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Enhancing high school human evolution education: Harnessing “sapiens: a brief history of humankind” as an effective learning resource

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ABSTRACT

Understanding human evolution can be challenging for students and may lead to misconceptions, often stemming from the learning materials employed. Current learning resources commonly include textbooks, images, and the internet. The popular science book "Sapiens: A Brief History of Humankind" offers potential as an educational tool for teaching human evolution. This study aims to assess the suitability of "Sapiens" for high school Biology education and its potential as a resource for teaching human evolution in senior high school. Employing a qualitative descriptive method with a content analysis approach, data is gathered through documentation techniques. Primary data is derived from the documentation and content analysis of "Sapiens: A Brief History of Humankind." Data analysis follows the model proposed by Miles and Huberman (1983), encompassing data reduction, presentation, and conclusion drawing. The findings indicate that the book effectively addresses 7 out of 9 (77.78%) sub-topics of human evolution commonly taught in high school Biology. Importantly, the book replaces outdated terms like *Pithecanthropus* and *Meganthropus paleojavanicus*, found in traditional textbooks. Moreover, the book fulfills the five criteria for selecting learning resources as outlined by Djohar (1987). Consequently, "Sapiens" can serve as a valuable learning resource for high school Biology, particularly regarding the study of human evolution.

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INTRODUCTION

Evolution constitutes a crucial topic within high school Biology curricula (Pobiner, 2016). It encompasses the origins of life, mechanisms of evolution, evidential support for evolution, geological timeframes, and human evolution (Cofré et al., 2016; Rachmatullah et al., 2018). The study of human evolution entails exploring data from various scientific domains, including Biology, Paleontology, and Anthropology (Stringer, 2016). As part of the history of science, it involves scrutinizing evidence gathered over millions of years to comprehend the origin and evolutionary trajectory of humans. Despite its significance, students often struggle to grasp human evolution's complexities, including scientific terms, intricate concepts, and accessing concrete evidence (Infanti & Wiles, 2015; Wei & Wang, 2021).

However, the material on human evolution is challenging for students to comprehend due to difficulties in accessing evidence of human evolution, involving many scientific terms, and having complex concepts (Dunk et al., 2017). The complexity of the concepts involved includes the history and changes of evolution over time, encompassing a combination of evolutionary biology, environmental factors, fossils, and various evolutionary theories. Evolution is a complex topic that is inherently difficult to learn, leading students to develop alternative conceptual understandings (Bishop & Anderson, 1990; Bravo & Cofré, 2016; Cofré et al., 2017). The low academic achievement of students in evolution-related topics can be attributed to their lack of understanding, resulting from various factors such as a lack of knowledge, errors, and misconceptions (Adrianto et al., 2017).

There are numerous misconceptions concerning evolution, particularly human evolution. Unfortunately, several textbooks in school incorporate these beliefs (Relethford, 2017). One of the most common misconceptions in human evolution is that humans originated from apes, as claimed by Darwin. That is absolutely incorrect; Darwin never asserted that humans originated from apes in any of his publications. Darwin stated that humans and other primates shared the same progenitor (Fuentes, 2021; Tocheri et al., 2008). Misconceptions about human evolution can stem from the learning materials employed (Abebe et al., 2017; Helmi et al., 2019). While textbooks, images, and the internet are used, textbooks may occasionally lack precision in presenting certain concepts accurately, such as the relationship between humans and chimpanzees (Adrianto et al., 2017; Tshuma & Sanders, 2015). The integration of alternative learning resources, such as popular science books, can address this gap and promote a deeper understanding of inadequately explained concepts (Nelson et al., 2019).

Shaw & Dybdahl, (2000) describes how children are exposed to informal science activities every day. Helping kids see science as part of everyday life, comprehend its value to themselves and other individuals, and see the various transgressions made by the popular media may be a fascinating experience for educators and pupils. Popular science books differ from textbooks. Textbooks summarize all current knowledge supported as facts by the scientific community. However, due to their concise nature, textbooks may present information that is overly simplified and incomplete. On the other hand, popular science books serve as narrative accounts of research, reporting new knowledge claims (Parkinson & Adendorff, 2004). The use of popular science books is still infrequent and relatively unexplored. However, popular science books offer numerous advantages, such as being more widely available in bookstores compared to technical science books, many being written directly by scientific practitioners, Nobel laureates, or talented communicative scientists, explaining topics from multidisciplinary perspectives, and being easy and engaging to read (Lam et al., 2005).

Among such popular science books, "Sapiens: A Brief History of Humankind" by (Harari, 2017), stands out. This book offers a comprehensive exploration of human history from various dimensions, including biology, culture, economics, politics, technology, and religion. In each section, Harari elaborates on the development of humankind from various aspects, such as biology, culture, economy, politics, technology, and religion (Harari, 2017). The book's success has led to translations in numerous languages, including Indonesian, with the title "*Sapiens: Riwayat Singkat Umat Manusia*." It has been acknowledged as a "Best-Selling Science Book" by The New York Times (The New York Times, 2015). Harari's presentation of human evolution material in "Sapiens" employs accessible language and is complemented by illustrative aids, enhancing reader comprehension.

The book "Sapiens" is not specifically a Biology book, thus requiring validation and evaluation of the representation of biological science within it. It should be noted that the language used in this book is adapted to facilitate general readers' understanding of the presented concepts. The use of imprecise

language in Biology can result in misinterpretations of concepts, particularly in this book, such as the concept of human evolution.

Ideally, biology learning occurs by observation of occurrences, or biological symptoms. It's merely that this pertains to events that are still present and occurring now. So, what about past phenomena? This undoubtedly presents its own set of issues, necessitating the use of unique tools (Malone et al., 2019). In this study, a learning material was selected that is packed in a popular scientific book that has many debates regarding human evolution. *Sapiens* has been widely read as a literary work, and it is now being utilized as a teaching tool to explore evolution, particularly human evolution.

Given this concern, the appropriateness of utilizing the book "*Sapiens*" as a learning source for high school Biology warrants deeper exploration. The effectiveness of "*Sapiens*" in conveying human evolution concepts within an educational context is a crucial consideration. This study aims to delve into how "*Sapiens*" addresses the subject of human evolution. If the book adeptly simplifies scientific jargon and renders the concept of human evolution understandable, it has the potential to serve as a significant asset in Biology education, aligning with the curriculum's requirements.

METHODS

Research Design

The research employs a qualitative descriptive method, aiming to deeply understand the human evolution content within the popular science book "*Sapiens*." Qualitative research is vital in comprehending complicated events and has a unique ability to capture people's varied perspectives. (Hall & Liebenberg, 2024). The content analysis approach is utilized for examining the subject of human evolution in the book. The researcher sees the potential of the book "*Sapiens*" as a learning resource for high school Biology, thus requiring an analysis of the relevance and comparison of the subject of human evolution in the book with high school biology textbook.

Population and Samples

The data utilized in this study is of a qualitative content nature derived from the textual composition of the book, encompassing linguistic elements ranging from phrases, individual words, to complete sentences. The principal dataset employed for this research emanates from the literary work titled "*Sapiens: A Brief History of Humankind*." Concurrently, supplementary data for this investigation is garnered from auxiliary sources, notably scholarly literature and books, which serve as corroborative references underpinning the primary dataset (i.e., the aforementioned book "*Sapiens*"). Additionally, supplementary data is also extracted from pedagogical documents, including educational curricula and high school Biology textbooks. Among the utilized textbooks are the Biology Class 3 textbook for senior high school, published by Penerbit Erlangga in 2018, and the Biology Class 12 textbook published by Penerbit Yrama Widya in 2021.

Instrument

In this research, both primary and secondary data are collected using documentation techniques, each with distinct purposes and methods. Documentation involves gathering data from various historical documents, including written texts, images, and significant works by individuals (Sugiyono, 2017). The aim is to categorize representations of human evolution in the book "*Sapiens: A Brief History of Humankind*" based on their forms and categories. This is achieved through the application of a coding sheet.

Procedure

The research begins by examining the entire and partial content of the book to identify the material on human evolution within the book. The overall examination is conducted to gain a comprehensive understanding of the book, while the partial examination is performed to delve deeper into the specific topic under investigation. Subsequently, the development of an instrument in the form of a coding sheet takes place. The human evolution materials from the book are categorized and represented in the coding sheet, accompanied by inferences made by the researcher. Then, for the secondary data, documentation is carried out by reinforcing the literature. The documents refer to the bibliographic sources from the primary data to corroborate the findings in the book "*Sapiens: A Brief History of Humankind*." Following

this, the data will be analyzed using (Huberman & Miles, 1983) model. Following the data analysis by Miles and Huberman, the optimal utilization of a learning resource depends on its temporal integration, implementation strategy, and targeted audience engagement; the data was then analyzed by (Djohar, 1987), who outlined five critical criteria that determine an item's eligibility as a learning resource.

Data Analysis Techniques

After the data has been collected, the analysis process involves three stages: data reduction, data display, and conclusion drawing.

1. Data reduction

Data reduction aims to simplify, categorize, and eliminate unnecessary data to conclude. After thoroughly reading the book "Sapiens: A Brief History of Humankind" and examining certain sections, a substantial amount of data will be gathered. Therefore, it is necessary to reduce the data to separate the relevant information from the irrelevant. This data reduction process is conducted to establish human evolution content derived from the book using the coding sheet.

2. Data display

Data display serves the purpose of presenting information in the form of narrative texts, which are quotations from the book. Each quotation will be assigned a code for numbering and referencing purposes. The material on human evolution obtained from the book will be explained based on its representations, accompanied by inferences from the researcher's interpretation of the author's writings.

3. Verification

The final stage in data analysis is concluding. After the data is presented according to categories and the researcher's interpretation of its context, scientific facts from the text in the book will be verified to ensure the credibility of the information provided.

RESULTS AND DISCUSSION

Although Harari does not go into detail on evolutionary mechanisms like natural selection, mutation, and gene flow in his article, he does implicitly discuss them. Harari, for example, explains natural selection by describing how *Homo sapiens* survived and thrived among other human species. Mutation and gene flow, as well as migration and interbreeding, are present in Harari's explanation of human evolution, including how *Homo sapiens* interacted with other species like Neanderthals.

Human Evolution in High School Curriculum

Within the framework of the Kurikulum Merdeka, the Biology curriculum at the high school level is bifurcated into two phases: Phase E and Phase F. Phase E caters to students in grade X, while grades XI and XII fall under Phase F. The content encompassing human evolution constitutes a segment of the broader evolutionary syllabus housed within Phase F. Thus, the material on human evolution is intended for students in grades XI and XII of high school. Teachers enjoy the flexibility to opt for the grade level at which the subject of evolution, specifically human evolution, shall be introduced.

Comprehensively, high school Biology textbooks encompass material related to human evolution, including the concepts of human evolution and ancient humans. The concept of human evolution encompasses topics such as the human evolutionary lineage (hominids), the classification of humans within the primate family, the development of human anatomical structures, and the factors driving human evolution. Concerning ancient humans, the topics encompass *Australopithecus*, *Homo neanderthalensis*, *Homo soloensis*, *Homo floresiensis*, and *Homo sapiens* (Nurhayati & Wijayanti, 2021; Pratiwi et al., 2017).

Human Evolution Content in the "Sapiens"

The exploration of human evolution within "Sapiens: A Brief History of Humankind" is situated primarily in chapters 1 and 2, titled "Animal No Significance" and "The Tree of Knowledge." The content is interwoven with a narrative style, meticulously adapted by Harari to enhance the engagement of readers. Consequently, an in-depth reading of the human evolution material enables a more profound comprehension.

A. Concept of Human Evolution

1. Divergence from the ancestor of all chimpanzees

Just 6 million years ago, a single female ape had two daughters. One became the ancestor of all chimpanzees; the other is our own grandmother... (Page 5)

Further back in the evolutionary timeline, humans and chimpanzees share a common ancestor. This explanation provides the answer to a long-standing misunderstanding. Humans did not evolve from other primates, and vice versa. Humans are phylogenetically related to other primate species, and each variety of primates evolved into the primates we see today, and humans are the only surviving hominids. The initial hominin species branched off from this common forebearer 6.3 million years ago, only to reunite with the chimpanzee lineage through hybridization (Patterson et al., 2006). This statement addresses the origin of humanity, a species that shared a common lineage with chimpanzees six million years ago. Over epochs, the human ancestral lineage underwent diversification into various hominid species, coexisting during distinct periods in disparate corners of the globe.

2. Human evolutionary line

*...It's a common fallacy to envision these species as arranged in a straight line of descent, with *Ergaster* begetting *Erectus*, *Erectus* begetting the Neanderthals, and the Neanderthals evolving into us. This linear model gives the mistaken impression that at any particular moment only one type of human inhabited the earth, and that all earlier species were merely older models of ourselves... (Page 8)*

Over time, the trajectory of human evolution has often been depicted as a ladder, with each rung denoting a hominid lineage. These hominid species were once envisioned as "sequential instances," with archaic species being "replaced" by more sophisticated ones, culminating in modern humans at the summit of this evolutionary ladder. However, evidence amassed over the last couple of decades from fossil records, coupled with novel analytical methodologies that unravel relationships among fossil species, challenges the validity of this ladder metaphor. Instead, the hominid evolutionary tree more aptly resembles a bush, branching from its base while converging closer to its apex (Wood, 1996).

Several students still retain misconceptions regarding the human evolutionary lineage, with some even misconstruing humans as direct descendants of apes. Harari's elucidations within the book aim to rectify these erroneous beliefs among students.

3. Development of the brain and bipedalism

*...The earliest men and women, 2.5 million years ago, had brains of about 600 cubic centimeters. Modern *Sapiens* sport a brain averaging 1,200–1,400 cubic centimeters... (Page 9)*

...Standing up, it's easier to scan the savannah for game or enemies, and arms that are unnecessary for locomotion are freed for other purposes, like throwing stones or signaling... (Page 10)

As posited by (Lewin, 2004), bipedalism (walking on two legs) and encephalization (brain expansion) constitute two pivotal junctures in human evolution. Bipedalism denotes the phase when humans evolved to stand on two legs, freeing their other two limbs (arms) for alternative functions. The advantages of bipedalism include enhanced visual range and a wider field of view, while disadvantages encompass potential issues such as back pain, neck strain, and narrower hips.

4. Out-of-Africa theory and interbreeding theory

The theory of replacement in the context of human evolution is commonly referred to as the "Out of Africa" theory. This theory posits that *Homo sapiens* originated from a single population of ancient humans in Africa and subsequently dispersed across the globe, leading to the replacement of pre-existing populations of ancient humans (Tattersall, 2009). During the time migration and interbreeding are elaborated by the gene flows (Carroll, 2005). According to this theory, the emergence of modern humans occurred in Africa approximately 200,000 to 300,000 years ago, followed by their migration out of the continent. This migration is believed to have transpired in

multiple waves, with the earliest wave taking place around 70,000 to 100,000 years ago.

...According to this theory, Sapiens and other humans had different anatomies, and most likely different mating habits and even body odours. They would have had little sexual interest in one another... (Page 16)

In contrast, the interbreeding theory proposes that the contemporary human population is the outcome of interbreeding between *Homo sapiens* and other human species. In this theoretical framework, various ancient human forms from across the world, such as *Homo erectus* and Neanderthals, along with modern forms of humans, gradually amalgamated into a diverse population of *Homo sapiens*, forming a continuous gradient.

...The 'Interbreeding Theory' tells a story of attraction, sex and mingling. As the African immigrants spread around the world, they bred with other human populations, and people today are the outcome of this interbreeding... (Page 16)

In his book, Harari offers an extensive exposition of the limitations inherent in both theories. Remarkably, the elucidation regarding the replacement and interbreeding theories remains a rarity in traditional classroom settings. Nonetheless, this content resonates with the four pivotal junctures in human evolution as delineated by (Lewin, 2004). Accordingly, acquainting students with the replacement and interbreeding theories holds the potential to augment their comprehension of the intricate tapestry of human evolution.

B. Ancient humans

1. Australopithecus

Humans first evolved in East Africa about 2.5 million years ago from an earlier genus of apes called Australopithecus, which means 'Southern Ape'. About 2 million years ago, some of these archaic men and women left their homeland to journey through and settle vast areas of North Africa, Europe and Asia... (Page 6)

Australopithecus, an extinct primate species often referred to as the 'southern ape,' exhibits a notable genetic proximity to contemporary humans, potentially serving as an ancestor or close relative. Fossil remnants of *Australopithecus* have been unearthed predominantly within the African continent. One noteworthy characteristic shared with modern humans is the adaptation of bipedalism (Kimbel & Villmoare, 2016). Within the realm of high school Biology education, *Australopithecus* frequently serves as a pivotal illustrative example to expound upon the initial phases of ancient human ancestors.

2. Homo neanderthalensis

Humans in Europe and western Asia evolved into Homo neanderthalensis ('Man from the Neander Valley'), popularly referred to simply as 'Neanderthals'. Neanderthals, bulkier and more muscular than us Sapiens, were well adapted to the cold climate of Ice Age western Eurasia... (Page 6)

Homo neanderthalensis possesses distinctive anatomical traits such as well-developed muscles, subcutaneous fat, a broad trunk, an enlarged nasal cavity equipped with turbinate bones (to condition inhaled air), and relatively shorter limbs, particularly the lower extremities. These morphological features illuminate Neanderthals' adaptive strategies for survival within frigid climates (Stegmann et al., 2002). Harari suggests that the robust and muscular build of Neanderthals was an outcome of their adaptation to the cold climate of Western Eurasia. As a result, the content elucidating *Homo neanderthalensis* in the book is pertinent to the pedagogical objectives of high school Biology.

3. Homo soloensis

On the island of Java, in Indonesia, lived Homo soloensis, 'Man from the Solo Valley', who was suited to life in the tropics. (Page 7)

Homo soloensis represents an ancient human species whose historical presence was localized within the vicinity of the Solo River region on the Indonesian island of Java. While high school Biology textbooks conventionally highlight *Megantrophus paleojavanicus* as the emblematic ancient human species originating from Java, the classification of the latter remains the subject of scholarly debate. This uncertainty stems from the scarcity of definitive evolutionary evidence, prompting deliberation over whether it should be categorized within the *Homo* genus or regarded as a distinct species. Within "Sapiens: A Brief History of Humankind," the detailed exposition of ancient humans is focused on *Homo soloensis*. The brevity of material concerning this species is attributed to the limited available information. For the time being, all the genus that mention the local sites to locate it, grouped named *Homo erectus* with the special subspecies Archaic, Typical, and progressive (Wood, 2020).

4. *Homo floresiensis*

On another Indonesian island – the small island of Flores – archaic humans underwent a process of dwarfing. Humans first reached Flores when the sea level was exceptionally low, and the island was easily accessible from the mainland... (Page 7)

Homo floresiensis, characterized by a diminutive stature weighing approximately 16-36 kg, traces its ancestry back to Sulawesi rather than Java. Plausible maritime currents are believed to have unintentionally facilitated the dispersion of its ancestors, diverging from the hypothesis of intentional navigation (Baab, 2016). The precise causal factors contributing to the dwarfism exhibited by *Homo floresiensis* remain subjects of ongoing investigation, with one hypothesis attributing it to resource constraints on Flores Island, exemplified by *Stegodon sondari* (an extinct dwarf elephant species weighing around 300 kg) (Dennell et al., 2014).

5. *Homo denisova*

In 2010 another lost sibling was rescued from oblivion, when scientists excavating the Denisova Cave in Siberia discovered a fossilised finger bone. Genetic analysis proved that the finger belonged to a previously unknown human species, which was named Homo denisova. Who knows how many lost relatives of ours are waiting to be discovered in other caves, on other islands, and in other climes... (Page 8)

Within the educational panorama of high school curricula, the ancient human species *Homo denisova* is frequently overlooked in instructional discourse. Notably absent from many Biology textbooks, this omission underscores the imperative for an updated representation of human evolution, especially concerning ancient humans, within scholastic learning materials. Thus, the narrative presented in "Sapiens: A Brief History of Humankind" offers a more comprehensive portrayal of ancient human species when contrasted with the traditional content of standard high school Biology textbooks.

6. *Homo sapiens*

The emergence of *Homo sapiens* occurred in the African landscape approximately 200,000 to 150,000 years ago, initiating a gradual dispersion that eventually encompassed global territories, including regions as distant and diverse as Australia, Siberia, and Western Europe, around 50,000 to 40,000 years ago (Bermúdez de Castro & Carbonell, 2022; Groucutt et al., 2015). "Sapiens: A Brief History of Humankind" meticulously unpacks the epoch of *Homo sapiens'* inception within Africa. Tudge, (1989), explained after *Homo sapiens* had been breaking the ecosystem laws, *Homo sapiens-sapiens* is become the newest-modern man.

Moreover, the book intricately explores an array of facets surrounding *Homo sapiens*, encompassing morphological attributes, the maturation of bodily organs, cultural evolution that encompasses the development of language, mastery of fire, crafting of stone tools, and the employment of hunting methodologies. The discourse on *Homo sapiens'* attributes and achievements resonates throughout both Chapter 1 and Chapter 2 of the book. Consequently, this thematic sphere receives comprehensive and in-depth treatment within the book's narrative framework.

The relevance of the material on human evolution in "Sapiens" to high school Biology Education

Table 1

Relevance of human evolution material in the book "Sapiens" with high school biology textbooks

Human Evolution's Topics	Human Evolution's Topics in Senior High School Learning	Human Evolution's Topics in the "Sapiens"	Availability in Senior High School Learning	Availability in the "Sapiens"	Relevance
Concept of Human Evolution	Classification of humans within primates	Divergence from chimpanzees	✓	✓	✓
	Human evolutionary line	Human evolutionary line	✓	✓	✓
	Development of human body organs	Development of the brain and bipedalism	✓	✓	✓
	Factors of human evolution	Out-of-Africa theory and interbreeding theory	✓	✓	✓
Ancient humans	<i>Australopithecus</i>	<i>Australopithecus</i>	✓	✓	✓
	<i>Homo neanderthalensis</i>	<i>Homo neanderthalensis</i>	✓	✓	✓
	<i>Homo sapiens</i>	<i>Homo sapiens</i>	✓	✓	✓
	<i>Megantrophus paleojavanicus</i>	-	✓	✗	✗
	<i>Pitechanthropus</i>	-	✓	✗	✗
	-	<i>Homo soloensis</i>	✗	✓	✗
	-	<i>Homo floresiensis</i>	✗	✓	✗
-	<i>Homo denisova</i>	✗	✓	✗	

In the Senior High School Biology textbook, there are nine distinct sub-topics pertaining to human evolution, categorized under two primary themes: "Concepts of Human Evolution" and "Ancient Humans." Among these sub-topics, Harari's seminal work "Sapiens" offers an effective explication of seven of them (as depicted in Table 1). The consequential relevance of "Sapiens" within this educational context approximates 77.78%, signifying its coverage of seven out of nine sub-topics. It is noteworthy that the terms "Pithecanthropus" and "Megantropus paleojavanicus" have become obsolete in the realm of human evolution. Consequently, these designations are absent from "Sapiens," as the book does not provide specific elucidations regarding these archaic human classifications.

However, "Sapiens" notably fills gaps in the Senior High School Biology textbook by effectively addressing certain ancient human species that are not encompassed in its content. These include *Homo soloensis*, *Homo floresiensis*, and *Homo denisova*. This dynamic underscores "Sapiens" as a comprehensive and current source of knowledge, augmenting the comprehension of human evolution. Importantly, "Sapiens" expands the intellectual horizon by accommodating discussions on these ancient humans that might be overlooked in the textbook, primarily due to the utilization of outdated terminologies.

In essence, "Sapiens" emerges as a multifaceted educational resource, capable of enriching students' insight into human evolution. As it provides a broader scope and contemporary perspective, it resonates as an engaging supplement to the existing curriculum, fostering a more nuanced grasp of the intricate tapestry of human evolutionary history.

"Sapiens" as an Effective Learning Resource in Senior High School

In light of the foregoing discussion, it becomes evident that the book "Sapiens: A Brief History of Humankind" holds great potential as a robust learning resource for high school Biology, specifically in the realm of human evolution. The book seamlessly elucidates key topics integral to high school biology curricula, covering seven out of nine subtopics in this domain. However, beyond mere compatibility with the curriculum, the suitability of "Sapiens" as a learning resource must also be carefully considered.

Selecting learning resources entails an alignment with instructional strategies. The optimal utilization of a learning resource hinges on its temporal integration, strategic implementation, and targeted audience engagement. (Djohar, 1987) outlined five critical criteria that determine the eligibility of an item as a learning resource. These criteria hold relevance in evaluating the appropriateness of "Sapiens" for educational purposes:

1. Clarity of the potential availability of objects and issues raised.

The book "Sapiens: A Brief History of Humankind" holds a notable position in the realm of popular science literature, enjoying widespread recognition and availability in various outlets, encompassing physical bookstores, libraries, and digital marketplaces. This literary work engages in a comprehensive exploration of human history, delving into the intricate narrative of human evolution. Leveraging this book can effectively address several challenges encountered when teaching human evolution at the high school level, including the complexities of scientific terminology and intricate concepts. The book's approach to presenting the material on human evolution through linguistic, narrative, and visual modes offers a facilitative framework for enhancing comprehension and engagement among its readerships.

2. Alignment with learning objectives.

Utilizing this book is anticipated to enable students to grasp the intricacies of human evolution, a foundational aspect of Biology spanning both individual and population levels. By doing so, students can gain insight into the innate interaction and dynamic transformation inherent in living systems, exemplified through the process of evolution. This comprehension is rooted in the investigative methodologies of scientists studying human evolution, encompassing elements like evolutionary drivers and ancestral human beings. Equipped with this grasp, learners are poised to engage with prevalent biological misconceptions in society, including the misinterpretation that humans directly evolved from apes.

3. Material targets and its purpose.

The book "Sapiens: A Brief History of Humankind" can serve as a valuable educational resource for the study of human evolution. This book encompasses pivotal and relevant aspects of human evolution, germane to the curriculum of high school Biology education. The covered material spans human history, the progressive changes wrought by evolution over time, and the origins of humanity.

The purpose of this book as an educational tool aligns seamlessly with its applicability within the scholastic context. "Sapiens" is authored in a manner accessible to a general readership, rendering its content comprehensible to students, who can readily follow the explanations provided within its pages. Moreover, the book presents information through engaging narratives and illustrations, which facilitate the visualization of intricate concepts. Consequently, it is suitably tailored to serve as a pedagogical resource in the classroom instruction of human evolution.

4. Information to be disclosed.

The book "Sapiens" delivers a comprehensive exposition of information concerning human evolution from various scientific perspectives, including biology. This book provides an elucidation of human evolution grounded in available scientific data and evidence. The information conveyed within its pages encompasses key facets of human evolution, encompassing the separation of humans from chimpanzees, the lineage of human evolution, developments in brain size and bipedalism, as well as theories like interbreeding and replacement. "Sapiens" also furnishes accurate and up-to-date insights based on the knowledge of ancient humans. In contrast to the high school Biology textbooks' utilization of terminologies like "*Pithecanthropus*" and "*Meganthropus paleojavanicus*," this book aptly explicates *Homo erectus*.

5. Guidelines for exploration and attainable acquisition.

The explorative guidance within the book "Sapiens" becomes evident through the author's (Harari's) lucid and systematic explication of human evolution concepts. Readers (students) are

enticed to engage deeply with the book's content and contemplate its implications for their understanding of humanity and life. Through "Sapiens," learners can attain knowledge about human evolution, grasp how environmental and cultural factors influence human development, and gain an introduction to the concepts and theories underpinning the study of human evolution.

In summary, the book "Sapiens: A Brief History of Humankind" emerges as a potent learning resource for the realm of high school Biology. Its comprehensive coverage of human evolution aligns with educational objectives and provides a fresh and engaging perspective compared to conventional textbooks. By meeting the outlined criteria for a learning resource, "Sapiens" effectively enriches students' understanding of human evolution, transforming it into a captivating and indispensable tool for educators. It's only that, in some circumstances, teachers avoid particular texts for specific reasons. There are various reasons, but the main one is that teachers already have limited time to explore additional learning resources (Schmidt et al., 2007).

CONCLUSION

The book "Sapiens: A Brief History of Humankind" holds significant relevance in the realm of high school Biology education. This is attributed to its comprehensive coverage of 7 out of 9 (approximately 77.78% with exceptions) sub-topics about human evolution, which are typically included in the curriculum. Furthermore, the book admirably fulfills the five criteria outlined by Djohar (1987) for being an effective learning resource. Thus, "Sapiens" can serve as a valuable learning resource for fostering a nuanced understanding of human evolution within the context of senior high school education.

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