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Collection of The Sangiran Early Men Site Museum and Cultural Heritage Unit as a Learning Resource for Evolution Materials in Indonesian High School Curriculum

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ABSTRACT

This is an exploratory study. The objectives of this research are: 1) mapping the needs of learning objects of evolutionary material in high school biology subjects and 2) mapping the collection of The Sangiran Early Men Site Museum and Cultural Heritage Unit that corresponds to the needs of learning objects of evolutionary material in high school biology subjects. The learning object used is the entire collection of The Sangiran Early Men Site Museum and Cultural Heritage Unit, adjusted to the needs of evolutionary material, including fossils, artifacts, and displays of evolution information from a biological point of view. The results of the exploration of the museum show that the Sangiran early man site museum has 115 kinds of biological collections on display in the exhibition room and 65 kinds of collections, of which 65 correspond to evolutionary material. In general, The Sangiran Early Men Site Museum and Cultural Heritage Unit is eligible as a learning resource for evolutionary material for class XII SMA or equivalent.

Keywords: evolution, learning resources, museum collections

INTRODUCTION

(OECD, 2018) states that students in Indonesia tend to have low scores in reading, math, and science activities. Reading activities play an important role in helping students understand a material during the learning process. This reading activity does not always come from books but also from learning resources, teaching materials, or even other learning media. In this case, the availability of learning resources is critical to the learning process (Dopo & Ismaniati, 2016). Irwandi & Fajeriadi, (2020) said that the environment that is used as a learning resource will be able to help connect between learning experiences and new information obtained by students. More broadly, learning resources are a source for changing anyone's knowledge, not just students in the classroom. According to (Hermawan et al., 2021) the museum is one of the community's learning resources and can serve as a learning resource for the society.

(Suhardi, 2012) defines biology learning resources as any objects or symptoms that can be used to gain experience solving specific biological problems. Learning resources provide opportunities and facilitate the learning process. Learning as a process is a system that is

inseparable from other components that interact with each other in it. Learning resources are one of the main components of the learning process. The importance of learning resources in the learning process requires teachers (lecturers) to be more creative in utilizing learning resources (Angio, 2020).

Evolution is one of the materials taught to students in grade XII that most often causes misconceptions. According to (Nehm & Reilly, 2007) evolution is one of the branches of biological science that is considered difficult because the material is abstract and complex, so many misconceptions are commonly found. Misconceptions that occur in evolutionary material in schools are in the concept of Darwin's theory of evolution, the evidence for evolution, and the mechanism of evolution (Candramila et al., 2016). (Suprapto, 2020) provide information that misconceptions occur not only at the children, but also for adult. It is means misconception might be occurs not only during learning but also in the teaching by the teacher. Misconception is failure to connect between the concept with the other concepts. Students' original concepts are frequently incorrect, so it is necessary to correct the concept that is thoroughly explored.

Teachers have difficulty delivering the subject matter of evolution to students because the material cannot be explained well except by observing the evidence for evolution. Real objects in evolution education include fossils or replicas. According to research (Wulandari et al., 2017), as many as 67% of high school biology teachers in Banyuwangi regency stated that teaching materials were incomplete, 33% of teachers stated that the evolution material in the book used by students was still abstract, and 44% of teachers stated that there were misconceptions in the content of the evolution material in the book. When teachers consider that evolution material is important material that needs to be delivered to students with the correct and appropriate concepts (Saputra, 2017), this is certainly an irony in and of itself. Teachers in several schools in Yogyakarta's Special Region use textbooks as teaching materials for evolutionary material up to 50% of the time, while students use textbooks up to 45% of the time and the internet as a 37.5% learning resource. This information was obtained by distributing questionnaires to 40 high school and MA students from four districts in Yogyakarta.

Museums as a learning resource can be a learning tool that encourages student's competence to learn to assess, think critically, and encourage students to provide a response and comment on a historical event that has occurred, so that the learning process is centered on the students (Maulana Yusuf A et al., 2018). Learning to approach the learning object directly can stimulate students to find concepts independently (Handziko & Suryadarma, 2021). The teacher's responsibility is to provide affirmation and confirmation of the concepts found by students. The museum as a learning resource can be used as a laboratory for students to get to know learning objects more intimately, so that learning that is prone to misconceptions due to a lack of material completeness in the sources mentioned above is expected to be resolved.

Sangiran is an early man site in Indonesia, located in the regencies of Sragen and Karanganyar in Central Java Province. The site is managed by the Sangiran Center for the Preservation of Ancient Human Sites (BPSMP) in Sangiran, one of the technical implementation units (UPT) of the Ministry of Education and Culture (Kemendikbud). Sangiran early men site

museum is contributing important knowledge about the evidence of the theory of evolution both in terms of evolution (physical changes) in humans, evolution in fauna, and cultural and environmental evolution that occurred two million years ago, so that this site has penetrated the international scene and has even been designated by UNESCO as a world cultural heritage (Mulyantari, 2021; Rara Sugiarti et al., 2019). The Sangiran Early Men Site Museum and Cultural Heritage Unit is well designed because, in addition to evidence of archaeological objects (fossils), it also contains explanations of ancient life in the form of dioramas and texts. This is in accordance with the presentation in Oliveira & Cook, (2017) which states that evolutionary literature can be communicated well in two ways, namely through visual metaphors and visual symbolism.

The Sangiran Museum of Early Men site is present as a provider of evidence of evolution with the discovery of hominid fossils and flora and fauna that can prove the truth of evolution. The existence of The Sangiran Early Men Site Museum and Cultural Heritage Unit can build students' engagement with knowledge materials to be able to discuss the origin of humans and the evolutionary process (Pobiner, 2016). The availability of various facts and information in the Sangiran Archaeological Museum is an original Indonesian asset with potential that is relevant to being appointed as a learning resource.

The objectives of this research are:

1. Mapping the needs of learning objects for evolution material based on learning indicators in high school biology subjects.
2. Mapping The Sangiran Early Men Site Museum and Cultural Heritage Unit collection that corresponds to the needs of learning objects for evolutionary material based on learning indicators in high school biology subjects.

METHOD

Research Design

The method used is exploratory research. The exploratory research method is used to map an object's relative depth. The entire museum collection is used as a population in this exploratory study, and museum collections that can be used as a learning resource for evolutionary material are used as a sample. The result of museum exploration is the number of museum collections related to evolutionary material from biology studies. The stages of research carried out include: (1) identification of the potential of the museum as a learning resource; (2) exploration of museum collections; and (3) mapping the results of exploration based on their relationship with evolutionary material from biological studies. Data collection techniques include (1) observation, (2) interviewing, and (3) documentation (Suharsimi Arikunto, 2016). After the data is obtained, the data is processed in three steps: (1) data reduction; (2) data presentation; and (3) conclusion drawing (Matthew B & Huberman A, 1994)

Population and Samples

The data mapped as objects include fossil collections, dioramas, replicas of fossils or artifacts, and display boards (information and images) obtained from the exploration of five

clusters of the Sangiran Early Man Site Museum, namely the Krikilan Cluster, Bukuran Cluster, Ngebung Cluster, Dayu Cluster, and Manyarejo Cluster. The data was documented in the form of photographs and research notes. In addition to museum collections, data were obtained from interviews with site managers, namely archaeologists, analysts, and managers of cultural heritage data and museum collections.

Not all museum contents can be used as data in this study. The data that can be used must be able to represent the needs of evolutionary material in high school biology. As a result, there is a data selection stage in this research method that aims to map museum collections with learning needs.

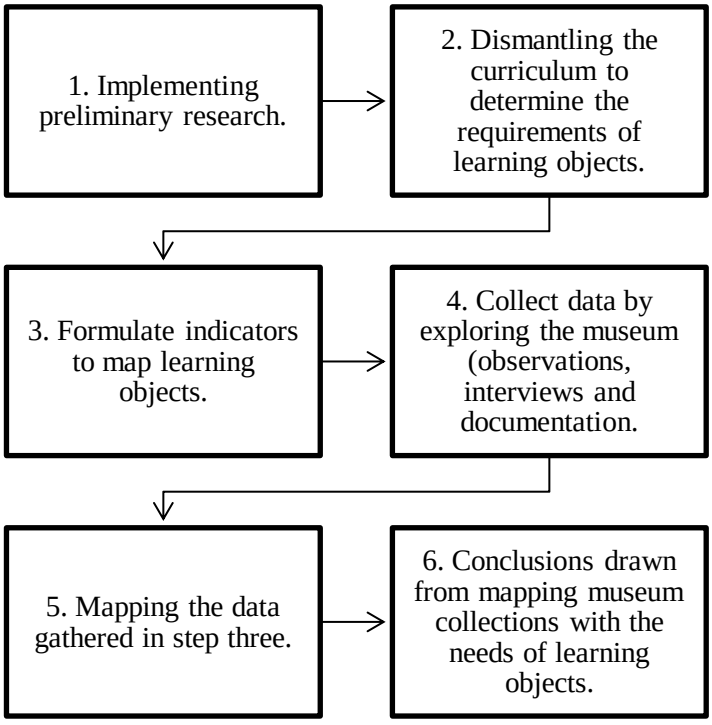
Instrument

The instruments used in this study were pre-research questionnaires, interview instruments, and evolution material mapping questionnaires for high school. The pre-research questionnaire aims to find out the basic knowledge of students about evolution and the learning resources for evolution material that are commonly used in the learning process. The results of the pre-research questionnaire are used as a reference to determine whether students have sufficiently understood evolutionary material, whether misconceptions still occur, and whether the museum has been used as a learning resource. The contents of the pre-research questionnaire include: (1) how the teacher conveys evolutionary material during learning, (2) learning resources or evolution teaching materials used, and (3) students' basic understanding of evolution, which includes the definition of evolution, the core of Darwin's theory, the causes of natural selection, examples of homology, and evidence of evolution.

Interview instruments include (1) the process of fossil evacuation and excavation, (2) the maintenance of excavation results before being stored in the museum, (3) the maintenance and management of museum collections, (4) a fossil inventory, (5) the role of museums in the world of education. The evolution material mapping questionnaire was prepared in four steps: (1) dissecting the basic competencies of evolution, (2) formulating learning objectives; (3), formulating learning outcome indicators, and (4) analyzing learning objects for each indicator and identifying suitable learning resources.

Procedure

Exploratory research has variations in its stages because it depends on the imagination and willingness of the researcher, which in this case is related to the needs of each researcher (Purba & Parulian Simanjuntak, 2011). In this study, researchers adapted and modified exploratory research steps in general, which include (1) identifying problems, (2) formulating hypotheses, and (3) conducting descriptive investigations. The development of this research step can be seen in Figure 1.



Picture 1. Step of exploration in this research

RESULT AND DISCUSSION

Widianto & Simanjuntak, (2010) mention that the Sangiran Early Men Site is a prehistoric site that contains a very large number of fossil findings, such as ancient hominid fossils, fauna and flora fossils, and stone artifacts. The diversity of findings and the abundant number of findings make the Sangiran Ancient Human Site have an important role for the development of science, especially in regard to human evolution, culture, and nature.

The Sangiran Early Men Site is divided into 5 sectors/clusters that have their own characteristics, centered on the Sangiran Antiquities Museum (Widianto & Simanjuntak, 2010). The five clusters are Ngebung Cluster, Manyarejo Cluster, Dayu Cluster, and Bukuran Cluster, with the Sangiran Antiquities Museum, also known as the Krikilan Cluster, serving as the museum's focal point. The Sangiran region experienced deposition from 2.4 million to 250,000 years ago. Sangiran has gone through several epochs with different characteristics, so that five land formations can now be seen in sequence, from the oldest to the top, which is the youngest uninterrupted formation. These five formations represent different epochs with accompanying environmental change (Sulistyanto, 2009).

Museums can be used as learning resources by adjusting the subject (Maulana Yusuf A et al., 2018). The Sangiran Early Men Site Museum and Cultural Heritage Unit is generally used as a source of learning history, but according to the results of the exploration carried out this museum also has potential as a source of learning biology. The Sangiran Early Men Site Museum

and Cultural Heritage Unit contains various information on evidence of past life and its changes to the present, which in biology studies can be explained as an evolutionary process.

Based on the exploration of five museum clusters, the museum collection is grouped into three types of data, namely fossil-artifacts, photo-information displays, and dioramas. The number of fossils and artifacts found and inventoried at the Sangiran early men Site reached approximately 13,000 pieces. Some of these, when collected, are parts of a single individual, but others are fragments of different individuals. So the number of fossils found reaches thousands because it is calculated based on the number of pieces not the number per individual.

The data obtained by researchers can almost all be used as a source of learning biology, and 90% of them are in line with class XII high school evolution material. Evolution is material that at the upper secondary education level is contained in Biology class XII, precisely on KD 3.9 and 4.9. The KD to be achieved reads analyzing the theory of evolution and natural selection with new views on the formation of new species on earth based on literature studies and reads evaluating self-understanding of various views on the evolution of living things and creating new ideas about the possibilities of evolutionary theory based on their knowledge.

Table 1. Mapping museum collections referring to the curriculum 2013

No	Curriculum Description	Object
1.	Expert opinions regarding the theory of evolution	Information Display about the theory from the expertise of evolution (Huxley, Haeckel, dan Mendel)
		Information display about thinking paradigm, also profile of Darwin and Wallace
2.	The phenomenas that Darwin encountered with the mechanism of natural selection	Information display about Darwin's travels and his findings (finch dan kura-kura)
3.	Evolution mechanism	Third display, the mechanisms (natural selection, adaptation, and variety)
4.	Sample of the evolution process on the population of organism	Display of *Biston bitularia* evolution
		Information display of human evolution
		Information display of Elephant evolution
		Information display of human anatomi evolution
5.	Human evolution process	The sequences of hominin at the Sangiran sites to understanding the development of hominin in Indonesia
		Information display of the three types of *Homo erectus*
		Reconstuction display of the Australopith and Hominin's cranial.
		The artefact of *Homo erectus* fossils.

6.	Evidence of evolution organisms	Fossils (Bones of deers, Cranials of Hominins, Bones of *Gavialis bengawanicus*, *Crocodylus* sp., *Bibos paleosandicus*, *Bibos paleokarrabau*, *Duboisia santeng*, *Cervidae*, *Rhinoceros sundaicus*, *Suidae*, *Panthera tigris*, *Hippopotamus* sp. Information display of organism's embryo differences
7.	Ecosystem evolution	Information display about the Sangiran environment in every layer of land formation Diorama of Sangiran excavations
8.	The differences of the Human and the other primates	Information display about differences between human and the other primates
9.	Scientists' views on evolution process	Information display about the Evolution scientist. Information display about the Sangiran people whose concern in evolution

The results of the curriculum description above and the mapping of learning object needs provided by The Sangiran Early Men Site Museum and Cultural Heritage Unit can be read in attachment on this journal since the data is big and various. The table. 1 shows all datas that is related to the learning object's needs. They are about history and point of few of evolutionist about evolution, the evidence of evolution such as artefact and fossils, newest information and found of evolution and many others.

Tabel 2. Mapping learning indicators and learning objects

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
1	Finding the relationship between the opinions of experts regarding the theory of evolution	- Opinions of experts on evolution: Linnaeus, Hutton, Lamarck, Malthus, Cuvier, Lyell, Darwin, Wallace, Mendel, Haeckel, Huxley, Weisman, Edwards, Helogenome Theory, Dawkins, Harun Yahya	- Literacy on the theory of experts	- Information display of the opinions of Linnaeus, Malthus, Lamarck, Darwin, Wallace, Mendel, and Haeckel
2	Connecting the phenomena that Darwin encountered with the mechanism of natural selection.	- Darwin's biography as the most influential evolutionary figure - Darwin's voyage on the HMS Beagle - Discoveries and phenomena in the Galapagos Islands	- Physical evidence of Darwin's book - Literacy of Darwin's biography - Darwin's sailing journey literacy; early history of sailing	- Display of early historical information on the voyage of the HMS Beagle - Miniature HMS Beagle - Fossil turtle carapace in Sangiran - Galapagos tortoise replica

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
		(finch beak, Galapagos iguana, Galapagos tortoise). - The theory of Darwin (adaptation, variation, and natural selection), - The work of Darwin (The Descent of Man and the Origin of Species)	- Knowledge of Darwin's ideas because of his journey - Literacy and real examples of Darwin's theory	- Display of Galapagos animal information that became Darwin's point of interest (Turtles and Finches) - Present information on Darwin's theory of evolution, specifically natural selection, adaptation, and decline with modification (variation). - Display of information regarding the Darwin-Lyell-Wallace relationship - Replica transcripts of Darwin's travel notes and his ideas on evolution - Replica transcript of Wallace's letter to Darwin - Darwin's books (The Origin of Species and The Descent of Man) replicas
3	Calculating gene frequencies in a population using the Hardy-Weinberg principle	- Hardy-Weinberg principal sentence - The condition in which allele frequencies in a gene pool are balanced, implying that a population has not evolved. - The Hardy-Weinberg principal formula	- The phenomenon of Biston Betaria can be used as an example of changes in allele frequencies in the gene pool. - Hardy-Weinberg equilibrium principal literacy, which includes the definition, conditions, and Hardy-Weinberg equilibrium formula.	
4	Prove the occurrence of evolution in a population using the Hardy-Weinberg principle	- Application of the formula and sound of the Hardy-Weinberg principle in a case that is shown.	- Actual evidence of evolution to serve as an example of application of the principle (e.g., using a sample albino population)	
5	Find the sequence of hominids to find out the development of hominins in Indonesia.	- Using data on the age of the discoveries and the ancient characteristics of each hominin (physical, environmental, and cultural), sort the hominins from most ancient to least ancient. - The hominin sequence as the foundation for the development of human evolution theory - Global spread of homo to Indonesia (multiregional theory, out of Africa/replacement theory) - The evolutionary relationship of man to the human races	- Data on physical, environmental, and cultural characteristics (artifacts) - Information on the origins of modern humans based on *A. aferensis, H. habilis, and H. erectus* (of which there are three types: archaic, typical, and progressive). *H. sapiens and H. sapiens sapiens* - Books: Widianto, Harry and Simanjuntak, Truman.	- Organism illustrationArboreal-terrestrial- bipedal - Replicas of Australopith fossils and displays of information on characteristics, culture, and environment (*A. aferensis, A. africanus, A. robustus, and A. boisei*) - Homo fossil replicas and information displays on characteristics, culture, environment, and artifacts (*H. habilis, H. rudolfensis, and H. erectus; archaic, typical, progressive, H. sapiens, H. neanderthalensis, and*

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
			Sangiran answers the world. Sangiran: BPSMP Sangiran, 2011.	*Cromagnon*). - Display of Australopith and Homo sketches and stone tools - Almost complete *Homo erectus* fossils (S17). - Reconstructed wax statue of *Pithecanthropus erectus* from its fossil findings at Sangiran Hominin phylogeny is shown, with the homo and australopith groups sharing a common ancestor. - The original stone and bone tools (artifacts) of the homo group - Fossil S4 (back skull and maxilla fragment with 10 teeth), fossil S31 (back skull fragment and part of the upper skull), fossil S9 (mandible fragment), and fossil P1 (child upper skull fragment) as representative fossils of the archaic *H. erectus* group. - *Pithecanthropus erectus* or *typic H. erectus* information displays - Fossil S17 (relatively complete skull with a maxilla with 5 teeth embedded in the jaw), S2 (cranium fragment of a female) - Display of information on the reconstruction of the S17 skull into a complete figure - Reconstructed wax figure from the fossilized skull of S17 - Imitations of fossil Ng12 (upper skull fragment) and Sm1 (upper skull fragment) as progressive *H. erectus* representatives - Display information about the general characteristics of *Homo erectus* - Display information about three different types of *Homo erectus*. - Display of sketches of *Homo neanderthalensis* stone tools found in Sangiran - Show data on the distribution of *Homo sapiens*, specifically the multiregional theory and the out-of-Africa theory or replacement theory.

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
				- Display information regarding the human race distribution - Presentation of Sangran environmental data in a timeline (Sangiran subsoil) as evidence of environmental evolution. - Sangiran soil section showing the Kalibeng, Pucangan, Grenzbank, Kabuh, and Notopuro Formations - The fauna of the Kalibeng formation includes fossils of ancient marine animals. - Fossils of ancient marine animals (crabs, turtles), Hippo, river crocodiles, and archaic *H. erectus* as organisms of the Pucangan formation - Fossil molluscs and foraminifera as cross-layer organisms/Grenzbank. - Herbivorous (bull, rhinoceros, elephants) and carnivorous (tiger) animal fossils, as well as *H. erectus* fossils, are typical Kabuh formation organisms. - Human-made stone artifacts in the form of flakes (hence the moniker "Sangiran flake industry"), jungle axes as evidence of the life of a progressive *H. erectus*, and the Notopuro formation
6	Describe the mechanism of evolution.	- Microevolution description - Natural selection (directional, disruptive, and stabilizing), sexual selection (inter and intrasexual), artificial selection (domestication), gene mutation and recombination, gene flow and genetic drift (bottleneck and founder effect) are all evolution mechanisms. - The relationship of the evolutionary mechanism to population allele frequency equilibrium (H-W principle)	- Literacy on the mechanisms of evolution	- Information display Natural Selection, Variation, and Adaptation are the three processes that explain how and why living things change from generation to generation. - Peacocks bred ex-situ in the Krikilan Cluster can be a real example of sexual selection. - Display of artificial selection information - Display of mutation and gene recombination information
7	Describe how the origin of an organism	- Mechanisms of speciation (allopatric, sympatric, peripatric, and parapatric) - Isolation (reproductive, environmental, behavioral, temporal, and mechanical) - The relationship of	- Knowledge of the mechanisms of evolution, isolation, and adaptive radiation	- Peacocks bred ex-situ in the Krikilan Cluster can be a real example of sexual selection

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
		reproductive isolation with sexual selection - Adaptive radiation		
8	Associated with the isolation of living things that led to the formation of new species	- The description of macroevolution in relation to the mechanism of speciation	- Literacy regarding macroevolution in relation to speciation mechanisms	
9	Outlines the various types of evidence for evolution	- Fossils (meaning fossils, fossilization, how to evacuate fossils/excavation procedures) - The origins of animals (including humans; correction of misconceptions regarding the assumption that humans descended from apes) and plants to explain the current existence of animals and plants (including their fossils) - Anatomical comparisons (homologies and analogies) - Vestigial organs - Embryological comparison - Biochemical comparison - Biogeography - Domestication	- Excavation - Animal fossils or their replicas - Plant fossils or their replicas - Fossils or human replicas - Artifacts - Data for comparing humans to apes (in the form of human and ape fossils, as well as cultural data) - Literacy regarding fossils, fossilization, and methods - Evolutionary evidence literacy (fossils, comparative anatomy (homologies and analogies), vestigal organs, comparative embryology, comparative biochemistry, biogeography, domestication)	- Display of information regarding the meaning of fossils - Books on fossilization and excavation procedures - Replica diorama of excavation activities - Display of the actual excavation site - Fossil storage laboratory - manuals on fossil storage and inventorying techniques - Fossilized stem fragments - Replica of dragonfly fossil prints - Replica of the fossil print of *Eurypterus lacustris* - Replica of the Pachops shutter fossil print - Fossil shells, bivalves, and molluscs - Replica of a fossilized shell from one of the Gastropod - Coelacanth fossil mold replica - *Crocodyles siamensis* fossil - *Crocodyles siamensis* information display - *Gavialis bengawanicus* fossil - *Gavialis bengawanicus* information display - Stegodon fossil - Stegodon information displays - Stegodon skeleton sketch - Fossil fragment of the lower jaw of a mastodon - Fossilized mastodon femur - Mastodon ivory fragments found in the Sangiran archaeological museum. - Display of different skull on Mastodon, Stegodon, and Elephas - Fossil lower jaw with loose teeth (molars) - Fossilized loose teeth (molars) belonging to Elephas. - Elephas hipbone fossil - Faux buffalo skeleton (*Bubalus palaeokarabau*) - Fossil bull skull and horns

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
				- Fossil deer antlers - Fossilized deer skull - *Rhinoceros sundanicus* fossil - Fossil fragment of the lower jaw of a river horse - Fossilized upper and lower jaws of ancient pigs. - Fossil fragments of tiger skulls - Reconstruction of an ancient human face in wax - demonstrate the differences between humans and apes. - Reconstructed facial features of *Australopithecus aferensis* from several fossil fragments found. - Reconstructed facial features of *Australopithecus africanus* from several fossil fragments. - Reconstructed facial features of *Australopithecus robustus* from several fossil fragments. - Sketches of the skull and sex of *Australopithecus robustus* - Reconstructed facial features of *Australopithecus boisei* from several fossil fragments found. - Reconstructed statue of *Pithecanthropus erectus* based on fossil findings. - *Australopithecus aferensis* is the common ancestor of the homo and australopith groups. - Phased stone ball, stone ball, slashing ax, chopping ax, hand ax, drill artifact, stone tool material artifact, blade artifact, gravel shear artifact, stone shaving tool artifact, bone tool artifact. - *Homo habilis*'s facial shape was reconstructed using fossil fragments discovered. - Sketches of *Homo habilis* skulls and artifacts - The facial shape of *Homo rudolfensis* is reconstructed. - The shape of the face of *Homo erectus* was reconstructed from several pieces of fossils found. - Sketches of skulls and stone tools used by *Homo erectus.* - Information display Comparison of head and facial shape of archaic, typical, and

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
				progressive *Homo erectus* - Individual Sangiran 4 (S4) fossil skull back fragment; maxilla fragment with ten teeth. - Fossil fragment of the lower jaw of individual S9 (Sangiran 9) or Pithecanthropus - Fossil fragment of the upper skull of individual S31 - Upper skull fossil fragment from a P1 child - Information display of the figure 'Piet' *or Pithecanthropus erectus* - Fossil skull S17 - show the reconstruction of the S17 skull into a complete one. - Faux S2 skull fossil - Reconstructed *Homo neanderthalensis* facial features - Sketches of skulls and stone tools used by *Homo neanderthalensis.* - Reconstructed Cro-Magnon face shape - *Homo sapiens* skull - Display multiregional and replacement theory information. - Display of comparative embryology data from various animals
10	Describe the mechanism of environmental evolution	- Demonstrate evolution by describing changes in nature over time as represented by different soil layers. - Describe the evidence of life and the natural conditions in each soil layer.	- Each time span has different soil layers.	- Presentation of Sangran environmental data in a timeline (Sangiran subsoil) as evidence of environmental evolution. - Sangiran soil section showing the Pucangan, Grenzbank, Kabuh, and Notopuro Formations - The fauna of the Kalibeng formation includes fossils of ancient marine animals, such as shells. - Fossils of ancient marine animals (crabs, turtles), water horses, river crocodiles, and archaic H. erectus as organisms of the Pucangan formation - Fossil molluscs and foraminifera as cross-layer organisms/Grenzbank Herbivorous (bull, rhinoceros, ancient elephants) and

No	Indicator	Material description	Required learning objects and resources	Learning objects are available at the sangiran museum
				carnivorous (tiger) animal fossils, as well as H. erectus fossils, are typical Kabuh formation organisms. - Human-made stone artifacts in the form of flakes (hence the moniker "Sangiran flake industry"), jungle axes as evidence of the life of a progressive H. erectus, and the Notopuro formation
11	Summarizing the opinions of experts and new evolutionary views regarding evolutionary events	- The theory of evolutionists	- Literacy on the experts' theory	- Display of information on the opinions of Linnaeus, Malthus, Lamarck, Darwin, Wallace, Mendel, and Haeckel
12	Look for and create ideas about new trends in the theory of evolution based on the understanding you have.	- From the concepts that have been obtained (understanding, expert opinions, mechanisms, and evidence), find new ideas about the theory of evolution.	- Literacy on the theory of experts - Literacy of evolutionary mechanisms	

The elaboration of the curriculum is carried out by formulating basic competencies into learning objectives, which are more specifically narrowed down to become learning indicators. The required learning objects are known after describing the curriculum. After mapping the required learning objects, the researcher conducted a survey and museum exploration to obtain data that corresponds to the required learning objects. So, when exploring the museum, researchers already know what collections can be designated as learning object-related material.

CONCLUSION

Based on the results of mapping the needs of evolutionary learning objects and museum exploration, 65 of the 115 kinds of collections at the Sangiran Early Man Museum correspond to the needs of evolutionary learning. They can meet eight of the twelve indicators of high school evolution learning out of the 65 types of collections. This means the Sangiran archaeological museum has the potential to be appointed as a learning resource on evolutionary material for high school students.

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