



Development of Plant Diversity Media and Plant Determination Key in Learning Plantae with the SETS Approach in High School X Grade

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Abstract

The results of interviews with biology teachers at SMA N 1 Bangsri showed that 69.4% of X MIPA students received incomplete scores on the Plantae material. This is because the media is not used that can guide students in classifying the plants in the school environment according to the expected competencies. This study aims to identify the diversity of plants in SMA Bangsri. This research aims to identify the diversity of plants found in SMA Bangsri and to analyze the validity and practicality of the plant diversity media and plant determination key as a classification guide, which will be used in the SETS approach of Plantae learning. This research, which was implemented at SMA N 1 Bangsri, used the Research and Development method with the following steps: identification of potentials and problems, data collection, product design, product validation, product revision, and small-scale trials. Small-scale trials of plant diversity media and the plant determination key were carried out on 36 students of XI MIPA 5 using a practicality questionnaire. The results of this study indicate that the plants diversity in SMAN 1 Bangsri includes 92 types of plants consisting of 6 divisions namely Bryophyta, Pteridophyta, Coniferophyta, Cycadophyta, Gnetophyta, and Magnoliophyta. Validity of the plant diversity media and the plant determination key according to the material validator is 91.67%, the media validator is 96.67% with 'very valid' criteria. While the media practicality assessment by 69.4% of students stated that the media was 'very practical' and 30.6% of students stated that the media was 'practical', and teacher assessing the media 93.75% with very practical criteria. This shows that the plant diversity media and the plant determination key are very valid and practical for students to use in the Plantae learning using the SETS approach in X grade.

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INTRODUCTION

Based on the results of interviews with the Biology teacher at SMA N 1 Bangsri, it was found that in the Plantae material the student of X MIPA mean value's was 65.05 while the Biology minimum completeness criteria was 70, with the percentage of students who did not complete it was 69.4%. This means that the learning outcomes of students on this material are still low or basic competencies have not been fulfilled optimally. Basic competence 3.8. explained that students are expected to classify plants into divisions based on general characteristics, and relate their role in life (BSNP, 2016). So far students are only invited to observe and classify plant diversity without using media that can be used as a guide for students in classifying plants easily. The student's teaching materials are only textbooks and student worksheets made by teacher. In the student' textbooks there are only descriptions of each plant group were found, but determination key was not found as a guide for students to classify according to the demands of basic competencies.

One of the efforts that can be made to overcome this problem is by utilizing a learning media that can guide students in the classification process of plant diversity and is also integrated with elements of the environment, technology, and society related to its use in accordance with the expected basic competencies. The media that can be used as a classification guide in this study are the media of diversity and also the plant determination key.

Biodiversity (biodiversity) is the information needed to describe or reproduce an ecological community as a complex life system (Farnsworth, Adenuga, and Groot, 2015). The high biodiversity of plants, especially plants on earth, requires a classification or grouping process so that the name of the plant species can be identified so that it can be used, identification of areas for conservation, and to help maintain the ecosystem.

The determination key is made solely for identification purposes, as well as to distinguish various diversity of organisms (Griffing, 2011). The determination key has a series of specific statements regarding the characteristics of living things at each level or taxon in an order of choice that allows a person to have alternatives in choosing based on the characteristics possessed by the living things found. The determination key in classification learning is very likely to be presented with the intention of increasing the accuracy of students in making observations and digging up information. By using the determination key, students have a guide in the observation process, making it more efficient in using time. In line with Izza, Retnoningsih, & Pukan's (2018) research which states that the determination key of the results of local wisdom exploration can be used as a medium in high school biology learning, namely the classification of living things.

The media developed is integrated with the SETS (Science, Environment, Technology, and Society) approach with the aim of fulfilling basic competencies. As in Rasyid's research (2018) which illustrates that the components of the SETS approach can be applied in an instructional media. The SETS (Science, Environment, Technology, Society) is an approach that combines science with the environment, technology and society. Steele (2013). This approach is meaningful if scientific knowledge can be used to obtain a technology that can benefit society and while considering its impact on the environment. The SETS approach was chosen on the basis of the fact that the concept of science will repeatedly even always be applied in various contexts of life.

Based on the background of the problems that have been described, the purpose of this research is to analyze the diversity of plants in SMAN 1 Bangsri and to analyze the validity and practicality of the diversity media and the key to plant determination for learning Plantae with the SETS approach? "

RESEARCH METHODS

Research development of diversity media and the plant determination key was carried out at SMAN 1 Bangsri in the even semester of the 2019/2020 school year. The research design used is R & D (Research and

Development) (Sugiyono, 2016) starting with the identification of plant diversity in schools to compiling the key of determination. In order to make good media and meet the criteria, a validation process is carried out as an assessment of the quality of a media by the validator (media and material). In addition, suggestions from students are needed to analyze the practicality of the media by conducting small-scale trials by 36 students of class XI MIPA 1 online. Questionnaire in the form of a Ms. Word file distributed through the class WhatsApp Group application. The instrument used in retrieving all the data was a questionnaire with certain aspects of the assessment and a Likert scale scoring system. Then the assessment data is translated and analyzed using predetermined assessment criteria (Sudjana, 2011).

RESULTS AND DISCUSSION

Identification of plant diversity and making the plant determination key

Plant data in SMAN 1 Bangsri after being identified were as many as 93 plant species consisting of six plant divisions namely Bryophyta, Pteridophyta, Coniferophyta, Cycadophyta, Gnetophyta, and Magnoliophyta (Classis Liliopsida and Magnoliopsida).

Table 1 Recapitulation of the percentage of data on the diversity of plant species in SMAN 1 Bangsri

No	Divisio	Percentage (%)
1	Bryophyta	1,09
2	Pteridophyta	5,43
3	Coniferophyta	4,35
4	Cycadophyta	2,17
5	Gnetophyta	1,09
6	Magnoliophyta	85,87
	a. Liliopsida	28,26
	b. Magnoliopsida	57,61

Based on these data, the number of closed seed plants was found more when compared to the open seed plants, which were less distributed due to their low reproducibility. According to Crisp & Cook (2011) gymnosperms spread more slowly than angiosperms. These data indicate that the existence of plants in the SMAN 1 Bangsri environment has represented an example of each plant division according to the basic competency needs of Plantae learning. The biology teacher at SMAN 1 Bangsri also stated that the school deliberately planted these plants, especially plants with open seeds (Divisio Coniferophyta, Cycadophyta, Gnetophyta) so that students could observe directly in the school garden. Then based on the characteristics of each plant division, a determination key is compiled as follows

The key to Divisio

1. a. Plants with an indistinguishable structure (roots, stems, and the leaves)..... Bryophyta
- b. Plants with a structure can be distinguished (roots, stems, and leaves) 2
2. a. Development with spores..... Pteridophyta
- b. Development with seeds 3
3. a. Has flower Magnoliophyta
- b. Has no flower 4
4. a. The leaves are needle-shaped or spike-shaped..... Coniferophyta
- b. Other leaves shaped 5
5. a. Single and deep grooved leaves Cycadophyta
- b. Single and elongated leaves..... Gnetophyta

The Key to Classis Divisio Magnoliophyta

1. a. Leafless leaves, generally parallel leaf bones, single leaves with sitting

- rosette bleaves or alternating, flower parts in multiples of 3 (trimers) Liliopsida (monocot)
- b. The leaves are not frond, generally pinnate or finger leaf bones, single or compound leaves, with scattered or sitting leaves craggy, flower parts in multiples of 2, 4, 5 (dimers, tetramers, or pentamer) Magnoliopsida (dicot)

The results of the development of diversity media and the plant determination key consist of three main parts, namely introduction, content, and closure, if described: manuals for use of books, introduction to plant diversity, conceptual material regarding classification and determination key, key sheet of determination, and the examples use of plants in various fields of life (SETS), several descriptions of terms along with pictures of plant morphology, as well as photographs of examples of plant species at each level. The description of the cover of diversity media and plant determination key is shown in Figure 1.



Figure 1 Cover (Front & back)

The media to be printed using A4 paper (210 mm x 297 mm) also contains material on plant diversity and its relationship with SETS components, especially knowledge about the use of plants in several fields of life (science, environment, technology, and society). The SETS (Science, Environment, Technology, Society) is an approach that combines science with the environment, technology, and society. This approach is meaningful if science can be used to obtain a technology that can benefit society and while considering its impact on the environment. The applied purpose of the SETS approach is to increase student's interest in learning, to practice how to think critically in making decisions in the context of social responsibility, teach students how to obtain data and how to act on it based on their knowledge, and to introduce elements of morality. (Steele, 2013).

The validity of the diversity media and the plant determination key

Validation according to the Kamus Besar Bahasa Indonesia (KBBI) means validating or testing the truth of something. Validity must be based on the needs of students so that conceptual knowledge and skills can be improved (Sari, 2017). Before a learning media is used by students, it must be validated by experts. The validation carried out in this case includes two aspects, namely the content of the material and the graphic aspects. Validation is carried out using a questionnaire instrument that is prepared in accordance with the standards of eligibility of teaching materials (BSNP, 2016).

Table 2 Validation results of diversity media and the plant determination key by the material validator

No	Assessment Aspects	Score	Maksimum score
1.	FEASIBILITY OF CONTENT	8	8
	Material Coverage	4	4
	Up-to-date and Contextual	4	4
2.	PRESENTATION COMPONENTS	35	40
	Presentation Technique	4	4
	Material Presentation Support	3	4
	Presentation of Learning	14	16
	Completeness of Serving	14	16
3.	LANGUAGE COMPONENTS	12	12
	Legibility	4	4
	Conformity with Indonesian Language Rules	4	4
	Use of Terms and Symbols / Symbols	4	4
Total Score Obtained		55	
Maximum Score Amount		60	
Percentage		91,67%	
Criteria		Very valid	

After calculating and categorizing the assesmen result of diversity media and the plant determination key on the material aspects, they are classified as very valid with a percentage score of 91.67%. There is a slight deficiency in one aspect of the material (not reaching the maximum score) that is in the aspect of the presentation components, including: supporting material presentation, presenting learning, and completing presentation. Supporting the presentation of the material in this case is the illustration given in the form of statements, examples and pictures that are appropriate, proportional and continuous with the material. The presentation of learning is related to the ability of the media to create active involvement of students. Completeness of presentation related to the preparation of the determination key sentences.

The criticisms given include: presentation of examples that unsustainable, presentation of images that are not in accordance with the description of the material, statements of material that are not accurate, and compilation of key sentences where errors are still found. Then the criticism is used as material for media revision before use. The substance contained in the media must be correct to prevent misconceptions in students, because if a misconception occurs it can cause interference with the formation of scientific concepts in the cognitive aspects of students (Suwarto, 2013).

Table 3 Validation results of diversity media and the plant determination key by the graphic validator

No	Assessment Aspects	Score	Maksimum score
1.	COVER DESIGN	16	16
	Book cover layout	8	8
	Book cover typography	8	8
2.	DESIGN CONTENT	23	24
	Complete layout elements	15	16
	The layout is consistent	4	4
	Layout speeds understanding	4	4
3.	TYPOGRAPHY OF CONTENT	8	8
	Simple typography	8	8

4. ILLUSTRATION OF CONTENT	12	12
Clarify and make it easier to understand	7	8
Generate attraction	4	4
Total Score Obtained		58
Maximum Score Amount		60
Percentage		96,67%
Criteria		Very valid

The assessment result of the graphic aspects are very valid with a percentage score of 96.67%. There are two aspects that do not reach the maximum value: elements of complete layout and illustrations that clarify understanding. The criticism given is related to the use of cover images and species samples in order to use own shots and not only take them from the internet. Because by displaying images of objects that are not found around students, students can visualize them easily. As according to Afifah, Sudarmin, & Widiarti (2014) the use of images in learning media can bring students to the place where the object comes from without coming directly there.

Illustrations and examples are important aspects in attracting interest and increasing participant's understanding, especially if the object being studied is abstract and cannot be presented directly in front of students. Providing illustrations in the form of images is considered more representative to depict an object compared to only a written description (Wulansari & Rachmadiarti, 2015). So that the learning objectives can be achieved because the media is functioning well (Adam, 2015).

Practicality of Diversity Media and the Plant Determination Key

Practical according to Kamus Besar Bahasa Indonesia is easy and happy to use. The characteristics of practical media according to Lestari, Alberida, & Rahmi (2018) are easy to use, learning time becomes more efficient, attractive and useful. Practicality data is taken from the results of the responses of educators and students to the media, namely through response questionnaires. Biology teachers who teach the material have the right to judge the practicality of the media being developed. teachers are also called practitioners because they often do direct practice in teaching and understand properly the material, learning management, to the needs of students. Thus it is hoped that the teacher can provide suggestions and comments that can be constructive for the media being developed.

Table 4 Results of teacher's responses to diversity media and the plant determination key

No	Assessment Aspects	Score	Maksimum score
1.	DISPLAY DESIGN	12	12
	Cover view	4	4
	Chapter title	4	4
	A mix of pictures and writing	4	4
2.	Material	14	16
	Suitability of material with basic competencies	4	4
	Integrity with SETS elements	3	4
	Convenience	4	4
	The suitability of the substance of the material	3	4
3.	PRESENTATION	10	12
	Sequence of concepts	4	4
	Completeness of information	3	4
	Sub-chapter linkages	3	4

4. BENEFITS	16	16
Learning efficiency	4	4
The activeness of students	4	4
Interesting learning	4	4
Ease of learners	4	4
5. LANGUAGE	8	8
Simplicity	4	4
Clarity	4	4
Total Score Obtained		60
Maximum Score Amount		64
Percentage		93,75%
Criteria		Very practical

Based on the results of the validation, there were several aspects that did not reach the maximum value, namely the material aspect (integration of media content with SETS elements and the suitability of material substance) and presentation (completeness of information and linkages between sub-chapters). The SETS approach was chosen in Plantae learning with the aim of increasing students' awareness of the high diversity and importance of preserving plants because humans are very dependent on their presence in life. According to Yörük, Morgil & Seçken (2010) which states that through the SETS approach students can connect between the concepts being studied and what is happening in the surrounding environment. In addition to gaining conceptual knowledge, student learning outcomes and activities can also be improved through this approach (Rasyid, 2018).

However, in general, the teacher gave a positive response to the media. This is relevant to the previous teacher's statement that the teacher felt very much in agreement if a plant classification guideline was developed in Plantae learning because if it was guided by the book it was still too broad and less specific. By using the key of determination, students have a guide in the observation process, making it more efficient in using time. In addition, it can also increase student activity (Purnamasari, Rahayuningsih, & Chasnah, 2012), process skills (Rosalia, Ariefa, & Kasrina, 2017), and understanding the concept of classification (Izza, et al., 2018).

Students' assessment to the media is also important to find out the opinions of students who will use that media, so that they get suggestions and constructive criticism to improve that. Because the purpose of this media being developed is that later it can be used by students in facilitating the learning process. The number of questions given was 15 points covering aspects: appearance design, interests, materials, and language. The results of each respondent's assessment were translated based on categories: very practical, practical, less practical, and impractical (Sugiyono, 2016). The data obtained by the classical average score of the results are shown in Table 5

Table 5 Percentage of student's response categories to diversity media and the plant determination key

No	Category	Percentage
1.	Very practical	69,4 %
2.	Practical	30,6 %
	Total	100 %

Based on these data students give a positive response to the media. There is an aspect with a minimum score that indicates a lack of media, which is seen in the cover aspect. In the aspect of media coverage, the majority (88%) of students stated that the cover made was attractive, but there was still a response that 8.3% of the votes less disagreed, even 2.7% disagreed. Based on the BSNP rules (2016) the appropriate cover has characteristics including: color elements (harmonious, contrasting, and clarifying

functions), illustrations (proportional and reflects the contents of the book), and typography (the letters used are communicative, attractive and easy to read) and all three displayed coherently and related to one another. So that making covers that are interesting and in accordance with the theme is very important to note because the cover can increase students' interest in learning something and is very effective as a source of learning by Karno (2015).

For criticisms and suggestions of media given by students, among others: there are still students who do not understand some terms, especially scientific names, so that they provide suggestions to include a glossary (even though information is available at the end of the chapter), besides that there are still a few errors in writing. The entire assessment is then used as the basis for revision so that the media can be used effectively in learning. Assessment by students of the media is important to find out the opinions of students who will naturally use the media. Media developed must be adapted to the characteristics of students because in addition to being a source of learning, media also has a psychological function (can affect the attention, affective, imaginative, motivational, and socio-cultural aspects) of students (Adam, 2015).

CONCLUSION

The results showed that the diversity of plants in SMAN 1 Bangsri included 92 types of plants consisting of 5 divisions, namely Bryophyte, Pteridophyte, Coniferophyte, Cycadophyte, Geophyte, and Magnoliophyte. Magnoliophyte Division dominated as many as 79 species (85.87%), consisting of 26 types of Liliopsida/Monocot Classis (28.26%), and Magnoliopsida/Dicotyl Classis as many as 53 species (57.61%).

Diversity media and the plant determination key were considered very valid by the material validator who rated the media at 91.67%, and the graphic validator assessed 96.67%. As many as 69.4% of students rated the media as very practical and 30.6% of students rated the media as practical, and biology teacher rated the media at 93.75%, which means that the media was very practical.

REFERENCES

- Adam S. (2015). Pemanfaatan Media Pembelajaran Berbasis Teknologi Informasi bagi Siswa Kelas X SMA Ananda Batam. *CBIS Journal*, 3 (2), 78-90.
- Badan Standar Nasional Pendidikan. (2016). *Naskah Akademik Instrumen Penilaian: Buku Teks Pelajaran Pendidikan Dasar dan Menengah*. Jakarta: Kementerian Pendidikan dan Kebudayaan.
- _____. *Silabus Mata Pelajaran Sekolah Menengah Atas/Madrasah Aliyah Mata Pelajaran Biologi*. Jakarta: Kementerian Pendidikan dan Kebudayaan.
- Crisp M.D. & Cook, L.D. (2011). Cenozoic Extinctions Account for the Low Diversity of Extant Gymnosperms Compared with Angiosperms. *New Phytologist*, 192, 997-1009.
- Farnsworth, K.D., Adenuga, & Groot A.H R.S. de. (2015). The Complexity of Biodiversity: A Biological Perspective on Economic Valuation. *Ecol-Econ*.
- Griffing, L. R. (2011). Who Invented The Dichotomous Key? Richard Waller's Water Colors of The Herbs of Britain. *American Journal of Botany*, 98 (12), 1911-1923.
- Karno, R. (2015). Penerapan Media Pembelajaran Biologi dengan Menggunakan Macromedia Flash Profesional 8. *Jurnal Ilmiah Edu Research*, 2(1), 79-84.
- Lestari, Alberida, H., & Rahmi, Y. L. (2018). Validitas dan Praktikalitas Lembar Kerja Peserta Didik (LKPD) Materi Kingdom Plantae Berbasis Pendekatan Saintifik untuk Peserta Didik Kelas X SMA/MA. *Jurnal Eksakta Pendidikan (JEP)*, 2 (2), 170-177.
- Purnamasari, H., Rahayuningsih, M., & Chasnah. (2012). Kunci Determinasi dan Flashcard sebagai Media Pembelajaran Inkuiri Klasifikasi Makhluk Hidup SMP. *Unnes Science Education Journal*, 1 (2), 103-110.
- Rasyid, A. (2018). Pengembangan Media Pembelajaran IPA Bervisi SETS. Berbasis *Edutainment* pada Konsep Pencernaan. *Jurnal Bio Educatio*, 3 (1), 53-59.
- Rosalia, R., Ariefa, P., & Kasrina. (2017). Pengembangan LKS Berdasarkan Hasil Studi Identifikasi Jenis Bambu di Desa Harapan Makmur. *Jurnal Pendidikan dan Pembelajaran Biologi*, 1 (1), 93-102.
- Izza, F.R., Retnoningsih A., & Pukan, K.K. (2018). Pengembangan Kunci Determinasi Tumbuhan Hasil Eksplorasi Hutan Wisata Guci Kabupaten Tegal untuk Sekolah Menengah Atas. *Indonesian Journal of Conservation*, 7 (1), 119-129.
- Sari, R. T. (2017). Uji Validitas Modul Pembelajaran Biologi pada Materi Sistem Reproduksi Manusia melalui Pendekatan

- Konstruktivisme untuk Kelas IX SMP. *Scientiae Educatia: Jurnal Pendidikan Sains*, 6 (1): 22–26.
- Stelle, A. (2013). Shifting Currents: Science, Technology, Society, and Environment in Northern Ontario Schools. *Brock Education*, 23 (1), 18-42.
- Sudjana. (2011). *Metode Statistika Edisi ke-6*. Bandung: Tarsito.
- Sugiyono. (2016). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, R & D*. Bandung: Alfabeta.
- Suwarto. 2013. *Pengembangan tes diagnostik dalam Pembelajaran*. Yogyakarta: Pustaka Pelajar.
- Wulansari, L. D. & Rachmadiarti, W. F. (2015). Pengembangan Atlas Keanekaragaman Tumbuhan: Euphorbiales, Myrtales, dan Solanales sebagai Sarana Identifikasi. *BioEdu Berkala Ilmiah Pendidikan Biologi*, 4 (3), 1029-1035.
- Yörük, N., Morgil, I., & Seçken, N. (2010). The Effects of Science, Technology, Society, Environment (STSE) Interactions on Teaching Chemistry. *Natural Science*, 12(2): 1417-1424.