Unnes.J.Biol.Educ. 11(1) (2022)

Journal of Biology Education

http://journal.unnes.ac.id/sju/index.php/ujbe

The Development of E-Atlas Avifauna of Surabaya as an Identification Tool of Birds and to Train Environmental Care Character for X Grade Students

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Article Info

Article History:

Received : April 2022
Accepted : April 2022
Published : April 2022

Keywords:
Means of identification, Animalia, Character education

Abstract

Increasing community participation in efforts to conserve natural resources is one of the important factors in conservation efforts. Therefore, it is necessary to train the character of caring for the environment in the community, one of which is by integrating it into biology learning at school. The purpose of this research was to produce a valid and practical E-Atlas Avifauna Surabaya of Surabaya as Identification Tool of Birds and to Train Environmental Care Character for Grade X Students. This research used a 4D development model without the dissemination stage. The validity of the E-Atlas was measured based on validation from education experts, material experts, and media experts. The practicality of the E-Atlas was measured based on the response of education practitioners (teachers) and students to the E-Atlas, as well as the response of the students' environmental care character. The data obtained were analyzed descriptive-quantitatively. The results showed that the E-Atlas Avifauna was declared valid or feasible with an overall mode of 4. The E-Atlas Avifauna was declared practical with a teacher's practical response percentage of 97.7%, a students' practical response percentage of 95.2%, and a caring character response students' environment percentage of 80% and 84% with practical categories. Thus, it can be concluded that the E-Atlas Avifauna Surabaya that has been developed is declared valid and practical as an identification tool for birds and to train environmental care characters of X Grade students.

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p-ISSN 2252-6579
e-ISSN 2540-833X

INTRODUCTION

Indonesia has a variety of natural resources, one of which is birds. There are 1.812 bird species in Indonesia, and 532 of them are endemic species (Burung Indonesia, 2021). This was supported by the opinion of Ekowati (2016), that birds are a type of wildlife that can be found in various ecosystems. According to Wulandari *et al.* (2019), the sustainability of an area can be measured using indicators of the diversity and abundance of existing bird species. This is because birds have sensitivity to changes that occur in their habitat (Fitri *et al.,* 2015).

In recent years, the high number of hunting and illegal trade in birds had an impact on their existence and balance in nature, so this has become the center of attention of environmentalists (Iskandar, 2014). In addition, other impacts that arise are the decreasing bird population in nature and the balance of the ecosystem was disturbed (Herdiawan *et al.,* 2019). Responding to this, it is necessary to increase community participation in environmental conservation efforts to preserve bird species in the wild. One thing that can be done is to integrate environmental care character education into learning in schools. This is in line with the formulation of cultural values and national character compiled by Badan Penelitian dan Pengembangan Pusat Kurikulum (2010), one of which is the character of caring for the environment. Environmental care character education can be integrated into biology learning in high school at Basic Competence (KD: *Kompetensi Dasar*) 3.9 and 4.9 class X for Kingdom Animalia sub-material Aves (Kemendikbud, 2018).

The characteristic of Kingdom Animalia material is that it requires students to be able to carry out classification activities on members of Kingdom Animalia, including the Aves sub-material. In classifying or classifying activities, facilities are needed so that learning objectives can be achieved (Wahyunindita *et al.,* 2016). One of the tools that can be used to assist students in the process of classification and identification is the diversity atlas. According to Wulansari *et al.* (2015), the role of the atlas in biology learning is to help the process of identifying species and creating meaningful learning activities.

In a general definition, an atlas is a collection of maps that have been recorded, both containing general maps and special maps (Waluya, 2009). However, as a means of identification, there are other types of atlases, namely the atlas of flora or fauna diversity, compiled by describing each species accompanied by characteristics and other information related to the species, the habitat and location found, the distribution area, and accompanied by a photo of the species (Lestari, 2017). According to Elizabeth (2016), an atlas of diversity in an area can be used as a means of identification in that area. The city of Surabaya is one area that can be used for the development of identification facilities in the form of an atlas of Avifauna diversity.

Badan Perencanaan Pembangunan Kota Surabaya (2016) stated that topographically the city of Surabaya is a lowland area that has different slopes in several areas. In addition, the city of Surabaya is also located downstream of the Brantas River watershed and is directly adjacent to the beach. Thus, it is very possible that there are high types of biodiversity in the city of Surabaya, one of which is birds. According to Desmawati (2010), in the Wonorejo Mangrove wetland area, 24 species of water birds were found. Then, in the Gunung Anyar Mangrove Ecotourism area, 19 species of birds were found (Handoko *et al.,* 2017). In addition, according to Ahmad *et al.* (2018), in the green open space (RTH: *ruang terbuka hijau*) area of Surabaya, 22 species of birds were found.

Along with technological advances, atlases can be developed digitally in the form of *e-books.* The development of digital learning resources will make it easier for students to access material to allow students to learn without being limited by space and time (Hussin, 2018). Digitally developed atlas is called E-Atlas or *electronic atlas.* E-Atlas is the development of atlas-based electronic learning media that contains material accompanied by images that can help students get a more real learning experience (Setiawati *et al.,* 2019). Setiawati *et al.* (2019) has developed an E-Atlas of cell structure material which is declared suitable for use as a learning medium. Thus, so that it is easier for students to get the concept of a material, it is necessary to develop an E-Atlas on other materials, one of which is the Aves sub-material.

Based on the description above, it is necessary to develop an alternative learning media innovation that supports the 4.0 industrial revolution in teaching and learning activities for the Aves sub-material,

namely by developing the E-Atlas Avifauna of Surabaya as an identification tool of birds and to train environmental care character for X grade students.

RESEARCH METHOD

This was developmental research, namely developing valid and practical E-Atlas Avifauna of Surabaya as an identification tool of birds and to train environmental care character for X grade students. This study used a 4-D development model (Define, Design, Develop, Dissemination). However, this research was only carried out in three stages, for the Dissemination stage it was not carried out. The development of the Avifauna E-Atlas was carried out from October 2020 to April 2021 at the Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, while data on the validity and practicality of the Avifauna E-Atlas were collected from May to July 2021.

Validation was carried out by three expert lecturers, namely education expert lecturers, material experts, and media experts. The instrument used is a validation sheet. The validation sheet consisted of three aspects, namely content feasibility, language feasibility, and presentation feasibility. The content feasibility aspect contains nine components that assess the suitability of the material with Core Competence (KI: *Kompetensi Inti*) and Basic Competence (KD: *Kompetensi Dasar*), the suitability of the material with the concept, and the components contained in the definition of environmental care character. Furthermore, the language feasibility aspect consists of three components that assess the use and selection of words, sentences and punctuation as well as sentence clarity and use of terms correctly. Finally, the presentation feasibility aspect contains five components that assess systematic consistency, suitability of font type and size, and image quality. The data from the validation results were analyzed descriptively quantitatively. Avifauna E-Atlas was declared eligible if the overall mode is 3.

Practical data were obtained from the results of teacher and student responses to Avifauna E-Atlas, and students' environmental care character responses. Practicality data was obtained by involving five teachers as education practitioners and 15 students of class X high school. The instrument used was a questionnaire sheet for teacher and student responses to E-Atlas Avifauna, and a questionnaire sheet for students' environmental care character responses. The teacher's response questionnaire sheet consisted of three aspects. The first aspect was the readability criteria, consisted of six components that assess the legibility of writing and the clarity of photos. The second aspect is the presentation criteria, consisting of five components that assess the appearance of the Avifauna E-Atlas, the function of photos and descriptions in facilitating the identification process and to train environmental care characters. The third aspect is content criteria, consisting of 4 components that assess the ease of use of the Avifauna E-Atlas feature as a means of identification and to train environmental care characters.

The second instrument to measure practicality is the student response questionnaire sheet. The student response questionnaire sheet consists of three aspects. The first aspect is readability criteria, consisting of six components that assess the clarity of the photos presented and the accuracy of the author in choosing the type and size of letters. The second aspect is the presentation criteria, consisting of five components that assess the appearance of the Avifauna E-Atlas, the ease of the identification process through photos and descriptions of species, as well as the features used to train environmental care characters. The third aspect, namely the content criteria, consists of four components that assess the ease of students in understanding the material presented and helps in training the character of caring for the environment.

The third instrument to measure the practicality is the question sheet for the students' environmental care character responses. The student environmental care character response questionnaire sheet consists of two categories. The first category is an attitude that always tries to prevent environmental damage in the natural surroundings. The second category is attitudes that develop efforts to repair the damage to nature that has already occurred. Each category consists of fifteen statements agree and disagree. The data obtained were analyzed descriptively quantitatively. Avifauna E-Atlas is declared practical if the percentage of each response is 71%.

RESULTS AND DISCUSSION

The results of this study are the E-Atlas Avifauna Surabaya City as a means of Aves identification and to train the environmental care character of class X high school students in pdf (portable document format). The three main sections in the E-Atlas Avifauna that have been developed consist of an introduction, a content section, and a closing section. In the introductory section, the E-Atlas contains an introduction, a table of contents, about this book, a map of the city of Surabaya, and an introduction. The content section of the E-Atlas contains Aves topography, Aves identification keys at the order level, Surabaya city birds grouped by order, and features to train students on environmental care characters. The feature to train the character to care for the environment is **Ayo Mencegah!** and **Ayo Berusaha!** (**Table 1**). The closing section of the E-Atlas contains reflections, a glossary, bibliography, and about the author.

Table 1 Features to train environmental care characters on Avifauna E-Atlas

No	Feature	Description
1.		This feature contains information about environmental conditions and the condition of birds in nature. This feature also contains invitations and appeals to prevent ecosystem damage.
2.		This feature contains information on efforts to improve the environment and the efforts made in bird conservation as well as an invitation to formulate ideas and actions to improve the ecosystem.

E-Atlas Avifauna which was developed to assist students in the identification and classification process of Aves and to train environmental care characters. The E-Atlas Avifauna contains pictures of birds taken directly in their natural habitat. In addition to the image of the species, a map of the distribution of the bird found is also displayed. The aim is to provide an overview to students about the habitat of these bird species and their distribution in the Surabaya City area. To train environmental care characters, E-Atlas Avifauna is equipped with Ayo **Mencegah!** and **Ayo Berusaha!**. In addition, the E-Atlas Avifauna is also equipped with a **Reflection** feature on the cover. The **Reflection** feature provides clarification to readers about what readers can do after studying Aves material using the E-Atlas Avifauna. The profile description of the E-Atlas Avifauna in Surabaya is shown in **Figure 1**.

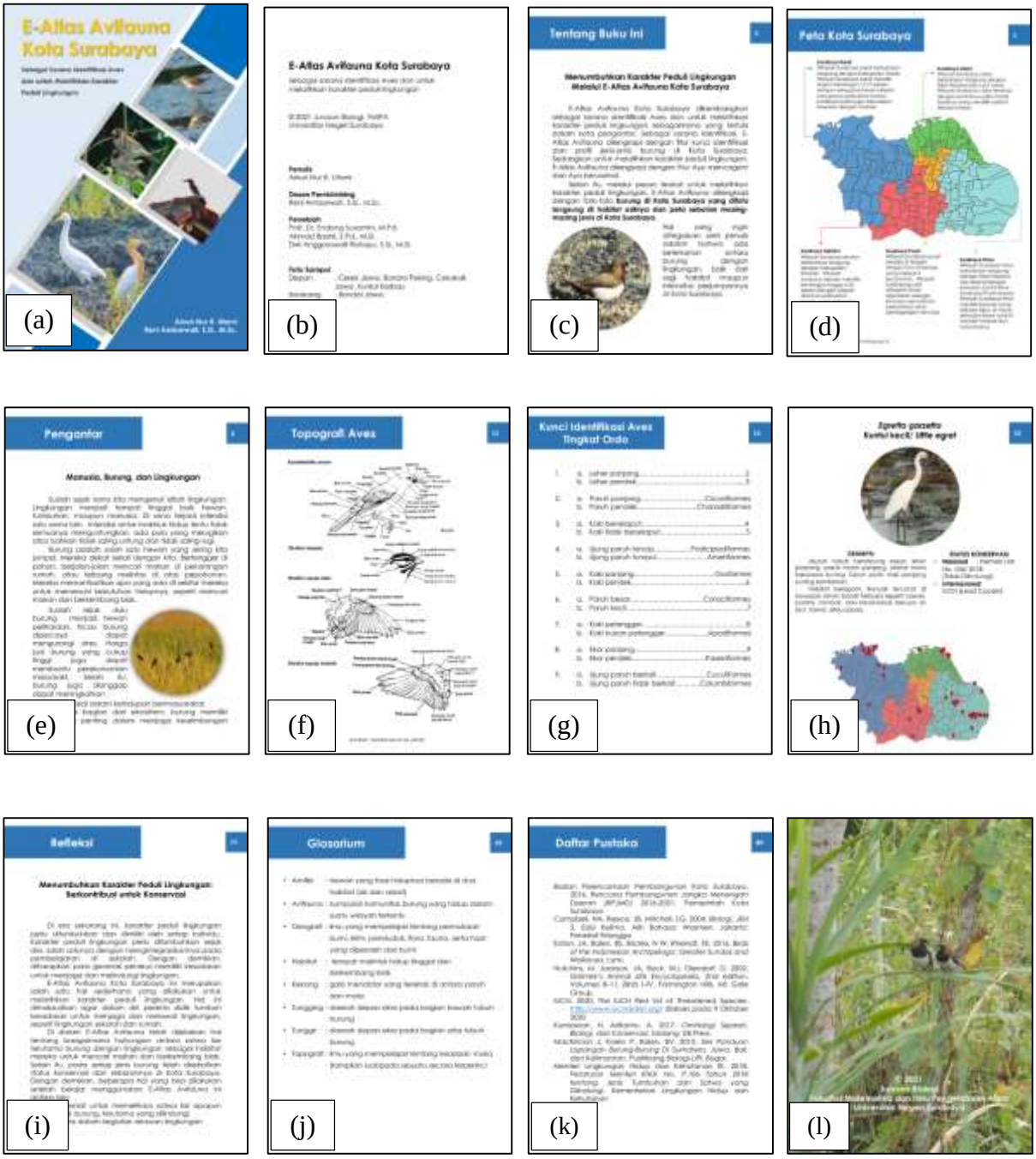

Figure 1 Avifauna E-Atlas Surabaya City (a) front page; (b) inner page; (c) About this book; (d) Surabaya city map; (e) Introduction; (f) Aves Topography; (g) Order level identification key; (h) Bird species profile; (i) Reflection; (j) Glossary; (k) Bibliography; (l) Back page.

The developed E-Atlas Avifauna has been validated by education expert lecturers, material experts, and media experts. The results of the validation of the E-Atlas Avifauna are stated in the very feasible category (**Table 2**).

Table 2 Avifauna E-Atlas Validation Results

No	Component	Component Mode	Category Validity
Content Feasibility			
1	The suitability of presenting the material in the E-Atlas Avifauna according to the Core Competencies (KI) and Basic Competencies (KD)	4	Very valid
2	Presentation of material in E-Atlas Avifauna in accordance with the truth of the concept	4	Very valid
3	Equipment for each animal	4	Very valid
4	Characteristics in E-Atlas Avifauna	4	Very valid
5	Completeness of contents of E-Atlas Avifauna	4	Very valid
6	Features to train environmental care characters in students	4	Very valid
7	The truth of the identification key concept	4	Very valid
8	Glossary	4	Very valid
9	Bibliography	4	Very valid
Component Mode		4	Very valid
Language Feasibility			
10	The words used are quite communicative and easy to understand	4	Very valid
11	Sentences do not contain double meanings and are clearly legible	4	Very valid
12	Using the correct terms	4	Very valid
Component Mode		4	Very valid
Presentation Feasibility			
13	Systematic consistency of presentation in sub chapters	4	Very valid
14	Physical form of E-Atlas Avifauna	4	Very valid
15	The suitability of the type and size of the letters used in the E-Atlas Avifauna	4	Very valid
16	Image quality used on E-Atlas Avifauna	3	Valid
17	Photos and descriptions help in the process of delivering information	4	Very valid
Component Mode		4	Very valid
Overall Mode		**4**	**Very valid**

The E-Atlas Avifauna which was developed was responded to measure practicality by providing assessments and suggestions by five education practitioners, namely high school biology teachers. Based on these results, it was found that the E-Atlas Avifauna was stated to be very practical (**Table 3**).

Table 3 Education Practitioners Response Results to Avifauna E-Atlas (n=5)

No	Component	Eligibility Percentage	Practicality Category
Readability Criteria			
1	Easy to read letters	100%	Very practical
2	Photos are clear and not blurry	60%	Practical enough
3	Sentences easy to understand	100%	Very practical
4	Photo captions make it easier for	100%	Very practical

No	Component	Eligibility Percentage	Practicality Category
	students to understand the concept		
5	The identification key can be used to find the order level	100%	Very practical
6	The glossary helps to find the meaning of foreign terms	100%	Very practical
X̄ Percentage of Readability Criteria		93.3%	Very practical
Presentation Criteria			
7	E-atlas Avifauna looks attractive	100%	Very practical
8	Images displayed according to topic	100%	Very practical
9	The order of the material makes it easier for students to learn Aves material	100%	Very practical
10	Teachers are interested in using E-Atlas Avifauna in the learning process	100%	Very practical
11	E-Atlas Avifauna can increase students' awareness about the importance of protecting the environment	100%	Very practical
X̄ Percentage of Presentation Criteria		100%	Very practical
Content Criteria			
12	The explanation of the material on the E-Atlas Avifauna is easy for students to understand	100%	Very practical
13	Make it easier for students to understand the distinguishing characteristics of each order	100%	Very practical
14	Helping students to be aware of and make efforts to protect and improve the environment	100%	Very practical
15	Helping students raise awareness to preserve and prevent the extinction of birds in their natural habitat	100%	Very practical
X̄ Percentage of Content Criteria		100%	Very practical
X̄ Percentage of practical responses		**97.7%**	**Very practical**

E-Atlas Avifauna was tested on 15 students of class X high school students. The results of the student response questionnaire to the E-Atlas Avifauna that had been developed by the researchers were stated in a very practical category based on three aspects, namely readability aspects, presentation aspects, and content aspects (**Table 4**).

Table 4 Results of Student Responses to Avifauna E-Atlas (n=15)

No	Component	Eligibility Percentage	Practicality Category
Readability Criteria			
1	Easy to read letters	100%	Very practical
2	Photos are clear and not blurry	93%	Very practical
3	Sentences easy to understand	93%	Very practical
4	Photo captions make it easier to understand the concept	100%	Very practical
5	The identification key can be used to find the order level	93%	Very practical
6	The glossary helps to find the meaning of foreign terms	93%	Very practical
X̄ Percentage of Readability Criteria		95.3%	Very practical
Presentation Criteria			
7	E-atlas Avifauna looks attractive	100%	Very practical

No	Component	Eligibility Percentage	Practicality Category
8	Images displayed according to topic	100%	Very practical
9	The order of the material makes it easy to learn Aves material	93%	Very practical
10	Students are interested in using E-Atlas Avifauna in learning activities	93%	Very practical
11	E-Atlas Avifauna can raise awareness about the importance of protecting the environment	93%	Very practical
$\bar{X}$ Percentage of Presentation Criteria		95.8%	Very practical
Content Criteria			
12	The explanation of the material on the E-Atlas Avifauna is easy to understand	93%	Very practical
13	Makes it easier to understand the distinguishing characteristics of each order	93%	Very practical
14	Helping to realize and work to protect and improve the environment	93%	Very practical
15	Help raise awareness to preserve and prevent the extinction of birds in their natural habitat	100%	Very practical
$\bar{X}$ Percentage of Content Criteria		94.75%	Very practical
$\bar{X}$ Percentage of practical responses		**95.2%**	**Very practical**

Besides being used as a means of identifying Aves, the developed E-Atlas Avifauna is also used to train environmental care characters. Based on the test results, the responses of students' environmental care characters are categorized into two categories based on the definition of environmental care characters according to BPPPK (2010). The first category is the attitude that always tries to prevent environmental damage in the natural surroundings, the second category is the attitude of developing efforts to repair the natural damage that has occurred. The percentage of the first category is 80% and the second category is 84% (**Table 5**).

Table 5. Students' Environmental Care Character Responses (n=15)

No	Character Category	Total Score	Average score	Percentage	Practicality Category
1	An attitude that always tries to prevent environmental damage in the natural surroundings.	180	12	80%	Practical
2	The attitude of developing efforts to repair the natural damage that has occurred.	188	12.53	84%	Practical

Validators, education practitioners, and students provided input for the Avifauna E-Atlas, including the presentation, writing consistency, and image quality in the Avifauna E-Atlas (**Table 6).**

Table 6 Comments from validators, education practitioners, and students for Avifauna E-Atlas

No	Comment from validator	Comments from education practitioners	Comments from students
1.	Writing a bibliography in Avifauna E-Atlas needs consistency. The rest is good.	Avifauna's E-Atlas is interesting and good for applying to Animalia learning materials.	Overall interesting. Both the arrangement, the pictures, and the sentences used are easy to understand.
2.	We recommend that you use an image that you took yourself, if not, then you should provide a source.	Need to add more glossary to the glossary. Fixed by adding some word lists.	Some pictures should be corrected because they are not clear. In the Avifauna E-Atlas has been improved

No	Comment from validator	Comments from education practitioners	Comments from students
			by replacing the image that is clearer and not broken.
3.	Some photos of birds need to be clarified because they are not bright enough and to make it easier for readers.	For further research, it is better to display the percentage distribution in the city of Surabaya.	Terms in conservation are still unfamiliar to some readers. So, readers need to find out.

This research aimed to produce an E-Atlas Avifauna Surabaya City as an identification tool of birds and to train the environmental care character of class X high school students that is valid and practical. In a general definition, an atlas is a collection of recorded maps, either in the form of general maps or special maps (Waluya, 2009). While the E-Atlas is an electronic-based atlas that was developed as a support for students to get a real learning experience (Setiawati *et al.,* 2019). According to Wulansari *et al.* (2015), atlases can be used to assist the process of species identification and create meaningful learning.

The developed E-Atlas Avifauna contains material about Aves or birds. E-Atlas Avifauna was developed by combining the concepts of *e-books* and atlases in general so that the E-Atlas Avifauna is produced in pdf (portable document format) format to make it easier for readers to access via smartphones. This is done because the development of science and technology also affects the education sector (Hussin, 2018), so that access to knowledge will be easier if it can be done by utilizing technology, one of which is a smartphone (Newman *et al.,* 2012).

E-Atlas Avifauna was developed in digital form with features that help make it easier for students to identify and train environmental care characters. To assist students in the identification process, the E-Atlas Avifauna is equipped with an order-level identification key. In addition, each bird profile section is equipped with a species identity, species image, species description, conservation status, and a map of the location where the species was found in the city of Surabaya. According to Abrori *et al.* (2017), pictures will facilitate students in the identification process and increase student learning motivation. Bird images in the E-Atlas Avifauna were taken directly in their habitat. In the profile of each bird species, the conservation status of the species is written according to the Minister of Environment and Forestry and the IUCN (International Union for Conservation and Nature). It aims to give the reader a real picture of the species, their habitat conditions, and their conservation status nationally and internationally. The components and features in the E-Atlas Avifauna were developed based on the purpose of developing the E-Atlas Avifauna and the characteristics of the *e-book* and the atlas itself. This is in line with the opinion of Sari *et al.* (2018) that there are several components that must be met in order for the diversity atlas to be a good learning resource, including titles, introductions to locations, location division, materials developed, identification keys, type pictures developed, and species descriptions.

E-Atlas Avifauna is equipped with features to train students' environmental care character based on the definition of environmental care character according to the Badan Penelitian dan Pengembangan Pusat Kurikulum (2010). The definition is attitudes and actions that always try to prevent damage to the surrounding natural environment, as well as develop efforts to repair the natural damage that has occurred. Based on this definition, there are two main features that were developed to train environmental care characters in students, namely the **Ayo Mencegah!** and **Ayo Berusaha!**

Features **Ayo Mencegah!** is an interpretation of one indicator of the character of caring for the environment, namely attitudes and actions that always try to prevent damage to the surrounding natural environment. In E-Atlas Avifauna, this feature contains information about environmental conditions and the condition of birds in nature. This feature also contains invitations and appeals to prevent ecosystem damage.

The second feature to train environmental care characters is the **Let's try!** This feature is an interpretation of the environmental care character indicators, namely attitudes and actions that develop efforts to repair the natural damage that has occurred. This feature contains information about efforts to improve environmental conditions as well as efforts made in bird conservation. In addition, this feature also contains an invitation to users to formulate ideas and actions to improve ecosystem conditions.

To train the character to care for the environment, apart from the two main features, there is also a reflection feature. This reflection feature is in the cover section. This feature was developed to provide clarification to readers on what can be done after studying Aves material and its habitat through E-Atlas Avifauna. This feature also invites readers to formulate positive actions that can prevent and delay environmental damage and bird extinction. Thus, it means that readers are also invited to add insight beyond the topic of Aves because according to Mardhiyana (2017), learning is not just understanding concepts, but also exploring new things so that what is learned is meaningful.

E-Atlas Avifauna of Surabaya was declared very valid in terms of validation results (**Table 2**). The feasibility points used in the validation assessment are content feasibility, language feasibility, and presentation feasibility, each of which has several components. This is in line with Nieveen's (1999) statement that the feasibility of a learning product is reviewed through several criteria, namely the suitability of the material with the applicable curriculum, content feasibility, and construction feasibility.

Feasibility of content assesses the Avifauna E-Atlas in terms of the features developed and their relation to Core Competencies (KI), Basic Competencies (KD), and entities that are in the definition of environmental care character. Content eligibility got component mode 4 which means it is very valid or feasible. Then, the feasibility of the language assesses in terms of the use and choice of words and sentences by the author in the E-Atlas Avifauna whether it is communicative enough and does not contain double meanings. According to Nurlaili (2011), the concepts taught to students will be easier if the sentences used are clear. Feasibility of the language got component mode 4 which means it is very feasible. Third is the feasibility of presentation. The feasibility of the presentation is assessed in terms of systematic consistency, the suitability of the type and size of the letters, as well as the quality of the images presented. Feasibility of presentation gets component mode 4 which means it is very valid. From the three eligibility criteria, the overall mode is 4. It means that the E-Atlas Avifauna which has been developed by the researcher is included in the very feasible category in terms of content, language, and presentation.

The practicality of E-Atlas Avifauna is viewed from three aspects, namely the teacher's response as an education practitioner, the student's response, and the student's environmental care character response. The first practical aspect is the teacher's response. The teacher's response to E-Atlas Avifauna assessed three criteria, namely readability, presentation, and content. First, the readability criteria include the legibility of writing and clarity of photos. In this criterion, the photo quality component gets the lowest percentage because there are some photos that are displayed that are not clear. The readability criteria got an average percentage of 93.3 % which means it is very practical. Next is the presentation criteria. The presentation criteria include the appearance of the Avifauna E-Atlas and the suitability of its function as a means of identification and to train environmental care characters. The presentation criteria get an average percentage of 100% which means it is very practical. The three content criteria. The content criteria include the ease with which the E-Atlas can be used as a learning resource and to train the character of caring for the environment. The content criteria get an average percentage of 100% which means it is very practical. Overall, the average percentage of teacher responses is 97.7 %, which means it is very practical (**Table 3**). This shows that according to education practitioners, E-Atlas Avifauna can be used as a source of student learning, teaching Aves material, and training environmental care characters. This is in line with the opinion of Kantun *et al.* (2015) that teachers play an important role in selecting and determining learning resources for students so that basic competencies can be achieved.

The second aspect to measure practicality is student response. Aspects of student response assess the E-Atlas Avifauna through three criteria, namely readability criteria, presentation criteria, and content criteria. The readability criteria for assessing the E-Atlas Avifauna include the clarity of the photos presented and the author's accuracy in choosing the type and size of letters. The readability criteria obtained an average percentage of 95.3 % which means it is very practical. Next is the presentation criteria. The presentation criteria include the appearance of the E-Atlas, the ease of photos and descriptions in helping the identification process, as well as the features used to train environmental care characters. On this criterion, students stated that the appearance of the E-Atlas was attractive. This is indicated by the percentage result on the display component of the E-Atlas of 100%, which means it is very practical. The

presentation criteria get an average percentage of 95.8 %, which means it is very practical. The third criterion is the content criteria. The components of this criterion include the ease of students in understanding the material presented and its use to identify and train environmental care characters. The content criteria get an average percentage of 94.75%, which means it is very practical. Overall, student responses get a percentage of 95.2 % which means it is very practical (**Table 4**). Based on the results of student responses, it can be concluded that E-Atlas Avifauna is an interesting learning resource and really helps students learn Aves material, including identifying species, and helping to train environmental care characters. According to Faridah *et al.* (2014), interesting learning tools will stimulate students to be more interested in something, one of which is through finding out activities.

The third aspect to measure practicality is the response of the students' environmental care character. Besides being used as a means of identification, the developed E-Atlas is used as a means to train students' environmental care character. Based on the definition of environmental care character according to the Badan Penelitian dan Pengembangan Pusat Kurikulum (2010), the measured environmental care character is divided into two categories, first, namely attitudes that always try to prevent environmental damage in the surrounding natural environment, the second category is attitudes to develop efforts to improve the environment. restore the natural damage that has occurred. Of the two categories, then developed into 30 statements of agree and disagree to measure the extent to which the character cares about the environment of students. The first category statement includes the urgency of preserving the environment and wildlife in the natural surroundings and preventing environmental damage, the second category statement includes self-awareness to seek repairs to environmental damage as a natural habitat for wild animals, especially birds.

Based on **Table 5.** it can be seen that for the first category, the percentage obtained is 80% and the second category is 84% which is included in the practical category. Students are aware of the urgency of preserving the environment and wildlife around them, among others, by studying the benefits of the environment for life and changing lifestyles to be more environmentally friendly. In addition, students also have self-awareness to seek repair of environmental damage as a natural habitat for wild animals, such as using social media for wildlife release campaigns and participating in revitalizing the environment around them so that they function optimally. The impact of education, including character education, cannot be observed in a short time, but can be trained consistently (Maunah, 2015). In addition, by collaborating between formal education in schools and non-formal education such as advice, examples, and motivation from the environment around students, the character of students' environmental care will be stronger (Muharlisiani *et al.,* 2021).

Thus, it can be concluded that the developed Avifauna E-Atlas of Surabaya City was declared very feasible based on the feasibility of content, language, and presentation. The Avifauna E-Atlas Surabaya City is also practical for Aves identification activities and to train the environmental care character of class X SMA students at school.

CONCLUSION

Based on the results of the study, the Avifauna E-Atlas Surabaya City as a means of identifying Aves and to train the environmental care character of class X high school students was declared very valid and practical. Avifauna E-Atlas was declared very valid in terms of presentation, content, and language. It is stated that it is practical in terms of the results of the teacher's, students' responses, and the results of the students' environmental care character responses. Avifauna's E-Atlas can be used for learning activities to identify Aves and train students to care for the environment.

REFERENCES

Abrori, F. M & Adhani, A. (2017). Developing an Atlas Based on Frond Venetion Patterns Analysis of Polypodiales in Tarakan. *Jurnal Pendidikan Biologi Indonesia* Vol. 3 No. 3: 222-231

Ahmad, N. A, Irawan, B & Hariyanto, C. (2018). Keanekaragaman Burung Di Ruang Terbuka Hijau Kota Surabaya. *Repository Universitas Airlangga*

Badan Penelitian dan Pengembangan Pusat Kurikulum. (2010). *Bahan Penelitian Penguatan Metodologi Pembelajaran Berdasarkan Nilai-nilai Budaya Untuk Membentuk Daya Saing dan Karakter Bangsa*. Jakarta: Kementerian Pendidikan Nasional

Badan Perencanaan Pembangunan Kota Surabaya. (2016). *Rencana Pembangunan Jangka Menengah Daerah (RPJMD) 2016-2021*. Pemerintah Kota Surabaya

Burung Indonesia. (2021). Status Burung di Indonesia 2021: Sembilan Jenis Burung Semakin Berisiko Mengalami Kepunahan. Diakses dari https://www.burung.org/2021/04/28/status-burung-di-indonesia-2021-sembilan-jenis-burung-semakin-berisiko-mengalami-kepunahan/ Accessed at October 26, 2021

Desmawati, I. (2010). Studi Distribusi Jenis-jenis Burung Dilindungi Perundang-Undangan Indonesia Di Kawasan Wonorejo, Surabaya. *Resource ITS*

Ekowati, A, Setyani, A. D, Haribowo, D. R & Hidayah, K. (2016). Keanekaragaman Jenis Burung di Kawasan Telaga Warna, Desa Tugu Utara Cisarua, Bogor. *Al-Kauniyah Journal of Biology* Vol. 9 No. 2: 87-94

Elizabeth, M. (2016). *What is an Atlas? An overview and History of Atlases*. Diakses dari http://geography.about.com/od/understandmaps/a/What-Is-An-Atlas.htm Accessed at March 19, 2020

Faridah, L. A, Purnomo, T & Ambarwati, R. (2014). Pengembangan Ensiklopedia dan LKS Invertebrata Laut untuk Pembelajaran Biologi. *BioEdu* Vol. 3 No. 3: 580-588

Fitri, L. M, Handika, H, & Solina, I. D. (2015). Burung Strata Bawah (*Understory*) Di Hutan Pegunungan Taman Nasional Kerinci Seblat (TNKS) Kerinci Jambi. *Jurnal Saintek* Vol. 8 No. 1: 82-85

Handoko, K. J, Pamungkas, D. B, Rochmadani, G, Herdiawan, B & Rukmana, R. (2017). Keanekaragaman dan Kemelimpahan Burung Di Kawasan Ekowisata Mangrove Gunung Anyar, Surabaya. *Prosiding Konferensi Peneliti dan Pemerhati Burung Indonesia 3*, Bali: 2-4 Februari 2017. Page 75-79

Herdiawan, B, Mubarok, M. M, Ambarwati, R & Prasetya K. N. (2019). Status Konservasi Burung pada Resort Coban Trisula dan Blok Ireng-ireng, Taman Nasional Bromo Tengger Semeru. *Simbiosa* Vol. 8 No. 1: 70-84

Hussin, A. A. (2018). Education 4.0 Made Simple: Ideas for Teaching. *International Journal of Education and Literacy Studies* Vol. 6 No. 3: 92-98

Iskandar, J. (2014). Dilema Antara Hobi Dan Bisnis Perdagangan Burung Serta Konservasi Burung. *Chimica et Natura Acta*, Vol. 2 No. 3: 180-185

Kantun, S & Budiawati, Y. S. R. (2015). Analisis Tingkat Kelayakan Bahan Ajar Ekonomi yang Digunakan Oleh Guru di SMA Negeri 4 Jember. *Jurnal Pendidikan Ekonomi.* Vol. 9 No. 2: 129-146

Kementerian Pendidikan dan Kebudayaan. (2018). *Peraturan Menteri Pendidikan No. 37 tahun 2018*. Tentang KI dan KD Kurikulum 2013. Pada Pendidikan Dasar dan Pendidikan Menengah. Jakarta

Lestari, P. (2017). Pengembangan Media Pembelajaran Biologi Atlas Invertebrata Untuk Siswa Kelas X SMA Pawyatan Dhaha Kediri. *Jurnal Artikel Skripsi* Universitas Nusantara PGRI Kediri

Mardhiyana, D. (2017). Upaya Meningkatkan Rasa Ingin Tahu Mahasiswa Melalui Penerapan Pembelajaran Berbasis Proyek pada Mata Kuliah Evaluasi Proses dan Hasil Pembelajaran Matematika. *Jurnal Ilmiah Pendidikan Matematika* Vol. 5 No. 1: 1-8

Maunah, B. (2015). Implementasi Pendidikan Karakter dalam Pembentukan Kepribadian Holistik Siswa. *Jurnal Pendidikan Karakter* Tahun V, No. 1: 90-101

Muharlisiani, L. S, Soesatyo, Y, Khamidi, A, Hariyati, N, Bariroh, S, Noerhartati, E, Sugiono J & Jatiningrum, C. (2021). Environmental Caring Through Character Education in Vocational School. *International Journal of Entrepreneurship and Business Develepment*. Vol. 04 No. 1: 41-46

Nieveen, N. (1999). *Design Approaches and Tools in Education and Training*. Netherlands: Kluwer Academic Publisher

Newman, G, Wiggins, A, Crall, A, Graham, E, Newman, S & Crowston, K. (2012). The Future of Citizen Science: Emerging Technologies and Shifting Paradigms. *Front Ecol Environ* 2012 Vol. 10 No. 6: 298–304

Nurlaili. (2011). Pengukuran Tingkat Keterbacaan Wacana dalam LKS Mata Pelajaran Bahasa Indonesia Kelas 4-6 SD dan Keterpahamannya. *Jurnal Universitas Pendidikan Indonesia (UPI).* Vol. Khusus 1: 167-177

Sari, F. E. P & Faizah, U. (2018). Validitas Atlas Keanekaragaman Animalia di Pantai Ria Kenjeran sebagai Sarana Identifikasi Hewan. *BioEdu* Vol. 7 No. 3: 530-536

Setiawati, D. A, Setiati, N & Pribadi, T. A. 2019. The Development of E-Atlas Learning Media Based on Mobile Learning on Cells Structure Concept. *Journal of Biology Education* Vol. 8 No. 1: 15-25

Wahyunindita, V, Rachmadiarti, F & Wisanti. (2016). Pengembangan Atlas Keanekaragaman Flora di Kampus Universitas Negeri Surabaya sebagai Sarana Identifikasi. *BioEdu* Vol. 5 No. 3: 344-351

Waluya, B. (2009). *Peta, Globe, dan Atlas*. Jakarta: Pusat Perbukuan Departemen Pendidikan Nasional

Wulandari, E. Y & Kuntjoro, S. (2019). Keanekaragaman dan Kemelimpahan Jenis Burung di Kawasan Cagar Alam Besowo Gadungan dan Sekitarnya Kabupaten Kediri Jawa Timur. *Jurnal Riset Biologi dan Aplikasinya* Vol. 1 No. 1: 18-25

Wulansari, L. D, Wisanti & Rachmadiarti, F. (2015). Pengembangan Atlas Keanekaragaman Tumbuhan: Euphorbiales, Myrtales, dan Solanales sebagai Sarana Identifikasi. *BioEdu* Vol. 4 No. 3: 1029-1035