BioEdu
Berkala Ilmiah Pendidikan Biologi
Vol. 14 No. 1 Tahun 2025 Hal: 128-139
https://ejournal.unesa.ac.id/index.php/bioedu

THE DEVELOPMENT OF A CONCEPT ATTAINMENT MODEL BASED E-WORKSHEET TO IMPROVE THE BIOLOGY CONCEPTUAL UNDERSTANDING OF HIGH SCHOOL STUDENTS ON THE MATERIAL OF ECHINODERMATA PHYLUM CLASSIFICATION

Pengembangan E-LKPD Berbasis Model Pencapaian Konsep untuk Meningkatkan Pemahaman Konsep Biologi Peserta Didik SMA dalam Materi Klasifikasi Filum Echinodermata

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Abstract

Understanding concepts is an important thing to be emphasized by students so that they are able to solve problems related to the material being studied. Understanding concepts is a prerequisite to train students' thinking skills. Indicators of understanding concept include, 1) interpreting, 2) classifying, 3) comparing, 4) exemplifying, 5) explaining, 6) inferring, and 7) summarizing. Concept attainment model-based e-worksheet can be one of alternative to train understanding concepts. The purpose of this research was producing concept attainment model-based e-worksheet on the material of the Echinodermata Phylum classification which is valid, practical, and effective to improve students' conceptual understanding. The applicability of the e-worksheet was limited to 30 students of a senior high school in Surabaya. Data collection methods included validation, observation, tests, and response questionnaires. The e-worksheet was valid if it got validity score of ≥ 2.51, the e-worksheet was practical if its applicability of e-worksheet and positive response of students was ≥ 75%, and the e-worksheet was effective if it obtains n-gain score of ≥ 0.7. The research results showed an average of the validity score of 3.6 (very valid), the applicability reached 94% (very practical), the positive response from students reached of 98.4% (very practical), and the n-gain score reached 0.71 (very effective). Based on these data, the e-worksheet is declared valid, practical, and effective to improve students' understanding concepts.

Keywords: E-worksheet, understanding concepts, concept attainment model

Abstrak

Pemahaman konsep merupakan hal penting yang perlu ditekankan oleh siswa agar mereka mampu menyelesaikan permasalahan terkait dengan materi yang dipelajari. Pemahaman konsep adalah prasyarat untuk melatih keterampilan berpikir siswa. Indikator pemahaman konsep meliputi, 1) menafsirkan, 2) mengklasifikasikan, 3) membandingkan, 4) mencontohkan, 5) menjelaskan, 6) menyimpulkan, dan 7) merangkum. E-LKPD berbasis concept attainment model dapat menjadi salah satu alternatif untuk melatih pemahaman konsep. Tujuan penelitian ini yaitu menghasilkan E-LKPD berbasis concept attainment model pada materi klasifikasi Filum Echinodermata yang valid, praktis, dan efektif untuk meningkatkan pemahaman konsep siswa. Penelitian ini menggunakan model 4D, yang terdiri dari langkah-langkah mendefinisikan, merancang, mengembangkan, dan diseminasi. Penerapan E-LKPD dibatasi pada 30 siswa dari salah satu SMA di Surabaya. Teknik pengumpulan data mencakup validasi, observasi, tes, dan angket. E-LKPD dinyatakan valid jika memperoleh skor validitas ≥ 2,51, dinyatakan praktis jika keterlaksanaan dan respon positif siswa mencapai ≥ 75%, dan dinyatakan efektif jika memperoleh skor n-gain ≥ 0,7. Hasil penelitian menunjukkan rata-rata skor validitas 3,6 (sangat valid), skor keterlaksanaan mencapai 94% (sangat praktis), respon positif siswa mencapai 98,4% (sangat praktis), dan skor n-gain mencapai 0,71 (sangat efektif). Berdasarkan data ini, E-LKPD dinyatakan valid, praktis, dan efektif untuk meningkatkan pemahaman konsep siswa.

Kata kunci: *E-LKPD, , pemahaman konsep, concept attainment model*

INTRODUCTION

Understanding concepts is an important thing to be achieved in student learning. Adhani & Rupa (2020) stated that understanding concepts plays an important role in solving problems related to the concept being studied. During the learning process, students often got misunderstandings in learning concepts or misconceptions (Safitri & Agnafia, 2022). It was happened because they received inaccurate or deviated information (Tompo *et al*., 2016). These misconceptions caused students to have trouble in linking one concept to others (Mentari *et al*., 2017). Students can be considered understand to biological concepts if they are able to fulfill the indicators of understanding concept, namely, explaining, exemplifying, interpreting, classifying, comparing, summarizing, and inferring (Anderson & Krathwohl, 2001; Safitri & Agnafia, 2022).

The characteristics of biology learning included factual, conceptual and procedural knowledges (Kusumaningrum *et al*., 2021), as well as learning on animal kingdom classification material for high school level (Jayanti *et al*., 2022). Some research showed that students had difficulties in understanding concepts related to the material of animal kingdom classification, thus obstructs their learning progress (Hindi & Muthahharah, 2021). This phenomenon is also found in one of high school in Surabaya. Based on an interview with three internship students of a biology education program and a high school biology teacher, the students' ability to understand the material of animal kingdom classification is considered low. In addition, this could also be proven by their summative scores. The scores showed that 103 of 144 students or about 71% of them got below the minimum score.

Understanding living things classification material needs a visual observation on specimens or objects (Pratami *et al*., 2022). Mahbubah *et al*. (2022) stated that results of morphological observations were used as a bases to classify animals into phyla. One of the phyla in the animal kingdom is Echinodermata. The Echinodermata phylum is divided into five classes, namely Asteroidea (Starfish), Ophiuroidea (Star snake), Holothuroidea (Sea cucumber), Echinoidea (Sea urchin), and Crinoidea (Sea lily). Each of them has special characteristics that are used for grouping (Sandhu *et al*., 2003; Mahbubah *et al*., 2021). In learning of this material, students are required to be skillful in building understanding concepts of the animal kingdom classification material.

Categorizing several characteristics into certain groups through morphological observations of specimens on the material of Echinodermata classification is in line with the concept attainment model activity. Concept attainment model is one of learning models that is represented to develop better thinking skills of students (Yuliati, 2018). Nainggolan & Derlina's research (2021) stated that students' learning mastery was high because they were motivated and interested in learning using the model. Weil and Joyce (1978) in Anjum's research (2018) explained that, the syntax of the concept attainment model contains three steps, namely 1) presenting data and identifying concepts, 2) testing attainment of the concept, and 3) analyzing of thinking strategies. The syntax guides students to understand the concept through inductive thinking after attributes of examples and non-examples were presented in learning. So that, the students gain depth understanding of certain concepts (Bruner *et al*., 1967; Johnson *et al*., 1992).

Observe the specimens of Echinodermata in their habitat was not possible because it takes a long time to get the area. The long trip would reduce a lot of learning time. So, the learning becomes ineffective. In this case, students from one of high school in Surabaya need a media which can visualize the characteristics of Echinodermata, so they can observe and identify the characteristics in order to learn the Echinodermata classification.

Based on this description, it is necessary to have an e-worksheet based on the concept attainment model to guide and support students' learning. The e-worksheet contains systematic instructions that guide students to carry out activities independently, such as learning material and training students' thinking skills (Azizah & Kuswanti, 2021). E-worksheet can be designed to stimulate students to be more active in learning and become accustomed to solve existing problems (Nisak & Susanti, 2023).

The e-worksheet should be designed as an electronic learning tool that could be accessed practically through laptop, tablet, or smartphone (Firtsanianta & Khofifah, 2022). The e-worksheet guides students to learn actively according to the syntax of concept attainment model. The activity is identifying the characteristics of specimens based on morphological observation. Visualization of the specimens in the e-worksheet was presented in two-dimensional and three-dimensional forms, so the morphological shape of the specimens can be observed as a whole. Two-dimensional visualizations can be obtained by capturing image and several from articles, while three-dimensional visualizations can be obtained

from Sketchfab.com. The representative visualization of the specimens will make students easier to do morphological observations of Echinodermata without having physical specimens (Ziegler *et al*., 2008).

This research is expected to help students to improve conceptual understanding. The purpose of this research is to produce a concept attainment model-based e-worksheet that is valid, practical, and effective to improve students' conceptual understanding on the material of the Echinodermata Phylum classification.

METHOD

This research was categorized as research and development (R&D) study used the 4-D model (define, design, develop, and disseminate). The define stage was a stage where researcher identified needs were used as a reference to create e-worksheet and overcome problems. The design stage was a stage where researcher designed a potential solution (product) by involving creativity and innovation. At the develop stage, researcher implemented the product design to become a real product, involving the stages of manufacturing, testing, validation and refinement. The last is the disseminate stage, which the stage of product dissemination through article publication.

This research developed concept attainment model-based e-worksheet to improve students' ability of understanding concept on the material of Echinodermata Phylum classification. The e-worksheet was implemented for grade 10 students of one of high schools in Surabaya to get empirical data. The research methods included product validation, observation, pre-test and post-test, and questionnaires.

The validation was carried out by an educational expert, a material expert, and a high school biology teacher. The validity assessment for each aspect referred to validity score criteria listed in Table 1.

Table 1. Criteria of E-worksheet Validity Score

Score	Criteria
1	Disagree
2	Weakly agree
3	Agree
4	Strongly agree

The validity of the e-worksheet was determined based on interpretation criteria listed in Table 2.

Table 2. Interpretation Criteria of E-worksheet Validity

Score	Criteria
1.00-1.75	Invalid
1.76-2.50	Quite valid
2.51-3.25	Valid
3.26-4	Very valid

Based on Table 2, the e-worksheet was declared valid if the validity was ≥ 2.51.

The practicality data of the e-worksheet were obtained from observation of the applicability and responses questionnaires. The applicability observation was carried out by three observers referring aspects listed in an observation sheet. The observation sheet used yes-no response format to quickly assessed whether particular aspects of an observation are applicable or not. The 'yes' response indicated that the criterion was met. Meanwhile 'no' response indicates that the criterion wasn't met. The applicability score of each aspect was determined by Guttman scale as listed in Table 3.

Table 3. Guttman Scale Score Criteria

Answer	Score
Yes	1
No	0

The applicability of the e-worksheet was calculated using the following formula:

$$Applicability\ (\%) = \frac{Total\ score}{Minimun\ score} x\ 100\%. \ldots . (1)$$

Percentage of applicability that obtained was interpreted based on the criteria listed in Table 4.

Table 4. Criteria of Applicability (Riduwan, 2018)

Applicability (%)	Criteria
0-48.9	Very impractical
49-61.9	Impractical
62-74.9	Fairly practical
75-87.9	Practical
88-100	Very practical

Based on Table 4, the e-worksheet was declared practically if it obtained applicability ≥ 75%. Another method to obtain the practicality data was students' responses questionnaires. Filling the responses questionnaires by students was carried out after learning activity. The questionnaires also used yes-no response format to categorize responses in two distinct categories. The 'yes' response represented a positive response or agreement with the statement or question. Meanwhile 'no' response represented negative response or disagreement. The responses were determined by Guttman scale listed in Table 3. The positive responses were calculated using the following formula :

$$PR\ (\%) = \frac{YR}{TAS} x100\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots . (2)$$

Notes :
PR : Positive responses
YR : Total of "Yes Response"
TAS : Total amount of students
The positive responses were interpreted based on criteria listed in Table 5.

Table 5. The Criteria of Positive Responses

Positive response (%)	Criteria
0-48.9	Very impractical
49-61.9	Impractical
62-74.9	Fairly practical
75-87.9	Practical
88-100	Very practical

Based on Table 5, the e-worksheet was declared practically if it obtained positive responses ≥ 75%.

The effectiveness of the e-worksheet was determined by analyzing the pre-test and post-test using the n-gain formula as follows:

$$N\,(g) = \frac{(Sf) - (Si)}{Smax - Si} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Notes :
N(g) : N-gain score
Sf : Post-test score
Si : Pre-test score
Smax : Maximum score (100)

The results of the n-gain scores were categorized based on n-gain score level criteria as listed in Table 6.

Table 6. N-Gain Score Criteria

N-gain Score	Category
(<g>)>0.7	High
0.3<(<g>)<7	Medium
(<g>)<0.3	Low

Based on Table 6, the effectiveness of e-worksheet is declared high if the n-gain score> 0.7.

RESULT AND DISCUSSION

Align with the purpose of the development, this research produced a concept attainment model based e-worksheet which valid, practical, and effective to improve biological understanding concept for students in the material of Echinodermata Phylum classification. Discussion related to the e-worksheet, the validity, practicality, and effectivity were explained detailly in the following description,

The Concept Attainment Model-Based E-worksheet Developed

The concept attainment-based e-worksheet was developed to improve the students' conceptual understanding. It has features that support concept attainment model learning, which are *"investigate the morphology", "observe the specimen", "define the concept",* and *"confirm the concept"*. This e-worksheet presents material related to the Echinodermata classification and visualizations of Echinodermata specimens. The visualizations are presented in two and three dimensions. Visualizations of two-dimensional specimens were taken from photos of original specimens. Those are presented with a blue background, including specimens of starfish, brittle stars, and sea cucumbers. The three-dimensional visualization of specimens is presented by embedding the link to the website of sketchfab.com that could be accessed independently by students. The three-dimensional visualizations could be observed as a whole morphology by rotating the specimen to get the oral and aboral side of it.

Each feature also presents test items that train students' conceptual understanding. The test items were arranged in the form of short descriptions and referred to the morphological observation. Indicators of conceptual understanding trained by using the e-worksheet included, 1) interpreting, 2) classifying, 3) comparing, 4) exemplifying, 5) explaining, 6) inferring, and 7) summarizing. These indicators can be achieved by steps of the syntax of concept attainment model, namely, 1) presentation of data and identification of concepts, 2) testing attainment of the concept, and 3) analyzing thinking strategies. The details of the e-worksheet are presented in Table 7.

Table 7. Product of Concept Attainment Model-Based E-worksheet

No.	Display	Description
1.	Cover Page	The cover page contains title of the e-worksheet, the characteristics of the e-worksheet, name of the topic to be studied, name of authors, and an identity form to be filled in by students.

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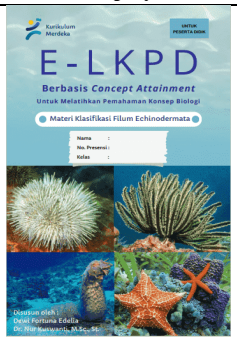
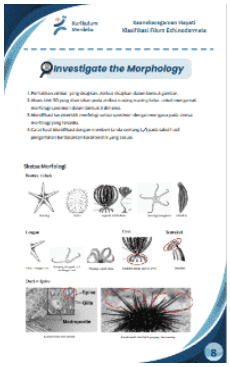
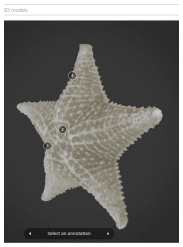
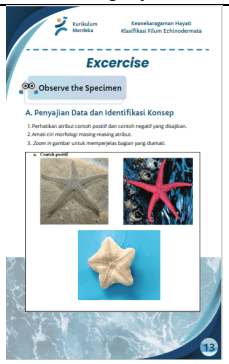
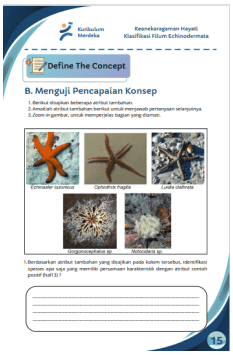
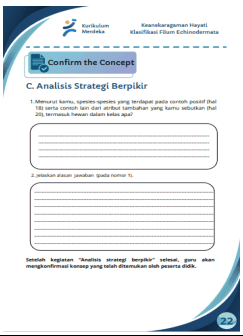
No.	Display	Description
		
3.	Theoretical overview page 	Theoretical overview page contains general description of the Echinodermata Phylum classification.
4.	Feature 1 : *Investigate the morphology* 	The feature of "investigate the morphology" contains instructions for doing morphological virtual observations of Echinoderms of five different classes, through two-dimensional and three-dimensional attributes, and also activities to identify morphological characteristics by filling table of observation results. The understanding concept indicators trained in this feature are interpreting and classifying.
5.	3D model display 	The 3D model display of specimens can be accessed at Sketchfab.com. The specimens can be rotated, so the students are able to observe the morphology as a whole.
6.	Feature 2 : *Observe the specimen*	The feature of "observe the specimen" contains attributes of positive examples and negative examples that will be identified by students and

No.	Display	Description
		also contains test items related to the differences of characteristics of the attributes. The indicators that are trained by this feature are interpreting and comparing.
7.	Feature 3 : *Define the concept* 	The feature of "define the concept" presents additional attributes without labeling positive and negative examples. The test items which presented in this feature train students to exemplify the specimens from additional attributes which have similar morphological characteristics with the positive attributes. The indicators that are trained by this feature are explaining and exemplifying.
8.	Fitur 4 : *Confirm the concept* 	The feature of "confirm the concept" contains test items to confirm the concepts that students have found in the previous learning phase. The indicators of conceptual understanding trained by this feature are inferring and summarizing.

The Validity of Concept Attainment Model-Based E-worksheet

The validity of the e-worksheet was determined based on the several validation aspects. The aspects included content, language, presentation, understanding concepts' indicators, and concept attainment model characteristics. Each aspect consists of several detailed criteria that were rated on a range of 1-4. The results of validation are presented in Table 8.

Table 8. Validation Results of the Concept Attainment Model-Based E-worksheet

Criteria	Validation Score			Ave-rage
	V1	V2	V3	
A. Aspect of Content				
Content of the Echinodermata Phylum on the e-worksheet is in line with the learning objectives	4	4	4	4.0
Content of the e-worksheet is correct according to the concept of the material that should be	4	3	3	3.3
Content of the e-worksheet is in line with the learning outcomes of the *Merdeka* curriculum	4	4	4	4.0
B. Aspects of Language				
The e-worksheet uses appropriate Indonesian language which in line with *PUEBI*	4	3	4	3.7
The sentences are clear, operational, and easy to be understood	4	3	3	3.3
C. Aspect of Presentation Validity				
The performance of the e-worksheets' cover is in line with the material of the Echinodermata classification	4	3	4	3.7
Topic in the e-worksheet is in line with the material taught	4	3	4	3.7
Images presented are representative and relevant to morphological observation	4	4	4	4.0
D. Aspect of Understanding Concept				
Activities in the e-worksheet train students to classify specimens based on their morphology	4	3	3	3.3
Activities in e-worksheet train students to compare the morphological characteristics among classes of the Echinodermata	4	3	3	3.3
The activities in the e-worksheet train students to explain the morphological characteristics of the Echinodermata Phylum	4	3	3	3.3
The activities in the e-worksheet train students to interpret the morphological characteristics of the Echinodermata Phylum	4	3	3	3.3
The activities in the e-worksheet train students to determine examples of animals that belong to the Echinodermata	4	3	3	3.3
The activities in the e-worksheet train students to infer the morphological characteristics of the Echinodermata Phylum	4	3	3	3.3
The activities in the e-worksheet train students to summarize the material	4	3	3	3.3
E. Aspects of Concept attainment Characteristics Validity				
Displaying learning objectives and guidelines for preparation of observation work	4	3	4	3.7
Displaying positive examples and negative examples as material for concept analysis (Phase 1: Presenting data and identifying concept)	4	4	3	3.7
Displaying additional examples that help students to check the acquisition of learning concepts (Phase 2: Testing attainment of the concept)	4	4	3	3.7
Displaying simple test items to be analyzed by students (Phase 3: Analyzing of thinking strategies)	3	3	3	3.0
Average Score				3,6
Interpretation of Validity				Very Valid

Based on Table 8, the e-worksheet obtained an average score of 3.6. The score is included in the very valid category (Riduwan, 2013). Some validity aspects received suggestions from the validators. The suggestions are described in Table 9.

Table 9. Validity Aspects and Validator Suggestions

No.	Validity Aspect	Validator Suggestions
1	Content	Need further explanation in the theoretical overview about general characteristics of the Echinodermata, including explanation about ossicle and benefits of Echinodermata in economy and medical field.
2	Language	Improvements for several sentences in the e-worksheet into operational sentences for easier understanding by students.
3	Understanding concepts' indicators	The ideal observation of the Echinodermata morphology is using real specimens. However, concept attainment model-based e-worksheet can be used as a solution to overcome school limitation in carrying out direct observations in the original habitat.
4.	Concept Attainment Model Characteristics	Change the sentence "Displaying simple test items to be analyzed by students" into "Displaying test items to be analyzed by students", because simple test items isn't relevant to the analyzing activities carried out in phase 3 : Analyzing of Thinking Strategies.

Based on Table 9, there are four aspects that received suggestion from validators.

The first aspect is about "content validity". The first and third criteria of this aspect obtained an average score of 4. Meanwhile, the second criterion obtained 3.3 (Table 8). The second criterion is about the correctness of the material that presented in the e-worksheet with the concept that should be. According to a validator, it needs further explanation about the material, so that, it can strengthen students' conceptual understanding (Table 9). The completeness of explanation ensures there is no concept is missed, so that students can build a strong knowledge base (Maharani & Hidayah, 2024).

The second aspect is "language validity". The criterion of "The sentences are clear, operational, and easy to understand" obtained an average score of 3.3. The sentences should be improved into operational sentences, especially instruction sentences (Table 9). The use of operational sentences in learning greatly affects students' reading comprehension (Özdemir, 2018).

The third aspect is "presentation validity". Its three criteria obtained scores of 3.7, 3.7 and 4.0 (Table 8). The validation scores of this aspect refers to cover display, the topics that presented in the e-worksheet, and representative visualization of specimens in two-dimensional and three-dimensional. An interesting and interactive presentation can increase student involvement in learning and can help students understand the concept more easily (Syafitri & Tressyalina, 2020).

The fourth aspect is "understanding concepts' indicators". It obtained average score of 3.3. The score is the lowest among others. According to the validator's opinion, using the e-worksheet to guide morphological observation of Echinodermata will not be optimal due to the limitation of digital specimen visualization, while the ideal morphological observation of Echinodermata is observing the real specimen directly. However, direct morphological observation in original habitat was not possible for students, because it would cause ineffective learning (Table 9). Therefore, using the e-worksheet can be a solution to improve their understanding concept of the material. These cognitive processes help students to more easily construct the meaning of the material being studied (Wilson, 2016).

The last aspect is "concept attainment model characteristics". This aspect obtained average score of 3.5 with a very valid interpretation (Table 8). The learning activities in the e-worksheet are in line with the syntax of the concept attainment model. Based on Table 9, The validator considered that the fourth criterion in the phrase of "displaying simple test items to be analyzed by students", is a contradictory statement. Because in analyzing, students need intricate test items that can train their thinking skills. The test items that presented in the e-worksheet should be complex. Therefore, the validators suggested to change the sentence of the criteria into "displaying the test items to be analyzed by students" (Table 9).

The Practicality of Concept Attainment Model-Based E-worksheet

The practicality of the e-worksheet was measured based on observation result of the implementation of e-worksheet and student response to the e-worksheet. Practicality data based on the applicability of using e-worksheet are presented in Table 10.

Table 10. Applicability of Using E-worksheet

No.	Applicability criteria	Applicability (%)
1.	Students read the instructions for using e-worksheet	96.7
2.	Students work in groups	96.7
3.	Students access the e-worksheet	96.7
4.	Students read the learning objectives	96.7
5.	Students read the theoretical overview listed in the e-worksheet	96.7
6.	Students do morphological observation activities to identify the morphological characteristics of Echinodermata	93.3
7.	Students categorize each of Echinodermata specimens based on morphological characteristics by filling characteristics table in the feature of "Investigate the Morphology"	96.7
8.	Students complete the test items that refer to the results of morphological observation	80.0
9.	Students do the Exercise in the feature of "Observe the Specimen" (Phase 1: Presenting data and identifying concept)	83.3
10.	Students do the Exercise in the feature of "Define the Concept" (Phase 2 : Testing attainment of the concept)	93.3
11.	Students do the Exercise in the feature "Confirm the Concept" (Phase 3 : Analyzing of Thinking Strategies)	96.7
12.	Students can exemplify the specimens which belong to the Echinodermata	96.7
13.	Students pay attention to the teacher's confirmation	96.7

No.	Applicability criteria	Applicability (%)
14.	Students write the conclusion of the result of learning activities that have been carried out	96.7
Average		94.0
Interpretation of Practicality		Very Practical

Based on Table 10, the applicability of using e-worksheet obtained an average of 94%. It interprets 'very practical' to be used in learning. The percentage shows that students were able to access the features, finished the learning activities, and completed the test items that presented in the e-worksheet. The aspects of applicability that are assessed include accessibility of the features by students, the suitability of syntaxes of the concept attainment model, and the suitability of features with indicators of conceptual understanding.

The practicality of using the e-worksheet could be influenced by features that can support students' learning. The features were adjusted to the syntax of the concept attainment model which was arranged coherently. It affected of learning efficiency. The e-worksheet is one of learning tools that can support efficiency and meaningful learning for students (Putri *et al*., 2021; Anisa *et al*., 2023).

Representative visualizations of Echinodermata which be provided in the e-worksheet shows the detail morphological part of Echinodermata. The students can practically observe the specimens of five classes from the dorsal to the aboral side, including body shape, arm shape, the presence or absence of arms and spine, and other details. The detailed display of body parts like the dorsal, aboral, and arms, along with specific features such as spines, makes it easier for students to understand structural differences across species (Arnone et al., 2015)

The practicality of the e-worksheet was also determined based on the result of students' response questionnaire. The results are presented in Table 11.

Tabel 11. Results of the Student Response Questionnaire

No	Criteria	Number of Students' Response		Positive Response (%)
		Yes	No	
A.	Aspect of Language			
1.	The e-worksheet uses Indonesian language that is easy to understand	30	0	100
2.	Instructions in the e-worksheet are easy to follow	30	0	100
3.	Questions in the e-worksheet are easy to understand	30	0	100
4.	The terms used in the e-worksheet are easy to understand	29	1	96.7
B.	Aspect of Presentation			
5.	The e-worksheet is interesting and in line with the material of the Echinodermata Phylum classification	29	1	96.7
6.	Cover design of the e-worksheet is interesting	27	3	90.0
7.	The size of letter/number in the e-worksheet is easy to read	30	0	100
8.	The e-worksheet interest you to learn it	29	1	96.7
9.	The e-worksheet can motivate you to learn through the activities in it	28	2	93.3
10.	Learning by the e-worksheet is fun and make you active	30	0	100
C.	Aspects of Concept Understanding Indicator			
11.	The e-worksheet trains you to interpret the morphological characteristics of Echinodermata	30	0	100
12.	The e-worksheet trains you to classify specimens in the appropriate class based on morphological characteristics	30	0	100
13.	The e-worksheet trains you to compare the morphological characteristics of specimens from several different classes	30	0	100
14.	The e-worksheet trains you to explain the morphological characteristics of Echinodermata	30	0	100
15.	Test items in the e-worksheet train you to exemplify animals included in the Echinodermata	30	0	100
16.	The activities in the e-worksheet train you to infer information from the observation activity	30	0	100
17.	The activities in the e-worksheet train you to summarize the learning material	30	0	100
18.	The activities in the e-worksheet train you to	30	0	100

No	Criteria	Number of Students' Response		Positive Response (%)
		Yes	No	
	draw conclusions related to the material that has been learned			
Average positive response				98.4
Interpretation of Practicality				Very Practical

Based on Table 11, the practicality of the e-worksheet obtained an average of positive response of 98.4% which is interpreted 'very practical'. The high positive response showed that learning using the e-worksheet could be carried out well. The e-worksheet that were assessed refer to the aspects included linguistic, presentation, and understanding concepts' indicators. The aspect that obtained highest positive response was understanding concepts' indicators which is reached an average (100%). It shows that the e-worksheet is relevant to be used in learning the material of Echinodermata classification to improve the understanding concepts. Mahbubah *et al*. (2021) stated that, the e-worksheet can be used as a learning resource for students in learning the material of the Echinodermata Phylum.

The Effectiveness of Concept Attainment-Based E-Worksheet

The effectiveness of the e-worksheet was determined based on n-gain scores' analysis of pre-test and post-test. The tests were conducted by students before and after using the concept attainment model-based e-worksheet in learning with the material of the Echinodermata Filum classification. The average of the n-gain scores of 30 students was 0.71 with a high effectiveness category (n gain> 7). The effectiveness are shown in Figure 1.

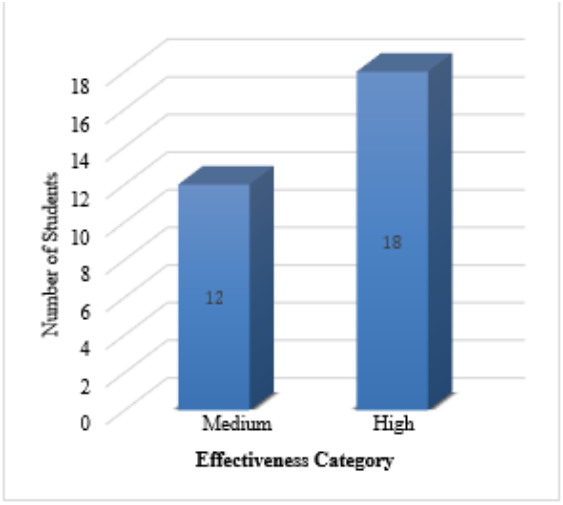


Figure 1. The Effectiveness Category of the E-worksheet

Based on Figure 1, the n-gain scores with high effectiveness category (0.71) were obtained by 18 students and medium category were obtained by 13 students. The high effectiveness was evidenced by the increase in post-test scores obtained by. It happened because during the period between the pre-test and post-test, students got learning material using the e-worksheet. So that, it could increase their understanding of the topic being tested (Marzano, 2003). The increase of the test scores shows that the e-worksheet is effective to improve students' understanding concept.

Overall, the students' ability to complete the test items related to the indicators of conceptual understanding, has increased. It shown in Figure 2.

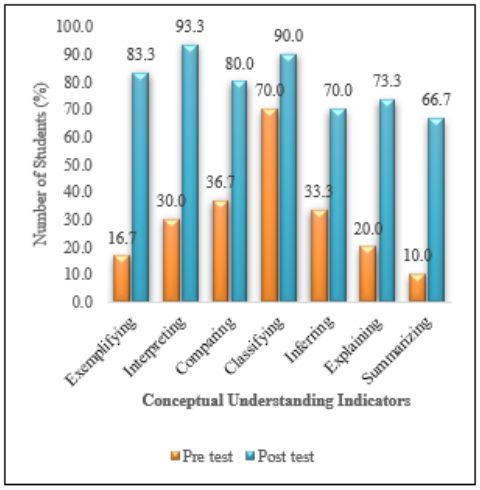


Figure 2. Improvement in Students' Understanding Concepts Ability

Based on Figure 2, the students' understanding increased for each indicator. The largest percentage are exemplifying indicator (66.7%) and interpreting indicator (63.3%). The ability to exemplify and interpret required students to understand the characteristics of the Echinodermata. The characteristics consist of, the shape of the body and arms, the presence or absence of arms, spines, cirri, and tentacles, also the size of the spines. Before using the e-worksheet, students had not mastered the material. It was the reason why many students got low pre-test score. In this case, the e-worksheet could guide and facilitate students to carry out morphological observation of Echinodermata using two-dimensional and three-dimensional visualizations. They facilitated to train their ability to interpret and classify.

The next indicator is comparing. Number of students who could achieve this indicator increased until 43.3% (Figure 2). This required students to identify the

differences and similarities of the specimens (Churches, 2008). The ability was trained by the feature of "observe the specimen" which is provide visualizations of specimens divided into positive and negative examples. The feature guide student to do morphological observation between two kinds of examples. Observing morphology is essential for training students to compare and distinguish characteristics between species (Krouki, 2022).

The next indicator is classifying. Before their learning activities, most of students who were able to achieve this indicator reached 70% (Figure 2). However, the post-tests' percentage was higher than the pre-test', achieving 90% (Figure 2). The improvement was supported by the specimens' visualization in the feature of "investigate the morphology". The visualizations are representative and complete for the five different classes of Echinodermata into two and three-dimensional. Visualization of specimens, whether through 2D or 3D models, can significantly help students in classifying and understanding the characteristics of biological structures (Tepla *et al*. 2022). Its feature presents guidance for students to classify animals in each class based on their morphological characteristics. Students' ability to classify was shown by their ability for grouping the specimens into certain classes.

The next indicator is inferring. The number of students who could do the test correctly was increased by 36.7% (Figure 2). This improvement was influenced by the learning activities guided by the e-worksheet. The feature of "confirm the concept" presents test items such as inferential questions in order to train students' ability to attain this indicator. When students work through inferential questions, they practice connecting the evidence to broader concepts or ideas, which strengthens their ability to interpret information and make logical conclusions (Dewitz, 2017).

The last two indicators are explaining and summarizing. The test items related to these two indicators are presented in essay questions. The percentages of these indicators' achievement were 53.3% and 56.7%. During the pre-test, most students had difficulty for describing their answers. In this case, the e-worksheet facilitated students by presenting feature of "define the concept" and "confirm the concept". By those features, they were trained for explaining and summarizing. After doing learning using the e-worksheet, students were able to elaborate their explanation in the post-test related to those indicators much better. This because during the period between the pre-test and post-test, students learned the material carefully and systematically, so that their understanding the topics improved (Marzano, 2003).

The effectiveness of e-worksheet is greatly influenced by its validity and practicality. A valid e-worksheet ensures that the material which presented is in line with the learning objectives and curriculum standards, thus providing a solid foundation for learning. A practical e-worksheet facilitated student easier to use it consistently. This combination of validity and practicality supported an effective e-worksheet which is able to improve students' learning outcomes and increase students' understanding concept (Fraenkel, 2009).

Conclusion

Based on the research, it has been produced concept attainment model-based e-worksheet to improve students' understanding concept in the material of Echinodermata Phylum classification. The e-worksheet is considered very valid with an average score of 3.6 included aspects of content, language, presentation, understanding concept, and concept attainment characteristics. The practicality was measured through applicability observations and students' response questionnaire, with a percentage of applicability of 94% and a positive response of 98.4% which interpreted very practical. The effectiveness of the e-worksheet was proven through an average of n-gain score of 0.71 which interpreted effectively high.

Suggestion

For future research, it is recommended to develop concept attainment-based e-worksheet for other biology materials with the appropriate characteristic and apply it at various levels of education and different locations to assess the consistency of its effectiveness. In addition, the integration of interactive technologies such as augmented reality (AR) can enrich the learning experience. A longitudinal approach can be used to evaluate the long-term impact of using the e-worksheet.

ACKNOWLEDGMENTS

The authors would like to thank Prof. Dr. Endang Susantini, M.Pd., and Mrs. Dr. Ulfi Faizah, S.Pd., M.Si. who have guided the author to complete this research and became validator. Thank is also given to the biology teacher as a validator and the observers who assessed the practicality of the e-worksheet.

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