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Research Paper

Student Responses to Personal Digital Inquiry (PDI) Learning Integrated with Citizen Science Project (CSP) on Biodiversity Materials in a Senior High School

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Abstract

The research was motivated by the fact that biodiversity is declining; therefore, the involvement of all parties, including students, is needed to help save biodiversity. One way to do this is to implement meaningful learning by utilizing the closeness of students and gadgets through the application of personal digital inquiry-integrated citizen science projects in the classroom, which involve experts in carrying out biodiversity conservation projects in the form of a "digital herbarium" uploaded on Instagram. Students' responses are important as a reference to the extent to which PDI learning integrated with CSP has succeeded. This study aims to analyze students' responses to Personal Digital Inquiry (PDI) learning integrated with the Citizen Science Project (CSP) on biodiversity material in grade X high school students. This research is a descriptive study using a survey method. Questionnaires were used to collect research data. A total of 42 respondents participated in this study. The questionnaire contains statements about the implementation of learning using six indicators, which were compiled into 34 statements using a Likert scale. The results show a score of 79.73, which is considered good. Students feel enthusiastic and happy to participate in learning, get new experiences interacting with scientists and the surrounding community, increase closeness with teachers and colleagues, and increase awareness to maintain biodiversity by utilizing social media.

Keywords: *Biodiversity, Citizen Science Project, Personal digital inquiry, Student Responses.*

INTRODUCTION

Human survival is highly dependent on biodiversity. Biodiversity is used to fulfill daily needs (Vijeta et al., 2021). Biodiversity has many roles, including providing the needs of other living things, balancing the environment, protecting the environment, and maintaining the sustainability of the ecosystem; even if well managed, biodiversity can improve the regional economy (Suwarso et al., 2019). Biodiversity is also useful in the fields of industry, pharmaceuticals, economics, and even science (Siboro, 2019). Finally, biodiversity is crucial to the existence, growth, and presence of biological species in nature, which are essential parts of a better and healthier ecosystem. It also contributes to the preservation of natural resources (DK, 2014).

Indonesia is known as a mega-biodiversity country because of its high level of biodiversity (Kusmana & Hikmat, 2015); behind this fact, it has been revealed that in Indonesia there is also a high decline in biodiversity (Setiawan, 2022) and a hot spot for animal extinction (Kusmana & Hikmat, 2015). The extinction of biodiversity causes us to do something to protect biodiversity. The results of research on the issue of moving the capital of Indonesia to Borneo about its impact on wildlife show that there is a potential for the extinction of clay animals, especially mammals (Spencer et al., 2023). The threat of land use change can trigger extensive forest fragmentation. Agricultural expansion and infrastructure development lead to changes in forest conditions and biodiversity, resulting in diverse impacts such as habitat destruction, animal behavior changes, and

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human-wildlife conflict (Gunawan et al., 2024).

The extinction of biodiversity causes us to do something to protect biodiversity. Biodiversity education is a breakthrough that can be maintained (Schneiderhan-Opel & Bogner, 2020). The way to implement it is by including biodiversity content in the high school curriculum (Pratiwi et al., 2019) and improving biology learning to make it more meaningful (Corebima, 2016) through the application of learning that invites students to play an active role by utilizing their gadgets and social media. This is done to increase the effectiveness of gadget use because student achievement is considered a construction of gadget use behavior and social media use (Shetu et al., 2024). A survey conducted with senior high school students in Depok City revealed that they were accustomed to using social media, especially Instagram. The results of other studies show the potential for using Instagram in learning biology (S & Yogica, 2024).

Using social media is an innovation offered in digital-assisted inquiry learning called Personal Digital Inquiry (PDI). Considering inquiry as the basis of biology (Lee, 2012), the application of PDI to teaching biodiversity in high schools is appropriate. PDI helps students thoroughly integrate scientific inquiry and digital tools to obtain deeper results and a more thorough understanding (Coiro et al., 2017). The investigation will become more meaningful when authentic scientific research is introduced into the classroom (Aristeidou et al., 2023) by integrating citizen science. Citizen science (CS) refers to public participation in research, a collaboration between scientists and non-scientists in data collection, sharing, and analysis of data that benefits science and society (Jennett et al., 2016; Jordan et al., 2012; Vohland et al., 2021). In the implementation, students will be given a project called the Citizen Science Project (CSP) (Aripin, 2022). There is a need for technology involvement in citizen science (Vohland et al., 2021), so integrating it with PDI by maximizing social media is an innovation offered. In the final stage of PDI integration with CSP (Bonney, Cooper, et al., 2009; Hidayat, 2023), the step of publishing the results is completed. At this point, Instagram is the social media choice to introduce student project results to the public. The project results, in the form of a “digital herbarium," are a complete description of plant identity, ranging from photos, scientific names, classifications, benefits, and extinction status in the form of an infographic. The choice of infographic to inform students’ project results has several reasons, including the fact that students get a good effect in learning writing after learning with an infographic (Putra et al., 2022). Infographics also trigger students to develop digital, visual, and information literacy, critical thinking, creativity, communication, and collaboration skills; thus, they are considered suitable educational tools to be applied in higher education (Jaleniauskiene, 2023).

It is expected that with PDI learning integrated with CSP, students will become more aware of biodiversity so that they can take a role in biodiversity conservation. Therefore, students’ responses after this learning are important to be a reference to the extent to which PDI learning integrated with CSP has succeeded in making students have a concern for biodiversity as one of the steps in conserving biodiversity. Therefore, this research is intended to analyze student responses to Personal Digital Inquiry (PDI) learning integrated with Citizen Science Project (CSP) on biodiversity material in grade X high school students, with the following research question: How do students respond to learning biodiversity through the Personal Digital Inquiry integrated Citizen Science Project?

LITERATURE REVIEW

In every learning process, feedback is needed so that teachers can evaluate the learning process that has been conducted, while for students, it serves as a source of verification for continuous self-development. This student's response is a reaction that students perform in response to the influence of stimuli or situations that have been conducted (Maharani & Widhiasih,

2016). Response can also be described as an impression or reaction obtained after observing the activities of sensing, assessing, and forming an attitude toward the object. Responses can be positive or negative attitudes (Hidayati & Nur M, 2013). The purpose of feedback is to improve the learning process because effective feedback must show its effect (Dawson et al., 2019). During the learning process, teachers can observe students' responses to learning, and students can respond and experience the learning process (Aisyah et al., 2016). This student's response will be low if the student is less interested, which can be determined through questionnaires (Lijina et al., 2020).

Previous research related to student responses to inquiry learning gave a very strong response (Suniah & Rizqiyah, 2018) and was very positive (Hairina et al., 2021). Students assess and respond very interestingly to learning media that utilize technology (Dewi et al., 2022) and give a good response to learning that uses infographics on biodiversity material (Fauziyah et al., 2021). The use of the plantlet application in learning also gave a good response (Rifa'i et al., 2020). The use of Instagram in learning also gave a positive response, namely, strongly agreeing to involve Instagram in learning as media (Laksono et al., 2019). The findings of the research on citizens' perceptions of the citizen science concept show that citizen science and scientific research are not widely known and popular, but most respondents have an interest in citizen science (Aripin & Hidayat, 2020). An analysis of the application of the Citizen Science Project shows that most students enjoyed the learning experience with CSP and stated that the activities conducted were interesting, fun, and accessible (Straub, 2020). Based on some previous studies, no study has specifically stated students' responses to PDI learning integrated with CSP on biodiversity material in senior high school, so this study tries to explore the information and analyze it into new findings.

Data on the responses to PDI learning integrated with CSP were collected after biodiversity learning was completed. CSP integration with PDI was carried out as a breakthrough that would make inquiry learning more meaningful in schools. Inquiry can be seen as a constructivist strategy that builds one's knowledge (Widodo, 2021). Along with technological advances, this field has become a study of practitioners so that innovations are made in the implementation of inquiry involving the use of gadgets and digital technology. PDI can assist students in thoroughly integrating scientific inquiry and digital tools to obtain deeper results and a more thorough understanding (Coiro et al., 2017). This leads to the need for new strategy skills in literacy (Braasch et al., 2018). The use of technology in learning must be mastered by teachers to create learning strategies that can improve learning outcomes (Castillo et al., 2024). Many studies have used information technology in learning, but few have applied it to biology learning. Inquiry-based learning through technology can improve concept understanding, problem solving, and students' interest in learning biology (Jiang & Yu, 2022). Learning biology using PDI can improve science and information literacy (Sholihah et al., 2023; Tyansha et al., 2022). The involvement of technology and gadgets in learning in Indonesia started a long time ago, but the most significant has been since the COVID-19 pandemic. In addition to Indonesia, the use of technology during COVID-19 also occurred in the Philippines, which highlighted technical issues and classroom management (Nolasco et al., 2024). Personal Digital Inquiry designs experiences that encourage collaborative discussion and reflection; in turn, these experiences lead to knowledge building, knowledge expression, and personal action (Coiro et al., 2020). Personal Digital Inquiry is implemented with several stages: (1) wonder and discover, (2) collaborate and discuss, (3) participate and take action, (4) analyze and reflect (Coiro et al., 2017). These practices integrate classic and contemporary principles of inquiry-based learning (Coiro et al., 2016).

Whereas citizen science (CS) involves public participation in organized research efforts, hundreds of thousands worldwide participate in the scientific process (Bonney & Dickinson, 2012). Another definition of citizen science (CS) is research that involves collaboration between the community and the public, and scientists to conduct scientific research to develop new knowledge

or solve problems in everyday life. The scope of citizen science includes biodiversity and conservation, ecology and environment, astronomy and astrophysics, biomedicine, water and soil research, animal observation, air and weather monitoring, history and culture, toxicology, plant science, agriculture, climate change, parasitology, radiology, nuclear and nuclear for medical, forestry, marine and freshwater biology, anatomy and morphology, and others (Aripin & Hidayat, 2023). CSP is a project applied in citizen science learning (Aripin, 2022) that can open opportunities to socialize research among students (Cerrato, 2022). In Indonesia, CSP has also been initiated, especially in biology education related to several materials in biology (Damayanti et al., 2021; Susbiyanto et al., 2024). Teachers have an important role in implementing CSP in schools, starting from adapting the project to the curriculum and exploring the environment that allows students to play a role as contributors, as well as maintaining student motivation in project involvement (Roche et al., 2020). This is supported by research findings that indicate that in science learning, the availability of laboratories affects teacher improvisation in developing learning materials (Anane & Lomotey, 2023). The CSP implementation steps are developed from the basic framework of inquiry, starting from formulating problems, collecting information, designing the process of data collection analysis, interpreting data to obtain conclusions, and publishing results (Bonney et al., 2009). The CSP implementation procedure is as follows: (1) FGD with experts, (2) mini-projects, (3) presentations attended by experts, (4) making reports, (5) publication of results in any form (Hidayat, 2023).

The application of PDI involving CSP is at the stage of data collection and observations. Instead of engaging in higher inquiry activities. This is done to improve content knowledge, scientific process, independence, and, most importantly, student engagement in learning (Aristeidou et al., 2023). CSP activities can provide opportunities for students to be active in learning and improve the quality of inquiry-based learning (Mitchell et al., 2017). The implementation of PDI integrated CSP in learning with the following steps; (1) wonder & discover: (a) Formation of student groups, (b) search, determine problems and topics to be discussed; (2) collaborate & discuss: FGDs with experts, discussions in groups on the topics discussed; (3) participate & take action: conduct mini projects involving student groups by maximizing technology and applications; (4) analyze & reflect: analysis of project results and project presentations attended by experts, making reports, publishing results through social media (Coiro et al., 2017; Hidayat, 2023).

The application of CSP in biology learning can be demonstrated in several high school biology materials in phases E and F. One of the materials suitable for CSP applications is biodiversity material (Aripin & Hidayat, 2023). Learning biology material on biodiversity as much as possible can be meaningful so that it can explore process skills, analysis, and communication. It is hoped that the learning process can form the scientific attitudes and profiles of students who are Pancasila (Badan Standar Kurikulum dan Asesmen Pendidikan, 2022) because the Citizen Science Project (CSP) can affect students' knowledge and behavior (Peter et al., 2021). Understanding and caring for biodiversity must be a special concern in learning because it can shape the character of students who love the environment so that they support conservation efforts (Leksono et al., 2015). Various reasons have been put forward as to why we should conserve biodiversity; moral arguments and arguments about the intrinsic and ecological value of biodiversity are potential starting points (Berry et al., 2018). In addition to the benefits of biodiversity in various aspects of human life (Siboro, 2019; Suwarso et al., 2019) and the current condition of biodiversity is currently experiencing a decline (Siboro, 2019; Sing & Sharma, 2017). The conservation of biodiversity is essential for humans to maintain life in various ways (Niesenbaum, 2019). Thus, it is expected that learning activities that apply CSP-integrated PDI can be an alternative to biodiversity conservation efforts through education. Based on this description, the student responses obtained from this

study are important.

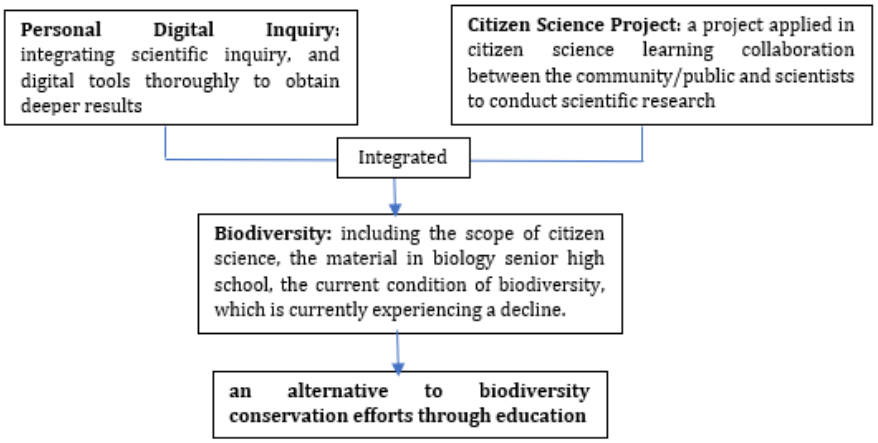

Figure 1. Theoretical framework

RESEARCH METHOD

This research is a descriptive study with a survey method that aims to analyze student responses to learning conducted at one of the high schools in Depok during the 2023/2024 school year. The sample was selected by cluster random sampling; thus, a class of 42 students was obtained. The student response is one of the data from the research on the application of PDI learning integrated with CSP on biodiversity material in class X senior high school in the experimental class. CSP-integrated PDI learning was conducted for four meetings. During the learning process, students work on the task of making a "digital herbarium" by identifying the plants around them and then analyzing them into an infographic that is easy to understand. The results are then uploaded to Instagram and social media. During the learning process, students are accompanied by teachers and biodiversity experts. The learning implementation was also accompanied by a senior biology teacher. The senior biology teacher has a role in observing the learning process of CSP-integrated PDI to ensure that the learning process takes place according to the learning scenario prepared. In collecting data, students are assisted by residents who contribute by sending photos of plants into a Google Drive database. After the learning was completed, the students were given a questionnaire containing 34 statements derived from six indicators (table 1) that had been determined previously. The questionnaire consisted of positive and negative statements on a Likert scale of 1–5. The questionnaire scoring categories are presented in Table 2. The Likert scale questionnaire was previously tested for expert validity (expert judgment) by expert lecturers. Students filled out a Google Form. Data analysis was carried out by tabulating by giving an assessment according to table 2.

Table 1. Details of student response questionnaire indicators

No	Indicators	Item no	Amount
1	Student opinions on PDI learning integrated with CSP	1, 2, 3, 4, and 5	5
2	Students' ease of understanding biodiversity material through PDI learning integrated with CSP	6, 7, 8, 9	4
3	Student interest in experiential learning	10, 11, 12, 13, 14, 15	6
4	Students' enthusiasm for PDI learning integrated with CSP	16, 17, 18, 19, 21	6

No	Indicators	Item no	Amount
5	Students' collaboration with friends and teachers after integrating PDI learning with CSP	22, 23, 24, 25, 26, 27, 28	7
6	Students' concern for biodiversity after learning	29, 30, 31, 32, 33, 34	6

(Coiro et al., 2017; Hidayat, 2023; Lubos, 2023; Straub, 2020)

Table 2. Scoring Categories of Student Response Questionnaires

Category	positive score	negative score
Strongly agree	5	1
Agree	4	2
Doubtful	3	3
Disagree	2	4
Strongly disagree	1	5

(Alfalah et al., 2023; Andin et al., 2023; Sumartini et al., 2020)

Based on these criteria, tabulations are then made using Excel (Microsoft Office LTSC Professional Plus 2021 Version 2206) to analyze the scores of each indicator for interpretation.

1) Determine the ideal maximum score by
   Ideal maximum score = number of component items X maximum scores per item.
2) The score is obtained by summing the scores of each criterion.
3) The percentage of validity

$$\text{Score (N)} = \frac{\text{Scor obtained}}{\text{Skor maximal}} \text{ x } 100\%$$

4) The obtained percentage results are then converted to the following table:

Table 3. Student response questionnaire score interpretation criteria

No	Score	Interpretation
1	80% ≤ N ≤ 100 %	Excellent
2	60% ≤ N < 79,99 %	Good
3	40% ≤ N < 59,99%	Enough
4	20% ≤ N < 39,99%	Bad
5	0% ≤ N ≤ 19,99%	Atrocious

(Alfalah et al., 2023; Andin et al., 2023; Sumartini et al., 2020)

The questionnaire results were tabulated using Excel by entering the score of each item according to the item number and indicator, and then summing it up. Then, the maximum score for each indicator is added. The percentage was calculated by dividing the score of each indicator by the maximum score of each indicator and then multiplying by 100. The results of the analysis are presented in a table so that interpretation can be made according to Table 3, and then analyzed for each indicator by linking it to previous studies to strengthen the findings.

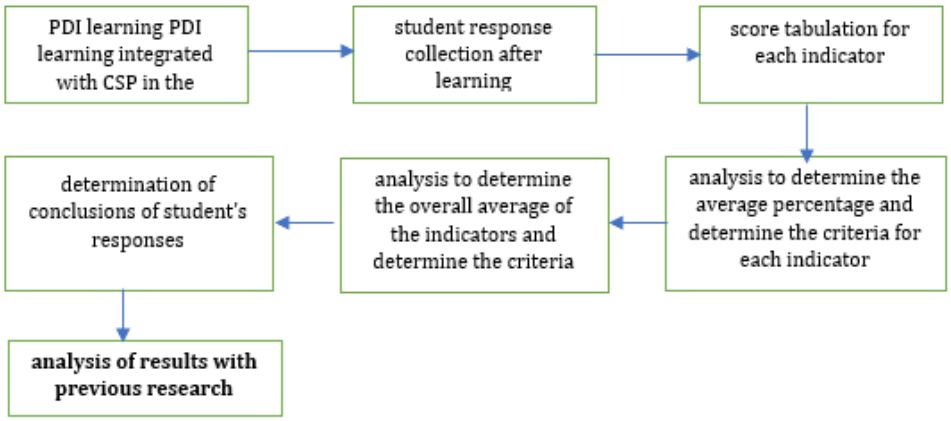

Figure 2. Analysis flow chart.

FINDINGS AND DISCUSSION

Students' responses to Personal Digital Inquiry (PDI) learning integrated with Citizen Science Project (CSP) on biodiversity material in class X senior high school students were obtained by distributing questionnaires to 42 students who took part in learning for 4 meetings. The biodiversity material is given to students by applying PDI learning integrated with CSP, which begins with giving a pretest, then group discussions to analyze problems and determine topics, FGDs with experts, formulation of CSP projects that require citizen involvement (students themselves, fellow friends, family, relatives, neighbors and residents), analysis of results, presentations, publication through social media Instagram, and ending with a posttest. The entire learning process is assisted by gadgets and applications related to biodiversity materials such as Canva, Plantnet, Google Classroom, Google Meet, Google Drive, and Google Docs. Students also use social media such as WhatsApp to collaborate, YouTube, and scientific journals as learning resources. During the learning process, students are in groups and collaborate. The project they are working on is the identification of plants around the school and where they live. During the learning process, students are accompanied by biology teachers and professors who are experts in biodiversity. The questionnaire was completed after the posttest, which was the last meeting. The questionnaire results were tabulated using Excel. The tabulation results can be seen in the following table:

Table 4. Table 2: Tabulation of student response questionnaire results

No	Indicator	Percentage	Category
1	1st Indicator	88.76	Excellent
2	2nd Indicator	80.83	Excellent
3	3rd Indicator	76.51	Good
4	4th Indicator	75.71	Good
5	5th Indicator	78.10	Good
6	6th Indicator	80.63	Excellent
	Average	79.73	Good

Based on Table 4, the percentage of student responses in each indicator and overall is shown. Overall, student responses are in the good category, with a value of 79.73%. This result was obtained by averaging the percentage values of each indicator. The highest value is found for indicator 1, which is 88.76%, which is a superb category. Indicator 1 examines students' opinions on PDI learning integrated with CSP regarding biodiversity material. Students responded very well to this indicator. A total of 5 questions given on this indicator were adjusted to the peculiarities of

the implementation of PDI learning integrated with CSP, namely, the involvement of gadgets and experts in the implementation of projects and the learning process. PDI is inquiry-based learning involving scientific investigation and gadgets to support each stage of its implementation to obtain in-depth results and a comprehensive understanding (Coiro et al., 2017). The integration of PDI with CSP is carried out to gain a more meaningful inquiry experience because the inquiry carried out at school is still a practice inquiry (Widodo, 2021). By integrating CSP with PDI, students can gain meaningful experience from expert involvement so that there is collaboration between scientists and non-scientists to construct knowledge (Jennett et al., 2016; Jordan et al., 2012; Vohland et al., 2021). The integration of PDI learning with CSP means that students gain research experience by bringing authentic research into the classroom and socializing research in the classroom (Aristeidou et al., 2023; Cerrato, 2022). The results of indicator 1, which show a very good category, indicate that students feel that PDI learning integrated with CSP is organized as it should be and that students get research experience involving technology as tools and collaboration with experts.

The second indicator has an average of 80.83%, which is in the excellent category. The second indicator is about student responses regarding the ease with which they understand biodiversity material through PDI learning integrated with CSP. The indicator examines how well students understand the material of diversity and apply it in everyday life. The results revealed that students easily understood the material and were eager to apply their knowledge in everyday life. The learning process is packaged interestingly by encouraging students to conduct meaningful investigations of the surrounding environment using the Plantnet application. Students gain real experience when learning biodiversity material. Sharing and discussions with experts in the FGD session added to students' insights into biodiversity, from the basics to the motivation to take care of biodiversity after being faced with the facts of biodiversity conditions. This shows that the application of PDI learning integrated with CSP can provide additional content knowledge, scientific process independence, and, most importantly, student engagement in learning so that inquiry-based learning becomes of higher (Aristeidou et al., 2023; Mitchell et al., 2017). Learning with CSP can increase student interest and motivation, as well as mastery of biodiversity material, especially positive attitudes toward wild animals, natural gardens, and biodiversity (Kelemen-Finan et al., 2018).

The third indicator examines students' interest in learning based on real experiences, with a percentage of 76.51%, including those in the good category. The statement items in this indicator examine students' interest in learning outside the classroom and gaining new experiences with biodiversity experts. This category did not receive a superb predicate because there were statement items about group work with friends and the ability to interact with residents. Students are not used to it, but they do get interesting experiences during learning. This opinion is per the condition that, so far, students have not been accustomed to learning that involves citizens supporting the process of knowledge construction; biology learning at school is still not meaningful (Corebima, 2016). A breakthrough in biology learning by bringing authentic research into the classroom, such as PDI learning integrated with CSP, provides a new color in the classroom learning process because it can socialize actual research with students by involving the role of experts and the community (Aristeidou et al., 2023; Cerrato, 2022; Jordan et al., 2012). This statement is supported by the results of the study, which showed attitudes and behaviors supporting biodiversity conservation are in the good category after participating in nature lovers' activities and other activities that involve students in citizen science activities on a local scale (Aripin et al., 2021).

Students are enthusiastic about learning with CSP-integrated PDI, as evidenced by the percentage in indicator 4, which is 75.71%, with a good predicate. This is because students are happy to receive new challenges in designing and working on projects. Early statements were

supported by the results of random interviews with several students while the teacher was accompanying the project. Students gain new experience using the Plantnet application to recognize and identify plants around them. Students are required to know the names of plants found around them. This statement is supported by the results of research that found that the use of Plantnet in biology learning for plant identification can improve student learning completeness (Muchsin et al., 2021). Teachers and students respond well to the use of Plantnet to help identify plants (Muchsin et al., 2021; Rifa'i et al., 2020). In addition, indicator 4 examines how students respond to the use of other applications when creating infographics and then uploading them to social media. Students are enthusiastic about this process considering that Gen Z students are close to technology (Adityara & Rakhman, 2019) and social media (Shetu et al., 2024), so the selection of Instagram social media to help students in learning is the right thing, which is supported by the results of research that Instagram social media has the potential to be used in biology learning (S & Yogica, 2024).

The 5th indicator highlights student collaboration with fellow students, teachers, and other parties involved in learning. The results show a good category, with a percentage of 78.10%. This indicates that PDI learning integrated with CSP can provide a positive response to collaboration skills. This is by the principle that collaboration between students and teachers is necessary in completing CSP projects (Gusnita et al., 2019), because in the implementation of learning, students are trained to collaborate so that they become accustomed to it. Inquiry that requires students to conduct scientific investigations also strongly supports a good response to student collaboration because it involves working with groups (Putri et al., 2018; Sarifah & Nurita, 2023; Yousif & Asan, 2006). The implementation of PDI learning integrated with CSP has a positive response to student collaboration.

Student responses to biodiversity awareness are highlighted in the 6th indicator. The results of the analysis show a percentage of 80.63% in the excellent category. This result shows that students feel more love and concern for biodiversity after learning with CSP-integrated PDI, which is supported by the results of other studies that state that CSP can improve students' inquiry skills and concern for biodiversity (Aripin et al., 2023). By the statement that biodiversity learning is part of sustainable education that contributes to caring for biodiversity (Schneiderhan-Opel & Bogner, 2019), PDI learning integrated with CSP is intended as a breakthrough in the application of biology learning in schools for the sake of biodiversity sustainability. Evidenced by the very good category in this indicator, meaning that students have begun to have an awareness of caring for biodiversity by utilizing their social media to publish the results of the project, which is the final part of the PDI learning integrated with CSP stage (Bonney, Cooper, et al., 2009; Hidayat, 2023), as well as evidence that students will be able to appreciate biodiversity and have specific skills to contribute to its conservation (Schneiderhan-Opel & Bogner, 2020).

The findings of this study can answer the research question of how students respond to learning, as indicated by the results of student responses in the good category, supported by previous research on learning with CSP, which makes students enjoy learning; the activities carried out are interesting and fun so that learning is felt to provide benefits (Straub, 2020). Some previous research results supporting the results of each indicator demonstrate that CSP-integrated PDI learning benefits students. Projects undertaken during learning can impact students' knowledge and behavior (Peter et al., 2021). PDI learning integrated with CSP allows students to gain in-depth results and a thorough understanding (Coiro et al., 2017) related to biodiversity. The use of technology in classroom learning can have positive outcomes on pedagogy and classroom practice (Mercer et al., 2019). The research findings can provide direction for the implementation of biodiversity learning in the classroom because biodiversity learning can contribute to maintaining biodiversity (Schneiderhan-Opel & Bogner, 2019).

CONCLUSIONS

The results show a score of 79.73%, which is considered good. Students feel enthusiastic and happy to participate in learning, get new experiences interacting with scientists and the surrounding community, have closeness with teachers and colleagues who show positive collaboration, and increase their concern for maintaining biodiversity by utilizing the social media they have. This research implies that the application of Personal Digital Inquiry (PDI) integrated with Citizen Science Project (CSP) can provide a new color to the application of inquiry in schools that makes students feel enthusiastic in learning to provide information and an overview of the significance of meaningful learning about biodiversity. Personal Digital Inquiry (PDI) learning integrated with the Citizen Science Project (CSP) can be an alternative to learning the biology of biodiversity material for educators and can also provide a reference for conducting similar research to provide benefits for biodiversity conservation.

LIMITATION OF RESEARCH

The research still involves a small scope, namely, only one class of 42 students in one school; it is necessary to conduct research involving more respondents from several schools. In addition, the research time of only 4 meetings is considered insufficient to work on the project to the fullest, in the sense that the process of data collection and collaboration with contributing citizens needs to be added to obtain more plant data, strengthen students' habituation to interact with citizens, and make more citizens contribute to the project.

These suggestions were developed based on the results of this research: several observers are needed to observe the implementation of the CSP integrated PDI learning process, preferably more than one observer; it would be better if one group is one observer to ensure the learning process is in accordance with the scenario that has been prepared so that the resulting learning response can be better. Similar research on student responses can be conducted using different materials with the same learning method.

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