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Development of Discovery Learning-based Student Worksheets Combined with FGD on Ecosystem Material to Determine Student Learning Outcomes at SMAN 12 Semarang		
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Article Info	Abstract	
Article History: <i>Received : September 2024</i> <i>Accepted : November 2025</i> <i>Published : April 2026</i>	The demands for learning outcomes in the independent curriculum expect students to have the ability to create solutions to problems based on local issues that are close to students' lives. To meet these demands, appropriate learning tools are needed. One learning tool that can be used is the Student Worksheet (LKPD). Applying the discovery learning model in student worksheets can help students to be more active in discussions and brave in expressing opinions during the learning process. This research aims to determine the characteristics, validity, practicality and effectiveness of student worksheets based on discovery learning on ecosystem material on student learning outcomes at SMA Negeri 12 Semarang. This research is Development Research (RnD) which uses research steps that have been modified into six steps. Data collection methods used interview methods, question instruments, practicality questionnaires and environmental care attitude questionnaires. The score data obtained was analysed using the KKTP (Criteria for Achievement of Learning Objectives) standard. The validity test of the developed student worksheet was carried out by two validators, namely material expert lecturers and media experts. From the results of the validity test, the student worksheet was declared very valid and suitable for use in learning with a percentage of scores from material experts of 91.66% and from media experts of 96.62%. The practicality test of the student worksheet was carried out by biology subject teachers and students. From the practicality test, the student worksheet was declared very practical and suitable for use in learning with a percentage score from biology subject teachers of 99.5% and students of 81.3%. Student cognitive learning results were obtained from 36 students, with 86% of students passing the KKTP score with a class average of 80. Meanwhile, the results of students' psychomotor assessments obtained a class average of 81 and the results of students' affective assessments, which were measured using an environmental care attitude questionnaire, obtained a class average of 70. Thus, it can be concluded that the student worksheet that has been developed is effective in helping to find out student learning outcomes and is practically used to help students be more active during learning through the help of discussion activities.	
Keywords: <i>Students Worksheet, Ecosystem, Discovery Learning, Focus Group Discussion, Learning Outcome</i>		
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INTRODUCTION

The importance of the objectives of national education is implied in the 1945 Constitution and reiterated in Law No. 20/2003 on the National Education System. The existence of quality national education is expected to fulfill the purpose and function of national education. In the world of education, there will definitely be various problems. One of them is the limited teaching materials or learning tools that facilitate students. The limitations of learning tools will affect the quality of learning, so the development of Student Worksheets is needed (Ariani & Meutiawati, 2020). Therefore, it is necessary to develop learning tools in order to improve the quality of student learning. The quality of student learning is also influenced by various factors. During learning, students who tend to be passive will find the learning atmosphere in the classroom very boring. Moreover, the learning method used is still teacher-centered, this can also affect students' understanding of learning materials. This factor causes many students to get scores below the KKTP. Therefore, it is necessary to develop teaching tools that can support learning and can overcome some of the problems that arise.

Ecosystem material is one of the biology learning materials found at the end of phase E at grade X SMA level. Where at the end of phase E, students are expected to have the ability to create solutions to problems based on local, national or global issues related to understanding the components of the ecosystem and the interactions between its components (Keputusan Kepala Badan Standar, Kurikulum, Dan Asesmen Pendidikan Nomor 008/H/KR/2022 Tentang Capaian Pembelajaran Pada Pendidikan Anak Usia Dini Jenjang Pendidikan Dasar Dan Jenjang Pendidikan Menengah Pada Kurikulum Merdeka, 2022). To achieve these learning objectives, the right learning tools are needed for the material. One of the learning tools that can be used is student worksheets. Student worksheets are sheets containing material, summaries, and tasks that must be done by students (Prahstiwi et al., 2021). Learning using student worksheets effectively improves student learning outcomes, knowledge, and skills (Ariani & Meutiawati, 2020). In meeting the demands of learning outcomes, the right learning model is also needed in addition to the use of learning tools. Student worksheets are teaching materials that can be used as learning guidelines that require students to be actively involved in learning and serve as a guide for exercises to develop cognitive aspects as well as all aspects of learning in the form of experimental or demonstration guides (Pawestri & Zulfiati, 2020). In the process of developing and preparing student worksheets, it must fulfill and pay attention to several requirements for making good LKPD, namely didactic requirements, construction requirements and technical requirements (Ariani & Meutiawati, 2020).

The Discovery Learning model is a learning model developed based on the view of constructivism (Rustamana, 2020). Discovery learning is a constructivist learning that is done by constructing phenomena through investigation based on scientific procedures to find a broad understanding of the phenomena presented in learning (Rubiyanto et al., 2016). The application of discovery learning can make students more active in reading and searching for information, knowledge and solutions to problems given by the teacher. According to Rismayani et al., (2013), if students have understood the material studied, they do not need to memorize the material they have learned before, so that when answering learning outcome test questions, students only need to recall their understanding of the material or knowledge that has been read and discovered by themselves. The discovery learning syntax used is (1) stimulation, (2) problem identification (problem statement), (3) data collection, (4) data processing, (5) verification and (6) conclusion (generalization) (Pernandes & Asmara, 2020). Discovery Learning has a characteristic that the problem presented must be based on real phenomena in everyday life. The suitable material to fulfill the criteria of discovery learning is ecosystems because the characteristics of the material in ecosystems discuss the environment by presenting various real phenomena that are closely related to human daily life (Rubiyanto et al., 2016).

Focus Group Discussion is an activity to explore a specific issue/phenomenon using the discussion method of a group of individuals that focuses on joint activities among the individuals involved in it to produce a mutual agreement. (Alfiyanti, 2008). By conducting discussions, students can help students understand the material, because in discussions students can obtain information from various points of view that can increase their knowledge. The FGD method is characterized by a fairly varied number of

individuals for one discussion group. One discussion group can consist of 4 to 8 individuals or 6 to 11 individuals (Alfiyanti, 2008; Indrizal, 2014).

One of the main problems in learning in formal education or schools recently is the low absorption and activeness of students (Widiyati, 2019). Teachers who still use the lecture method to deliver material and are textbook-oriented will make students become listeners only and indirectly make students passive during the teaching and learning process. Teachers who still use the lecture method to deliver material and are textbook-oriented will make students become listeners only and indirectly make students passive during the teaching and learning process. According to Prastowo (2012), this situation will make students feel pressured, because students cannot bring out their creativity and ideas.

This research utilizes the surrounding environment as a source of student learning on ecosystem material. The hope is that the student worksheets developed combined with focused discussion activities can help teachers improve student learning outcomes both cognitively, affectively and psychomotorically. Research conducted by Jannah et al., (2020), had the aim of developing student worksheets using the 4D model. Based on the development that has been carried out, the student worksheets produced on ecosystem material are valid with a percentage of 84.30%. Practicality obtained from teachers with a percentage of 79.76% and students with a percentage of 87.67%. Based on the results of previous research, student worksheets can be developed into better devices in order to help teachers and facilitate student learning. Based on this background, the purpose of this study is to determine the characteristics, validity, practicality and effectiveness of student worksheets on ecosystem material based on discovery learning that has been developed to determine student learning outcomes in both cognitive, affective and psychomotor aspects.

RESEARCH METHOD

This research was conducted at SMA Negeri 12 Semarang in the even semester of the 2022/2023 academic year. This research is a research and development (Research and Development) using the ten-step model from Borg and Gall which has been modified into 6 steps (Figure 1). Before being used, discovery learning-based student worksheets will be validated by two expert validators, namely material expert validators and media expert validators. After that, the student worksheets were tested on class X-11 students with a total of 36 students. The data in this study included student learning outcomes and teacher responses which were analyzed using descriptive quantitative percentages.

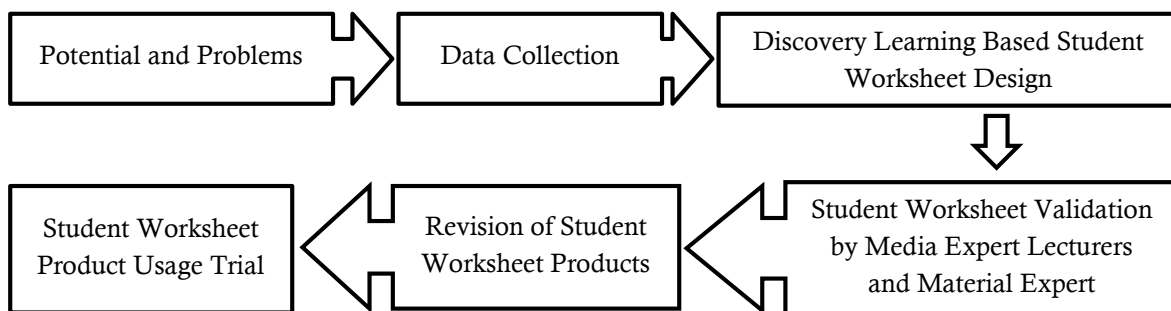


Figure 1. Research Stages of Discovery Learning-Based Student Worksheet Development used

RESULT AND DISCUSSION

The purpose of this study was to determine the characteristics, validity, practicality and effectiveness of discovery learning-based student worksheets on ecosystem material on student learning outcomes. The validity of discovery learning-based student worksheets on ecosystem materials is measured from the results of validity assessments conducted by two validators, namely material expert validators and media expert validators. The practicality of discovery learning-based student worksheets on ecosystem materials is measured from the average results of the LKS practicality response by teachers and students. The effectiveness of discovery learning-based student worksheets on ecosystem material is measured by the effectiveness indicators that have been determined, namely classical learning completeness $\geq 85\%$ with 75 criteria for achieving learning objectives (KKTP).

Student Worksheet Characteristics

Student worksheets are prepared in accordance with the requirements for making good student worksheets and are arranged according to the general student worksheet structure which is then developed. The student worksheets that have been developed contain learning outcomes, learning objectives, instructions for use, ecosystem material and instructions for doing activities so that they can help students to find concepts independently in order to realize more meaningful learning. The student worksheet product is a product developed using discovery learning syntax which is incorporated into each activity in the student worksheet. Students are invited to discover the concept of ecosystems independently so that they are able to describe the meaning of ecosystems, classify ecosystem components, to be able to analyze ecological pyramids and biogeochemical cycles whose phenomena are close to the student environment by discussing, searching for literature from reliable sources and communicating the results of problem solving to make a conclusion.

The activities in the discovery learning-based student worksheets amount to 3 activities consisting of sub-chapters of material on the components that make up the ecosystem, energy flow material, and material on ecological pyramids and biogeochemical cycles. Each sub-chapter has activities developed based on discovery learning syntax. Student worksheet products are designed in printed form for several reasons, one of which is to avoid cheating students so that they do not directly copy-paste answers from the internet. In addition, the use of printed student worksheets can also be used in various situations because it does not depend on signals and any electronic devices so that it is more effective for students to use for learning. This student worksheet is also equipped with other learning resources that can be accessed by students freely through the QR Code Scan which is directly connected to Youtube or can access videos through the links that have been included.

Student Worksheet Validity Test Results

The validity test data was obtained from the assessment of student worksheets by material expert validators and media experts. Both validators came from the Biology Department of Semarang State University. Validity was measured by the validators by providing an assessment on the assessment instrument provided. Furthermore, after the assessment, the student worksheet was improved according to the suggestions given by the validators. The results of the validity test by material experts are presented in Table 1 and the results of the validity test by media experts are presented in Table 2.

Table 1. Results of Validation Test by Material Experts

No	Aspect	Score Earned	Max Score	Percentage (%)	Category
1	Student Worksheet Components	25	25	100	
2	Feasibility of Student Worksheet Content	18	20	90	
3	Presentation of Student Worksheet	17	20	85	
4	Discovery Learning	18	20	90	
5	Language	14	15	93,3	
Average Percentage				91,66	Very Valid

Table 2. Results of Validation Test by Media Experts

No	Aspect	Score Earned	Max Score	Percentage (%)	Category
1	Components of Student Worksheets	24	25	96	
2	Dictate Requirements	9	10	90	
3	Construction Requirements	25	25	100	
4	Technical Requirements	68	70	97,1	
5	Discovery Learning	20	20	100	
Average Percentage				96,62	Very Valid

Based on Table 1 and Table 2, the student worksheet product developed obtained a percentage value of 91.66% from the material aspect and obtained a percentage value of 96.62% from the media aspect which both percentage values are included in the very valid category so it is feasible to use in learning even though there are still some parts that need to be improved. Product validation is an important step in the development of a product, because from the results of product validation we can find out whether the product that has been made meets the needs and objectives to be achieved. With the validation process, we can find out what things still need improvement. This improvement is intended so that student worksheets on ecosystem material based on discovery learning become more valid and more feasible when used as student learning tools in the classroom. The improved student worksheets can be used by students to support the learning process to be more meaningful so that it can help students in understanding ecosystem material so that it can have an impact on student learning outcomes. Improvements include material and media aspects in accordance with the suggestions given by the validator. Table 3. contains some suggestions and necessary improvements from both validators.

Table 3. Suggestions From Material Expert and Media Expert Validators

Validation Results (Suggestions and Improvements)	
Validator Suggestions	Revision Result
There are some writing errors on some pages (such as writing the word "dibawah", etc.)	Fixed some writing errors on some pages (such as writing the word "dibawah", etc.)
Parts that need to be improved because they still use Curriculum 2013 components and do not include instructions for use	Parts that have been improved by changing the Core Competencies (KI), Basic Competencies (KD), Competency Achievement Indicators (IPK) to Learning Outcomes (CP) and Learning Objectives (TP) and adding Instructions for Use of discovery learning-based student worksheets.

KI, KD DAN IPK

KOMPETENSI INTI

- KI 1 : Menghayati dan mengamalkan ajaran agama yang dianutnya.
- KI 2 : Menghayati dan mengamalkan perilaku jujur, disiplin, tanggung jawab, peduli, (gotong royong, kerjasama, toleran, damai), santun, responsive dan proaktif dan menunjukkan sikap sebagai bagian dari solusi atas berbagai permasalahan dalam berinteraksi secara efektif dengan lingkungan sosial dan alam serta dalam menempatkan diri sebagai cerminan bangsa dalam pergaulan dunia.
- KI 3 : Memahami, menerapkan, menganalisis dan mengevaluasi pengetahuan faktual, konseptual, procedural, dan metakognitif berdasarkan rasa ingin tahunya tentang ilmu pengetahuan, teknologi, seni, budaya, dan humaniora dengan wawasan kemusiaan, kebangsaan, kenegaraan, dan peradaban terkait penyebab fenomena dan kejadian serta menerapkan pengetahuan prosedural pada bidang kajian yang spesifik sesuai dengan bakat dan minatnya untuk memecahkan masalah.
- KI 4 : Mengolah, menalar, menyaji dan mencipta dalam ranah konkret dan ranah abstrak terkait dengan pengembangan dari yang dipelajarinya di sekolah secara mandiri serta bertindak secara efektif dan kreatif dan mampu menggunakan metoda sesuai kaidah keilmuan.

KOMPETENSI DASAR DAN INDIKATOR PENCAPAIAN KOMPETENSI (IPK)

3.10 Menganalisis komponen - komponen ekosistem dan interaksi antar komponen tersebut

- 3.10.1 Mengidentifikasi komponen - komponen penyusun ekosistem
- 3.10.2 Menjelaskan tipe - tipe interaksi antar komponen biotik
- 3.10.3 Menggambar skema pola interaksi antar komponen biotik menjadi rantai makanan atau jaring-jaring makanan
- 3.10.4 Membedakan berbagai macam piramida ekologi
- 3.10.5 Menganalisis produktivitas ekosistem
- 3.10.6 Menguraikan interaksi komponen biotik dan abiotik dalam berbagai daur biogeokimia dan perubahannya di ekosistem
- 3.10.7 Menyajikan karya dalam bentuk tertulis berdasarkan hasil observasi

4.10 Menyajikan karya yang menunjukkan interaksi antar komponen ekosistem (jaring-jaring makanan, siklus biogeokimia)

- 4.10.1 Membuat karya berupa poster jejaring makanan yang terjadi pada ekosistem air/darat/batuan/suksesi dan macam-macam interaksi komponen ekosistem yang dilakukan secara berkelompok.

CAPAIAN PEMBELAJARAN, TUJUAN PEMBELAJARAN DAN PETUNJUK PENGGUNAAN

CAPAIAN PEMBELAJARAN (CP)

Pada akhir fase E, peserta didik memiliki kemampuan untuk responsif terhadap isu-isu global dan berperan aktif dalam memberikan penyelesaian masalah. Kemampuan tersebut antara lain mengamati, mempertanyakan dan memprediksi, merencanakan dan melakukan penelitian, memproses dan menganalisis data dan informasi, mengevaluasi dan merefleksikan, serta mengkomunikasikan dalam bentuk proyek sederhana atau simulasi visual menggunakan aplikasi teknologi yang tersedia terkait dengan energi alternatif, pemanasan global, pencemaran lingkungan, nano teknologi, bioteknologi, kimia dalam kehidupan sehari-hari, pemanfaatan limbah dan bahan alam, pandemi akibat infeksi virus. Semua upaya tersebut diarahkan pada pencapaian tujuan pembangunan yang berkelanjutan (SDGs). Melalui keterampilan proses juga dibangun sikap ilmiah dan profil pelajar pancasila.

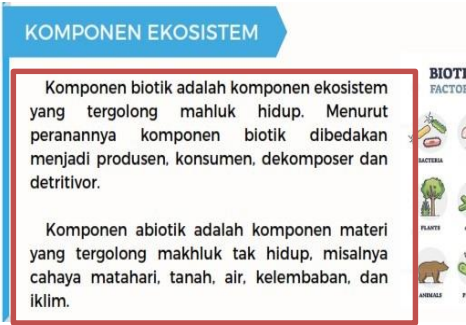
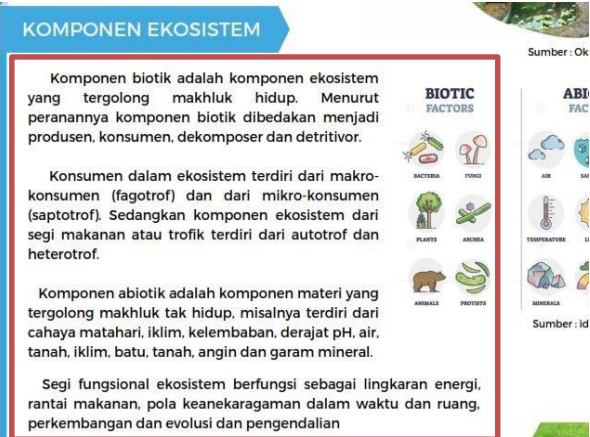
TUJUAN PEMBELAJARAN (TP)

- Siswa mampu mengidentifikasi komponen - komponen penyusun ekosistem
- Siswa mampu menjelaskan tipe - tipe interaksi antar komponen biotik
- Siswa mampu menggambar skema pola interaksi antar komponen biotik menjadi rantai makanan atau jaring-jaring makanan
- Siswa mampu membedakan berbagai macam piramida ekologi
- Siswa mampu menganalisis produktivitas ekosistem
- Siswa mampu menguraikan interaksi komponen biotik dan abiotik dalam berbagai daur biogeokimia
- Siswa mampu menyajikan karya dalam bentuk tertulis berdasarkan hasil observasi
- Siswa mampu menganalisis data pengamatan tentang hubungan antara komponen biotik dan abiotik, peranannya dalam ekosistem, dan mengaitkannya dengan keseimbangan lingkungan yang disajikan dalam bentuk laporan tertulis.

PETUNJUK PENGGUNAAN LEMBAR KERJA PESERTA DIDIK (LKPD)

- Bacalah petunjuk penggunaan dengan seksama.
- Isilah identitas kelompok Anda pada kolom yang sudah disediakan.
- Pastikan Anda sudah memahami dengan baik materi ekosistem yang telah dijelaskan sebelumnya oleh Guru Biologi.
- Bacalah petunjuk kerja dengan teliti pada setiap kegiatan dalam LKPD atau dengarkan instruksi yang diberikan oleh guru.
- Kerjakan setiap kegiatan dengan penuh tanggung jawab, disiplin, dan sesuai dengan prosedur ilmiah.
- Catat semua hasil diskusi pada lembar yang sudah disediakan dan jawablah pertanyaan yang tersedia dengan tepat.
- Tanyakan pada guru apabila terdapat hal yang belum dimengerti.
- Presentasikan hasil diskusi kelompok Anda dan kumpulkan kepada Guru.

Validation Results (Suggestions and Improvements)

Validator Suggestions	Revision Result
Section that needs to be improved by adding information to the title of the activity 	Section after revised by adding information to the activity title 
Sections that require additional in-depth information 	Section after being corrected according to suggestions from material expert validators 
The part that needs to be corrected is the writing of the image source which is still written incorrectly. 	The part that has been corrected by changing the image source to Oktaviana, 2022 

Practicality Test Results of Student Worksheets

Data on the results of the practicality test were obtained from the assessment of student worksheets that had been developed on the questionnaire instrument for the practicality of student worksheets by teachers and students that had been provided. The purpose of the practicality test is to test whether the development product is practical and easy to use by users (Annisa et al., 2020; Fithriyah & As'ari, 2015). Practicality is measured after students are given learning treatment using student worksheets on ecosystem material based on discovery learning with discussion methods. Furthermore, after being given treatment and the practicality assessment stage by teachers and students, the results were analyzed descriptively to determine the practicality of the discovery learning-based student worksheets that had been developed. The results of the biology subject teacher's practicality test are presented in Table 4.

Table 4. Results of Practicality Test of Student Worksheets by Biology Subject Teachers

No	Aspect	Score Obtained	Max Score	Percentage (%)	Category
1	Student Worksheet Materials	20	20	100	
2	Student Worksheet Presentation	50	49	98	
3	Discovery Learning	20	20	100	
4	Benefits	10	10	100	
Average Percentage				99,5	Very Valid

The results of the student practicality test are presented in Table 5.

Table 5. Practicality Test Results of Student Worksheets by Students

No	Aspect	Percentage (%)	Category
1	Student Worksheet Material	84,4	
2	Readability of Student Worksheet	81,2	
3	Attractiveness	79,3	
4	Benefits	80,2	
Average Percentage		81,3	Very Valid

Based on Table 4 and Table 5, the student worksheet products developed obtained a percentage value of the practicality of student worksheets from teachers of 99.5% and obtained a percentage value of the practicality of student worksheets from students of 81.3%. Where from the two percentage values, the student worksheets are included in the very valid category so that they are practical to use in learning even though there are still some revisions. This is in line with Riduwan's (2013) statement which states that the practicality score obtained is categorized as very practical and easy to use because the score obtained is $\geq 80\%$ (Riduwan, 2013). Umbaryati (2016) states that student worksheets are useful for activating students in the learning process, helping to develop concepts, train to find an' develop process skills, as guidelines for teachers and students in carrying out the learning process.

Results of Student Worksheet Effectiveness Test

To determine the effectiveness of the product on cognitive student learning outcomes, researchers used evaluation questions on ecosystem material which before being tested in large-scale classes the questions were first analyzed and selected in order to get good quality questions. The question selection process used a limited class of 12 students with 25 questions. The questions used consisted of questions at levels C1 to C6 according to Bloom's taxonomy. On this occasion, we used three limited classes to test the questions so that the questions used totaled 75 questions. After the questions were tested in a limited class, the questions were then analyzed using the Anates V4 Application to determine the quality of the questions based on the validity, reliability, difficulty level and differentiation of the questions. The questions used are questions that have high validity and moderate to high question reliability. In addition, the criteria for the selected questions must also have criteria for easy, medium and high difficulty levels and good question differentiation. After that, evaluation questions are used to determine and evaluate the knowledge of students who have used discovery learning-based ecosystem material student worksheets.

The effectiveness test of student worksheets needs to be carried out at SMA Negeri 12 Semarang, this is because the learning outcomes of the cognitive domain of students have not reached classical completeness. The percentage of students in class X-11 before the treatment who had reached classical completeness was only 47% of the total 36 students. This is because the teaching materials used have not led students to find concepts, but only give concepts (Setiowati et al., 2017). Therefore, in our research, we conducted an effectiveness test to determine the extent to which the student worksheets on ecosystem material based on discovery learning were developed on student learning outcomes in the cognitive domain, psychomotor domain and affective domain. The percentage of the number of students who get complete and incomplete scores after using student worksheets can be seen in Figure 2.

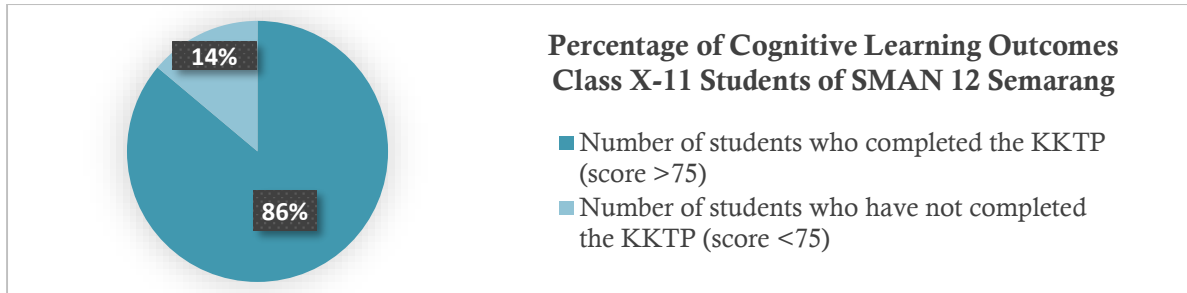


Figure 2. Percentage of the number of students who scored complete and incomplete after the use of Student Worksheets

The number of students in one class was 36 students. The percentage of students whose scores were complete (exceeding the KKTP threshold of 75) was 86%, which was 31 students (Figure 2). The classical learning completeness value of class X-11 was 86%. This percentage shows that the students of class X-11 as a whole are declared to have completed their learning because in one class there are more than or equal to 85% of students who have completed their learning. The use of discovery learning-based student worksheets will have a positive impact where students will be directly involved in learning by finding and exploring information independently so as to provide new understanding and learning outcomes (Siahaan et al., 2022). The results of data analysis of student learning outcomes of class X-11 SMA Negeri 12 Semarang are presented in Table 6.

Table 6. Data Analysis of Student Learning Outcomes

Average Learning Outcomes		
Cognitive Score	Psychomotor Score	Affective (Attitude) Score
80	81,2	70

Based on these results, it can be interpreted that student worksheets are feasible and practical to use for students to support biology learning on ecosystem material. Student worksheets are declared to be good and able to add students' insights, motivate students, and help students solve problems and find concepts independently and can make students more active during the learning process. The active attitude referred to in this study is student activeness during discussion activities, courage to express opinions, can complete tasks well and can carry out presentation activities well. Discovery learning-based student worksheets are considered capable of helping students become more active during the learning process and in finding a concept. According to Jahrah (2022), using student worksheets can make it easier for students to understand the material, summaries and assignments given by the teacher in accordance with the material being taught and can make students active in the process of learning activities by asking questions, discussing with their peers so that they can get maximum learning results.



Figure 3. Students of Class X-11 SMA Negeri 12 Semarang are very enthusiastic and active in discussing the activities in the Student Worksheet.

The results of the psychomotor assessment of students in class X-11 SMA Negeri 12 Semarang were assessed by four aspects of assessment, namely discussion skills, completing tasks, courage to express opinions and presentation activities. Based on Table 6, the average result of psychomotor assessment of students in class X-11 SMA Negeri 12 Semarang is 81.2. This value can be interpreted that students of class X-11 after implementing learning using discovery learning-based student worksheets on ecosystem material have the ability to discuss well among group members and have the courage to express opinions in a discussion (Figure 3). In addition, students can also complete the tasks given well and can communicate the results of the discussion in the form of presentations well. Psychomotor assessment is needed because this assessment is used to determine the extent to which each student learns and the extent to which they apply their learning outcomes (Lubis, 2021). Psychomotor assessment is an assessment conducted by teachers to measure the level of achievement of student skill competencies (Yulianti et al., 2014). On the results of the assessment of affective aspects, namely the environmental care attitude of students in class X-11 SMA Negeri Semarang, the class average score was 70 (Table 6). Where the value shows that the environmental care attitude of students in the class is in the good category. Instilling an attitude of environmental care towards students can be started from keeping the class and school clean by throwing garbage in its place, doing class picket, caring for plants, and others (Ismail, 2021). This behavior plays a very important role in instilling the character value of environmental care (Harianti, 2017).

Most of the students in class X-11 SMA Negeri 12 Semarang obtained satisfactory scores above the KKTP score limit of 75 and stated that the student worksheets were practical to use to increase their insight and understanding of ecosystem material. They were also observed to be active in discussions, dare to express opinions, can complete tasks well and are able to convey the results of discussions in presentation activities well. Some students said that the many terms in biology material made them confused so they did not like biology lessons. In addition, teacher factors can also affect students' dislike of learning materials. Students who feel comfortable learning with the situation and the teacher who teaches them will be more helpful in understanding concepts so that they can improve their learning outcomes. This is indicated by the presence of students who feel confused and difficult when working on practice problems that are slightly different from the example problems that the teacher has given. This is the main cause of low student learning outcomes (Samitra et al., 2018). The use of the discovery learning model can make students more active in discussions and can find concepts independently so that interaction between students can also be well established with the discussion.

Overall from the results that have been obtained, it states that the student worksheets developed are declared valid and practical to use during the learning process, besides that the student worksheets are also declared effective for students to help improve understanding of ecosystem concepts and student learning outcomes at SMA Negeri 12 Semarang and are able to help improve student skills so that students become active in discussions, can complete tasks well, dare to express opinions and communicate the results of discussions through presentation activities.

CONCLUSION

Student worksheets on discovery learning-based ecosystem material that have been developed have different characteristics from previously developed student worksheets. In this student worksheet, it is designed with a simple display so that students are more focused on the content that we compiled in accordance with the syntax of the discovery learning model which hopes that students can find concepts independently so that more meaningful learning can be realized. In addition, based on the data analysis and discussion that has been carried out, the student worksheets on ecosystem material based on discovery learning that have been developed are declared valid and feasible to use with validity from material experts of 91.66% and validity from media experts of 96.62%; practical to use with practicality from teachers of 99.5% and practicality from students of 81.3%; and student worksheets are declared effective in ecosystem learning in the classroom based on student learning outcomes, namely the class average for cognitive scores of 80, psychomotor scores of 81 and affective scores of 70.

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