if one of the students does not understand the answer given, he will ask the student who explained it again, so that the student repeats the answer in detail which causes the student who does not understand to understand the answer given. This is in line with research conducted by Hamia, et al. (2020) that the high communication skills of students are due to the use of appropriate learning strategies so that the material presented by the teacher is easy for students to understand and the learning method directs the improvement of students' communication skills so that it encourages students to be more skilled in communicating.

Conclusion

The purpose of this study was to determine the 21st Century Skills of Class XII MIPA Students in Biology Learning at Adabiah Padang Private High School. In detail, students' 21st century skills in critical thinking skills, creativity, collaboration and communication were respectively 73.21; 65.10; 69.64 and 70.31 with high criteria. Based on the results of the research that has been conducted, it can be concluded that the 21st century skills of class XII MIPA students in biology learning at Adabiah Padang Private High School are at high criteria.

References

Arikunto, S. (2016). Basics of Educational Evaluation. Jakarta: Bumi Aksara.

Budiman, H. (2011). Improving Students' Critical and Creative Mathematical Thinking Skills Through Problem-Based Learning Approach Assisted by Cabrid 3d Software. Journal of Education. 13 (1):1-80.

Fajri, M. (2017). Mathematical Thinking Skills in the Context of 21st Century Learning in Elementary Schools. Lemma Journal, 3, 1–11.

Greenstein, L. (2012). Assessing 21st Century Skills a guide to evaluating mastery and authentic learning. California: Corwin.

Hamia, Muhiddin, P., Arsal, AF (2020). Students' Communication Skills: A Case Study of Biology Learning at SMA Negeri 1 Sidrap. Journal of Education, 9(2), 1–7.

Hidayat, K., Hasan, SH, and Wiyanarti, E. (2022). Critical thinking skills of students in hybrid learning. Basicedu Journal, 6(2), 1517–1528.

Hidayah, N. (2015). Sharpening Critical and Creative Thinking Skills. Proceedings of the National Seminar on Guidance and Counseling, PD ABKIN East Java, 1(2), 49–61.

Kholifah, RB, and Hariastuti, RT, (2022). Overview of Collaboration Tendencies of Vocational High School Students in Gempol District. Guidance and Counseling 12(4):1001–13.

Mahanal, S. (2009). The Effect of Implementing River Water Quality Detection Learning Tools with Project-Based Biological Indicators on High School Students' Learning Outcomes in Malang City. Unpublished Doctoral Dissertation, Postgraduate Biology Education Study Program, UM. Malang.

Pratiwi, AI, Sunarno, W., and Sugiyarto. 2019. "Analysis of Students' Creativity Ability on Human Digestive System Material Reviewed from Gender Perspective." National Seminar on Science Education 70–75.

Sani, RA, (2019). How to Make HOTS (High Order Thinking Skills) Questions. Tangerang. Tira Smart.

Septikasari, R. (2018). 21st Century 4C Skills in Learning. Journal of Tarbiyah Al-Awlad, VIII, 107–117.

Yunus, MRK (2023). Analysis of Collaboration Skills of Class XI Mia Students of Sma Negeri 1 Barru in the Number Heads Together Cooperative Learning Model. Biogeneration Journal, 8(1), 350–357.