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Learning Outcomes of Post-Pandemic Invertebrate Systematics Practicum for Biology Education Students

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ABSTRACT

The covid-19 pandemic has an impact on student learning outcomes in the practicum of the invertebrate systematics course.The aim of this research is to determine the learning outcomes of post-pandemic invertebrate systematics practicum for students in semester 5, academic year 2022/2023. The method used in this research is a descriptive qualitative method. The sample used in this research was 5th semester students with a total of 5 classes totaling 97 students. The sampling technique used was the Population Sampling Technique. Data was obtained from a list of TKP scores, report scores, response scores and student perceptions submitted using a Google Form questionnaire. The results obtained by Biology Education students in the Invertebrate Systematics Practicum were based on TKP scores of 45.4% in the high category, 49.5% medium and 5.2% low. Based on the report value, 96.9% is in the high category, 2.0% is medium and 1.0% is low. Based on the response value, 3.1% were in the high category, 28.9% were medium and 68.0% were low. And based on the results of the student perception questionnaire, it can be interpreted that post-pandemic learning has had a positive impact, including being able to carry out practicums in the laboratory and improving student learning outcomes.

KEYWORDS

Learning outcomes, Invertebrate systematics, Covid-19

1. Introduction

Learning is a process of interaction between students and educators and learning resources in a learning environment. In the learning process there are many aspects that influence the quality of a learning process. Learning is assistance provided by educators so that the process of acquiring knowledge, mastering skills and habits, as well as forming attitudes and beliefs in students can occur (Saraswati and Mertayasa, 2020). Learning is also defined as a process to help students learn well. This learning process is experienced by a human throughout his life and applies anywhere and at any time. In the educational context, educators teach students so they can learn and master subject content so as to achieve a specified objective (cognitive aspect), and can also influence changes in attitudes (affective aspect) and skills (psychomotor aspect) of a student. (Djamaluddin and Wardana, 2019).

Biology is a study that studies very broadly about living things and their lives. Biology learning cannot be separated from the role of lecturers as educators and motivators for students, while students are active learning objects in carrying out discovery activities in gaining knowledge (Nugroho, 2019). Practical activities are an inseparable part of science learning, especially biology.

Practicum is an activity that aims to equip students to better understand theory and practice. Through practicum activities, students can gain many things, including being able to practice skills, giving students the opportunity to apply and integrate the knowledge and skills they have effectively. real in practice, and can prove something scientifically (Nisa, 2017). Biology practicum is also usually carried out to strengthen or hone students' skills in the learning material which is carried out by direct observation in the field or in the surrounding environment based on the material being taught.

The Biology Education study program has one of the mandatory courses and practicums that must be taken by semester 5 students, namely Invertebrate Systematics. This Invertebrate Systematics practicum course discusses 5 phyla, namely Porifera & Coelentrata, Helmints, Mollusca & Echinodermata, Crustacea, and Insecta. This Invertebrate Systematics practicum course is a practicum course that is difficult to understand and carry out. The animals used as material for practical work are rarely found, such as porifera and insects. The aim of this course is to develop students' understanding, skills and learning abilities through explanation (assistance), discussion, observation, interpretation, identification, cataloging and independent observation.

With the COVID-19 pandemic in 2020, significant changes occurred in the practical learning of Invertebrate Systematics. Carrying out practicum activities online raises pros and cons. Invertebrate Systematics Practicum, initially the preparations or materials were provided by laboratory assistants and there was an efficient time estimate. After the pandemic, the practicum was carried out independently at home by looking for your own preparations around the house or searching on internet pages with time estimates. which is less efficient. So, after the COVID-19 pandemic, students experienced difficulties in implementing invertebrate systematics practicum when practicum activities were not carried out, namely lack of time and students' habit of using tools in the laboratory to help solve problems was considered lacking. Therefore, students will experience difficulty in understanding the material. This significant change will affect student learning outcomes.

Based on previous research (Rokhanah, Supriyanto, and Priyono, 2015), the low learning outcomes for animalia are caused by difficulty understanding abstract objects, especially invertebrates. Apart from that, being seen as critical towards learning is also low so that students tend to receive information rather than looking for information. Learning also does not develop science process skills and only prioritizes achieving the cognitive domain. whereas ideal learning should develop the cognitive, psychomotor and affective domains.

Based on previous research (Suwondo, Febrita, and Suryana. 2013), the student learning process for Invertebrate Systematics lectures has not shown an increase in activity, this can be seen from the learning difficulties experienced by students in the activity of paying attention and listening to lecturer explanations, asking questions or expressing opinions, conducting observations, discussions and working on LKM, which is caused by students' lack of readiness in attending lectures, lack of student participation in the learning process and lack of mastery of the material. While many studies have addressed the impact of online learning on learning outcomes in general (Adedoyin & Soykan, 2020; Pokhrel & Chhetri, 2021), there is still a gap on the specific effects on practicum learning of Invertebrate Systematics post-pandemic.

Previous studies have shown that biology practicums face unique challenges during the transition to distance learning (Babinčáková & Bernard, 2020). However, most of these studies focused on the acute phase of the pandemic, rather than the post-pandemic period when face-to-face learning began to be restored. This gap is important to address given the potential long-term impact of learning disruptions on students' practical skills (Ferdig et al., 2020). Furthermore, while some studies have explored the adaptation of biology practicum during the pandemic (Gamage et al., 2020), few have specifically examined the learning outcomes of Invertebrate Systematics practicum. This field requires special attention due to its nature of requiring direct observation and manipulation of specimens, which is difficult to replicate in a virtual setting (Pather et al., 2020).

Furthermore, while student perceptions of online learning have been widely researched (Dhawan, 2020), there remains a lack of understanding of how students perceive the transition back to face-to-face practicum learning, particularly in the context of Invertebrate Systematics. This understanding is important to inform effective teaching strategies in the post-pandemic era. This study aims to fill the gap by investigating student learning outcomes in the post-pandemic Invertebrate Systematics practicum. As such, this study will provide valuable insights into the effectiveness of adapted learning strategies and may assist in designing better approaches to biology education in the future. It is important to evaluate learning outcomes post-pandemic to ensure the quality of education is maintained. Changes in practicum

delivery during and after the pandemic require assessment of effectiveness for further adjustments. This research will fill the gap in the literature on the post-pandemic impact on learning biology practicum, particularly Invertebrate Systematics.

2. Method

This research was conducted from February to June 2023 at the Biology Laboratory, Faculty of Teacher Training and Education, Muhammadiyah University, Surakarta. This type of research is descriptive research which aims to describe learning outcomes and student perceptions regarding Invertebrate Systematics Practical Learning Post the COVID-19 Pandemic. The sample used in this research was 5th semester students with a total of 5 classes totaling 97 students. The sampling technique used was the *Population Sampling Technique.* Data collection on learning outcomes is carried out by documenting a list of TKP values, reports and responses. Meanwhile, student perceptions were carried out using a questionnaire using *Google Form* for Invertebrate Systematics Practicum students Semester 5 FY 2022/2023. The data taken is in the form of crime scene scores, reports, responses and results of student perception questionnaires. Research data on crime scene values, reports and responses will be averaged and grouped into high, medium and low categories. The reference used to group values using predicate ranges (Rigusti, 2020) is as follows.

Table 1. Reference for Grouping TKP Values, Report Values, and Response Values

Category	*Mark*
Tall	≥ 70
Currently	50 ≤ X < 70
Low	< 50
Low	< 50

Then the assessment results data in the form of student perceptions obtained from the *Google Form questionnaire* were analyzed and calculated through the average percentage for each question indicator and presented in the form of descriptive sentences (Arikunto, 2010).

3. Results and Discussion

This research aims to determine the learning outcomes of Post-Pandemic Invertebrate Systematics Practicum for Students in Semester 5 FY 2022/2023. The learning outcomes analyzed in this research are TKP scores, report scores, and response scores. Apart from that, this research also aims to find out student perceptions regarding Post-Pandemic Invertebrate Systematics Practical Learning for Students using a student perception questionnaire via *Google Form.* Based on the research results, the TKP value analysis can be seen in Table 2 as follows:

Table 2. Analysis of TKP Value Data (Practical Competency Test)

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Tall	44	45.4	45.4	45.4
	Currently	48	49.5	49.5	94.8
	Low	5	5.2	5.2	100.0
	Total	97	100.0	100.0	

Based on the research results in (Table 2) regarding the analysis of TKP scores, the results showed that of the 97 students, 45.4% got scores in the high category, 49.5% of the students were in the medium category, and 5.2% of the students were in the low category. Then the analysis of the report value data can be seen in Table 3. Based on the research results in (Table 3) regarding value analysis, the report shows that out of 97 students, 96.9% of students got grades in the high category, 2.1% of students were in the medium category, and 1.0% of students were in the low category.

Table 3. Data Analysis of Report Values

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Tall	94	96.9	96.9	96.9
	Currently	2	2.1	2.1	99.0
	Low	1	1.0	1.0	100.0
	Total	97	100.0	100.0	

Then the response value data analysis can be seen in table 4 as follows:

Table 4. Data Analysis of Response Values

		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Tall	3	3.1	3.1	3.1
	Currently	28	28.9	28.9	32.0
	Low	66	68.0	68.0	100.0
	Total	97	100.0	100.0	

Based on the research results in (Table 4) regarding the analysis of Responsive scores, the results showed that of the 97 students, 3.1% got scores in the high category, 28.9% of the students were in the medium category, and 68.0% of the students were in the low category. Based on the research results, it can be seen that students have understood the material presented during the lecture. Students successfully apply their understanding of the material when carrying out practicum directly in the laboratory. The results of research on student perceptions obtained in Table 5 are as follows:

Table 5. Recapitulation of Student Perception Percentage Results

No	*Question*	*Answer Percentage (%)*			
		Strongly Agree	*Agree*	*Disagree*	*Strongly Disagree*
1	Carrying out practicum offline is more effective and efficient	60.8	34	3.1	2.1
2	During the offline invertebrate systematics practicum learning, I was more active and comfortable in asking questions to lecturers and assistants	50.5	43.3	4.1	2.1
3	Offline lectures make it easier for me to submit assignments and reports on time	45.4	46.4	3.1	5.2
4	I feel lazy about carrying out invertebrate systematics practicum offline	9.3	13.4	66	11.3
5	In my opinion, offline invertebrate systematics practicum is more fun than online practicum	51.5	39.2	6.2	3.1
6	The grades I got in the invertebrate systematics practicum course were good and in accordance with my understanding	33	60.8	3.1	3.1
7	Offline learning makes it easier for me to understand the invertebrate systematics practical material	26.8	67	3.1	3.1
8	Invertebrate systematics practicum material is well available so it makes it easy for me to understand and comprehend	66	25.8	5.2	3.1
9	During the offline invertebrate systematics practicum, it was easier for me to get learning resources	36.1	57.7	3.1	3.1
10	I had difficulty understanding the invertebrate systematics practical material because the material was not available properly	5.2	9.3	75.3	10.3
11	Offline lectures make it difficult for me to submit assignments and reports on time	8.2	7.2	76.3	8.2
12	Offline learning made it difficult for me to understand the invertebrate systematics practicum material	3.1	7.2	80.4	9.3
13	I didn't understand the invertebrate systematics practical material so I got a bad grade	3.1	6.2	77.3	13.4
14	Offline invertebrate systematics practicum lectures made it difficult for me to get the opportunity to ask questions, so I rarely asked	4.1	11.3	72.2	12.4

No	Question	Answer Percentage (%)			
		Strongly Agree	Agree	Disagree	Strongly Disagree
15	I think offline invertebrate systematics practicum is boring	4.1	5.2	82.5	8.2
16	Offline learning materials are not suitable for invertebrate systematics practicum	3.1	6.2	83.5	7.2
17	I am very enthusiastic about carrying out invertebrate systematics practicum offline	43.3	49.5	4.1	3.1
18	The value I got on the invertebrate systematics practicum material while offline was less than optimal	4.1	4.1	77.3	14.4
19	The material provided in the offline invertebrate systematics practical lecture is very complete	35.1	56.7	5.2	3.1
20	The offline invertebrate systematics practicum is quite fun because you are cutting into preparations and observing directly	51.5	42.3	4.1	2.1

Based on the research results, it can be seen that overall the offline implementation of the post-pandemic invertebrate systematics practicum can run well and smoothly. Most of the TKP (Practical Competency Test) scores of Invertebrate Systematics Practicum students are in the medium to high category. This shows that students have adapted from online learning during the COVID-19 pandemic to offline or face-to-face learning. The learning outcomes in the form of TKP (Practical Competency Test) scores show that the percentage of medium to high score categories is a form of understanding of the material presented in offline lectures. The availability of materials, two-way lectures and methods that are appropriate to the Invertebrate Systematics practicum activities support students to achieve good learning outcomes.

According to Nuridayanti (2022), learning outcomes are changes in behavior which include the cognitive, affective and psychomotor domains. Learning outcomes are obtained from the teacher's assessment of learning outcomes to measure students' competency levels and serve as a reference for improving learning. TKP (Practical Competency Test) itself is a form of learning outcome from the cognitive domain.

Based on the research results, most of the Invertebrate Systematics Practicum student report scores were in the medium to high category. This shows that students understand the material presented in the lecture. Students successfully apply their understanding of the material when carrying out practicum directly in the laboratory. Invertebrate Systematics Practicum using original and preserved preparations is able to improve students' skills in scientific thinking and improve clear data organization. In practicum, students can choose preparations according to their theme and understanding, so that during practicum obstacles can be reduced.

Based on the research results, it can be seen that the student response scores are in the low category. This is because students are not used to understanding various practice questions so that student learning outcomes in the form of responses are not optimal. Students also have different motivations for learning so students will not necessarily try and practice on their own.

This is in line with research (Rokhanah, Supriyanto, and Priyono, 2015), the low learning outcomes in animalia are caused by difficulty understanding abstract objects, especially invertebrates. Apart from that, being seen as critical towards learning is also low so that students tend to receive information rather than looking for information. Learning also does not develop science process skills and only prioritizes achieving the cognitive domain. whereas ideal learning should develop the cognitive, psychomotor and affective domains.

Based on the results of research on student perceptions regarding the Post-COVID-19 Pandemic Invertebrate Systematics Practical Learning, it consists of questions with 4 alternative answers using a *Likert scale* with the categories Strongly Agree (SS), Agree (S), Disagree (TS), and Strongly Disagree (STS). These four alternative answers will provide an overview of student perceptions regarding

Invertebrate Systematics Practical Learning Post the COVID-19 Pandemic. Each student gives a different perception, this can be seen from the percentage of questionnaire answers via *Google Form* for each question given.

Question 1 concerns the effectiveness of implementing offline learning. Based on the research results in (Table 5) , the perception obtained was that 60.8% of the 97 students strongly agreed that implementing offline practicum was more effective and efficient, 34% agreed, 3.1% disagreed, and 2.1 strongly disagreed. Offline learning is considered more effective and efficient than online learning. Most of the students answered that they strongly agreed because this face-to-face practicum can provide students with direct learning experiences through interactions with lecturers and students. Students receive practical material more effectively and more easily accept the material offline. Offline practicum is more effective and efficient because it can develop competence, especially in the psychomotor domain.

Question 2 concerns students' activeness and comfort in asking questions. Based on the research results in (table 5), the perception obtained was that 50.5% of the 97 students strongly agreed with the question, 43.3% agreed, 4.1% disagreed, and 2.1% strongly disagreed. Students who answer strongly agree can mean that students feel more comfortable when asking questions to lecturers or assistants so that students are more active during learning. Offline learning must be carried out interactively. Offline interactive learning aims to develop students' thinking abilities. Students must be actively involved in learning so that students do not lose motivation in learning. Student activity can be seen from their mastery of learning skills so that students dare to ask questions.

Question 3 concerns the ease of submitting assignments and reports in a timely manner. Based on the research results in (table 5), it was obtained that the perception of 45.4% of 97 students strongly agreed that offline lectures made it easier for students to submit assignments and reports on time, 46.4% agreed, 3.1% disagreed, and 5.2% strongly don't agree. Collecting assignments and reports offline makes it easier for students to collect them. This is because students submit assignments and reports to the lecturer's room or laboratory without internet network interference.

Question 4 concerns student motivation in carrying out offline invertebrate systematics practicum. Based on the research results in (Table 5) , the perception obtained was that 9.3% strongly agreed, 13.4% agreed, 66% disagreed, and 11.3% strongly disagreed. It can be seen that there are more students who answer disagree than those who answer agree. This shows that students are not lazy to carry out practicums offline in the laboratory. Most students are encouraged to carry out Invertebrate Systematics practicum. Some students who answered in the affirmative were because the students were less motivated due to limited communication with lecturers, assistants and friends. Apart from that, what influences student learning motivation are intrinsic and extrinsic factors. According to Nurhidayah (2014), a person's learning motivation is influenced by two factors, namely intrinsic factors including the environment, attention from parents, teachers and extrinsic factors including physiological and psychological (attitudes, interests and talents).

Question 5 concerns student motivation in carrying out offline invertebrate systematics practicum. Based on the research results in (Table 5), it was obtained that the perception of 51.5% of 97 students strongly agreed that offline practicum was more fun than online practicum, 39.2% agreed, 6.2% disagreed, and 3.1% strongly disagreed. agree. Most students answered that they strongly agreed that face-to-face practicum learning was considered more enjoyable than online practicum learning. This is because face-to-face learning can provide students with direct learning experiences through interactions with lecturers and other students. Some students also answered that they disagreed because offline practicum also has the disadvantage of requiring physical laboratory space. So students and lecturers must meet face to face at the same place and time, and must interact directly.

Question 6 concerns the learning outcomes of invertebrate systematics obtained by students. Based on the research results in (Table 5), it was obtained that the perception of 33% of the 97 students strongly agreed that the grades obtained in the invertebrate systematics practicum received good grades according to their understanding, 60.8% agreed, 3.1% disagreed, and 3.1 % strongly disagree. Most students answered in the affirmative because the grades obtained by students were in accordance with their

understanding of the practicum material received. Meanwhile, some students answered that they did not agree with this, because the assessment was not only based on understanding the practical material, but also on the final results of the TKP (Practical Competency Test), reports, responses and other additional points.

Question 7 concerns the ease of students understanding invertebrate systematics practical material. Based on the research results in (Table 5) , the perception obtained was that 26.8% of 97 students strongly agreed that offline learning made it easier for students to understand practical material, 67% agreed, 3.1% disagreed, and 3.1% strongly disagreed. Most students answered in the affirmative because students felt it was quite easy to understand the material in each practical lecture using the face-to-face learning system and students had adapted from the online learning model to offline learning. Meanwhile, students who answered disagreed were because students were still having difficulty adapting because the learning model had changed so that students did not fully understand the material. According to Saputra, et al (2022), lecturers who teach invertebrate systematics practicum courses with offline learning must be active in delivering the material, so that students can understand the practicum material well.

Question 8 concerns the availability of material as a practical learning resource for invertebrate systematics. Based on the research results in (Table 5) , the perception obtained was that 66% of the 97 students strongly agreed that the practicum material was well provided, 25.8% agreed, 5.2% disagreed, and 3.1% strongly disagreed. Students who answered in the affirmative because the availability of material has a very important role in increasing understanding and good learning resources really support better learning fluency. This shows that the availability of material in the invertebrate systematics practicum provided is well available and accepted by students. The supporting materials provided include invertebrate systematics practicum modules, video explanations of the material, and PPT.

Question 9 concerns the availability of material as a practical learning resource for invertebrate systematics. Based on the research results in (Table 5), it was obtained that the perception of 36.1% of 97 students strongly agreed that offline practicum students find it easier to get learning resources, 57.7% agreed, 3.1% disagreed, and 3.1% strongly disagreed. agree. It can be seen that the majority of students answered in the affirmative, this is because during offline practicum it makes it easier for lecturers to provide learning resources and learning media around them so that when learning takes place, students can easily observe the learning media provided by the lecturer.

Question 10 concerns students' difficulties in understanding because the material is not available properly. Based on the research results in (Table 5) , the perception obtained was that 5.2% strongly agreed, 9.3% agreed, 75.3% disagreed, and 10.3% strongly disagreed. Based on the research results obtained, only a few students experienced difficulties because the material was not available properly. According to Fatah, et al (2021), the factors that cause students to have difficulty learning are a less supportive learning atmosphere, a less strong learning foundation, a less conducive learning environment, teaching design and delivery of lesson material.

Question 11 concerns students' difficulties in submitting assignments and reports on time. Based on the research results in (Table 5) , the perception obtained was that 8.2% strongly agreed, 7.2% agreed, 76.3% disagreed, and 8.2% strongly disagreed. It can be seen that there are fewer students who have difficulties compared to students who do not experience difficulties. Students experience difficulties because the distance from where they live to campus is very far, so that they cannot submit assignments and reports on time or are late.

Question 12 concerns students' difficulties in understanding invertebrate systematics practical material. Based on the research results in (Table 5) , the perception obtained was that 3.1% strongly agreed, 7.2% agreed, 80.4% disagreed, and 9.3% strongly disagreed. Most of the students answered disagreeing, this shows that students do not find it difficult to understand the material and students have adapted and are used to offline learning. Meanwhile, there were students who answered in the affirmative, this was because students still found it difficult to understand the invertebrate systematics practicum material. Difficulty in understanding invertebrate systematics practical material is a condition of the learning process which is characterized by certain obstacles in achieving learning outcomes. Monariska

(2019), believes that one of the signs of difficulty understanding the material is students with low learning outcomes below the average scores achieved by other students.

Question 13 concerns the learning outcomes of invertebrate systematics obtained by students. Based on the research results in (Table 5) , the perception obtained was that 3.1% strongly agreed, 6.2% agreed, 77.3% disagreed, and 13.4% strongly disagreed. This question is about the difficulty of understanding the material which influences the grades students get. Understanding the material is a very important part that must be achieved by students. If students have difficulty understanding the material, it will affect learning outcomes in the form of final grades. Based on the research results, most students answered that they disagreed, this was because students did not experience difficulty in understanding the material so they got good grades. It can be seen that, based on the TKP scores in (Table 2) 45.4% of the 97 students got scores in the high category, 49.5% of the students were in the medium category, and 5.2% of the students were in the low category, and the report scores were in (Table 3) 96.9% of the 97 students got scores in the high category, 2.0% of the students were in the medium category, and 1.0% of the students were in the low category. Meanwhile, there were several students who answered in the affirmative because the students had difficulty understanding the material, which affected their final grade. It can be seen in (Table 4) regarding the analysis of response scores that of the 97 students, 3.1% of the students got grades in the high category, 28.9% of the students were in the medium category, and 68.0% of the students were in the low category.

Question 14 concerns students' difficulties in getting the opportunity to ask questions. Based on the research results in (Table 5) , the perception obtained was that 4.1% strongly agreed, 11.3% agreed, 72.2% disagreed, and 12.4% strongly disagreed. Most students answered disagree, this shows that students in offline lectures have no difficulty in getting the opportunity to ask questions. Students have adapted to offline learning so that students are bolder in their opinions, more confident, actively ask questions, discuss and answer questions from lecturers because learning takes place face-to-face between lecturers and students. Based on the research results, there were also several students who answered in the affirmative, this was because students had difficulty getting the opportunity to ask questions. According to Febrilia (2020), post-pandemic face-to-face learning is quite a mental test for students because students have to be actively involved in offline learning, especially in asking questions, let alone dealing directly with lecturers.

Question 15 concerns student motivation in carrying out offline invertebrate systematics practicum. Based on the research results in (Table 5) , the perception obtained was that 4.1% strongly agreed, 5.2% agreed, 82.5% disagreed, and 8.2% strongly disagreed. This question concerns the implementation of offline invertebrate systematics practicum. Most students answered disagree compared to students who answered agree, this is because students prefer direct or face-to-face practicum. Several students also answered in the affirmative because students were used to online practicums so offline practicums were very boring.

Question 16 concerns the suitability of the material for invertebrate systematics practicum. Based on the research results in (Table 5) , the perception obtained was that 3.1% strongly agreed, 6.2% agreed, 83.5% disagreed, and 7.2% strongly disagreed. This question concerns material that is not suitable for practicum learning in invertebrate systematics. Practicums can be carried out in the laboratory or outside the laboratory according to the practicum material. Based on the research results, it can be seen that the majority of students answered disagreeing , because the learning material was in accordance with the invertebrate systematics practicum. As stated in the Ministry of Education and Culture (2014), practicum supports a more realistic explanation of the subject matter. Practicums can also support students' understanding of learning material which of course influences student achievement of learning outcomes.

Question 17 concerns student motivation in carrying out offline invertebrate systematics practicum. Student motivation in taking part in offline learning is encouragement from the students themselves to take part in learning according to their wishes. Based on the research results in (Table 5) , the perception obtained was that 43.3% strongly agreed with the enthusiasm for carrying out practicum offline, 49.5%

agreed, 4.1% disagreed, and 3.1% strongly disagreed. Based on the results obtained, students who were enthusiastic in carrying out practicum were higher than students who were less enthusiastic in carrying out practicum. Motivation is a process of trying to influence someone to carry out a task to achieve the desired goal. According to Hidayati (2022), student motivation can be driven by external factors such as the provision of materials by teachers that are arranged creatively, support from parents, while motivation from internal factors can be driven by students' interest in learning.

Question 18 regarding student learning outcomes in invertebrate systematics practicum while offline was less than optimal. Based on the research results in (Table 5) , the perception obtained was that 4.1% strongly agreed, 4.2% agreed, 77.3% disagreed, and 14.4% strongly disagreed. This question concerns the value obtained during offline learning which is less than optimal. It can be seen that some students answered disagreeing with this question because students have adapted from online learning to offline learning so that the value obtained during the face-to-face invertebrate systematics practicum is maximum. Based on the research results, it was also found that students answered in the affirmative, this was because students had not fully adapted to the changing pattern of learning from online to offline, thus affecting students' grades which were less than optimal.

Question 19 availability of offline invertebrate systematics practical material. Based on the research results in (Table 5) , it was obtained that the perception of 35.1% of the 97 students strongly agreed that the material questions provided in the offline invertebrate systematics practicum were very complete, 42.3% agreed, 4.1% disagreed, and 2.1 % strongly disagree. Most students answered in the affirmative to this question. This shows that when carrying out offline invertebrate systematics practicum the material provided is very complete and acceptable to students. The supporting materials provided include invertebrate systematics practicum modules, video explanations of the material, and PPT.

Question 20 concerns student motivation in carrying out offline invertebrate systematics practicum. Based on the research results in (Table 5), it was obtained that the perception of 51.5% of the 97 students strongly agreed with the question that the offline invertebrate systematics practicum was fun because they cut the preparations and observed them directly, 42.3% agreed, 4.1% disagreed , and 2.1% strongly disagree. In the invertebrate systematics practicum, you are required to understand the characteristics of invertebrate animals. Invertebrate systematics practicum activities require students to observe and incise preparations directly. With face-to-face practicum, it is easier to understand and more fun because the practicum activities are seen directly or in real life. Students are interested in observing and touching the preparations directly because students will understand better.

Based on the results of the research on student perceptions above, it has provided views regarding offline invertebrate systematics practicum learning. Overall, the implementation of offline invertebrate systematics practical learning went well. The obstacles faced by students are normal, due to the change in learning methods from online learning to offline learning.With the COVID-19 pandemic, the learning process shifted from online to offline learning, which reopened created a pattern of adjustment to new habits. Offline learning has advantages, including, 1) The material can be delivered clearly, 2) Communication between lecturers and students is better established, 3) The ability to socialize becomes very broad, 4) Motivates students to be more enthusiastic, and 5) Minimizes waste. a technical error occurred.

Research on the learning outcomes of post-pandemic Invertebrate Systematics practicum for Biology Education students revealed several important findings. In general, students show good adaptation in the transition back to face-to-face learning, despite certain challenges.

Student learning outcomes show a diverse pattern. Most students were able to achieve the expected competencies, but there were gaps in some practical skills. This is in line with the findings of Gamage et al. (2020), who identified challenges in maintaining the quality of practicum learning during and after the pandemic.

Student perceptions of post-pandemic learning were generally positive, with appreciation for the opportunity to return to direct observation of specimens. However, some students reported difficulties

in re-adapting to the rhythm of face-to-face learning, similar to those reported by Dhawan (2020) in the context of learning transitions.

Key challenges identified include the need to recover practical skills that may have diminished during distance learning. This is consistent with Pather et al. (2020) on the impact of disruption on anatomy learning, which shares similarities with Invertebrate Systematics in terms of the need for direct observation.

Effective learning strategies post-pandemic involve a hybrid approach, combining hands-on practice with digital resources. This is in line with Pokhrel and Chhetri's (2021) recommendation to utilize blended learning in the post-pandemic era. Despite the challenges, the learning outcomes of the post-pandemic Invertebrate Systematics practicum demonstrate the resilience and adaptability of students and educational institutions. This research emphasizes the importance of flexibility in curriculum design and teaching methods to deal with future disruptions.

4. Conclusion

From the research findings, it can be concluded that the implementation of the "Merdeka" Curriculum at SMA Negeri 1 Pariangan falls under the category of Good with a degree of achievement score of 3.06. The implementation of the "Merdeka" Curriculum has a positive impact on the students, such as a well-allocated lesson time, easily achievable Learning Achievements (CP), and more flexible teaching tools and media, making it easier for students to comprehend the subject matter, particularly in biology. In the implementation of the Student Profile of Pancasila (X1), a score of 3.83 was obtained. For Learning Achievement (X2), the score was 3.82. Lesson Hours (X3) received a score of 3.96. The Learning Organizational Approach (X4) obtained ascore of 3.35. Student Graduation Requirements (X5) received a score of 3.33. The Differentiated Learning Approach (X6) received a score of 3.88. Assessment (X7) achieved a score of 4. Teaching Aids (X8) obtained a score of 3.7. When the scores for each indicator are averaged, the overall average indicator score is 3.73, which is categorized as "Very Good."

As for recommendations, the author suggests that the school could provide more platforms for teachers to engage in discussions and enhance their understanding of the "Merdeka" Curriculum. Teachers are encouraged to be more innovative in preparing teaching materials and adopting enjoyable teaching methods to capture students' interest. Furthermore, for future researchers, it is advised to consider this study as a reference source for subsequent research related to the implementation of the "Merdeka" Curriculum.

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