

Improving scientific literacy through an interactive e-book: a literature review

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Abstract. Students' scientific literacy in Indonesia still in low. Various attempts have been made by educators to improve student's scientific literacy such as using different learning models; using varied facilities, media, or learning resources; and using scientific approach in the learning process. However, these efforts haven't been able to helps students achieve the average standard of scientific literacy skills. Interactive e-book can be used as an alternative learning resources to improve scientific literacy. This literature study aims are to give overview how interactive e-book improving scientific literacy. Interactive e—book has 6 content that will help student to increase their ability on scientific literacy: Animation picture, videos, hyperlink, interactive question, student worksheet, and evaluation.

Keywords: *scientific literacy, interactive e-book*

1. Introduction

Science is a series of concepts that are interconnected with concept charts that have been developed as a result of experimentation and observation and are useful for further experiments and observations. Referring to understanding of science, then the nature of science includes four elements, there are: (1) attitude : curiosity about object, natural phenomena, living things, and casual relationships that cause new problems that can be solved through correct procedures; science is open ended; (2) process: problem-solving procedures through scientific methods; scientific methods include developing hypotheses, designing experiments or experiments, evaluating, measuring, and drawing conclusions; (3) products: in the form of facts, principles, theories, and laws; (4) application: application of scientific methods and concepts of science in everyday life [1]. The application of a scientific approach which includes five learning experiences (observing, asking questions, gathering information, reasoning/associating, and communicating) has a goal that students can obtain the nature of learning science. Thus in the process of learning science in school students can find their own concepts that are studied thoroughly, meaningfully, authentic, and actively. The meaningfulness of science learning in schools can be obtained if students have a good scientific literacy skill.

In this era, the students require some competencies such as using scientific culture, critical thinking, and making correct decision to solve the problem on his/her daily life [2]. On the other hand, the researched of learning science in junior high school in Indonesia shows less emphasis on the process of formulating scientific questions for inquiry, using knowledge to explain a natural phenomenon, and drawing conclusions based on observed fact [3]. This is reinforced by the results of the PISA student's scientific literacy measurement test in 2015 which showed an average score of 403 or still in the low



category compared to the OECD average of 493 [4]. These results indicate that students have difficulty in making connections between science concepts and phenomena in daily life.

There are several factors that influence the low level of student's scientific literacy including student attitudes toward science, science learning process at school, and student's interest and motivation in learning science [5]. Various attempts have been made by educators to improve student's scientific literacy such as using different learning models; using varied facilities, media, or learning resources; and using scientific approach in the learning process. However, these efforts haven't been able to help students achieve the average standard of scientific literacy skills.

Giving of scientific materials in school that have a balance of scientific literacy and always associated with social and technological issues of society is one of the effort that can be done [6]. One of materials that's used by teachers is the books. Books are still functioned as the main learning resources and the most effective learning support and resources beside the teachers [7]. Recently, education undergoes a significant transformation along with the emergence of digital technology, such as: internet, laptops, mobile phones and most recent is electronic book or e-book [8]. In its development, e-book combined with various media on computer so that e-books are more interactive and called interactive e-book.

Interactive e-book is a form of interactive multimedia. Interactive e-book combine sound, video, animation, images, graphics, tables, and text in a form arranged according to the characteristic of the e-book. Interactive e-book make learning remains student-centered, so they can understand the content well [7]. On the other hand, multimedia can improve student's scientific literacy skills because students can study deeply and are able to apply knowledge to real, new, and different condition [9].

The rest of this paper is organized as follow: section 2 presents a review of interactive e-book improve scientific literacy. Finally, section 3 concludes this work.

2. A Review of Improving Scientific Literacy Through Interactive E-book

This section presents a review of improving scientific literacy through an interactive e-book.

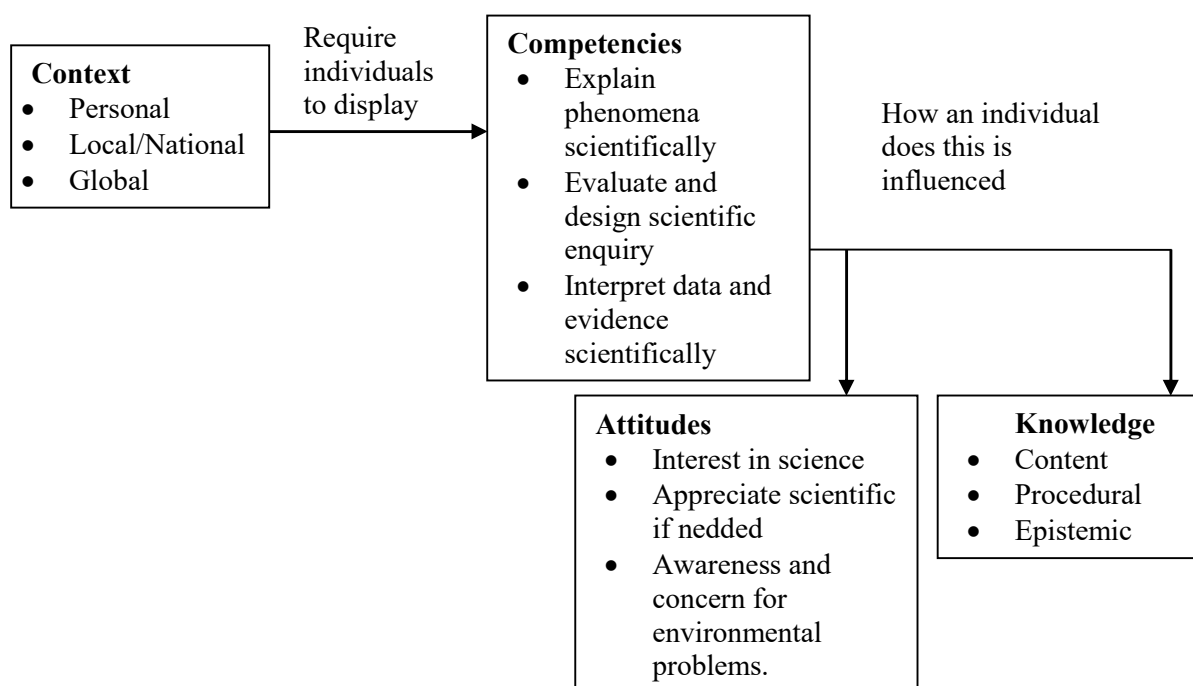
2.1. Scientific Literacy

The essence of science learning not only to understanding concept, but student also can be applied their concept in the daily activities. The means in science learning can be acquired through students' sciences literacy which is beneficial in problem solving activities [10]. The ability of scientific literacy needed to apply, synthesize and evaluate existing information effectively and efficiently [11]. Science literacy is the ability possessed by someone to connect the scientific knowledge that has been possessed in everyday life based on available evidence and facts and is used to solve problems and make decisions. Scientific literacy is very important for students because it is related to real life, where, nowadays, human can't be separated from technology and science in managing the environment. Scientific literacy is the main objective of science education and is used as an indicator to see the quality of education and human resource in a country [12], [13].

There are four aspects of science literacy: context, knowledge, competency, and attitude. Context aspect in science literacy include natural resources, environmental quality, hazard, health, and the application of science & technology in personal, local/national, and global issues, both current and historical. Knowledge aspect of science literacy consists of several knowledge's: 1) content knowledge includes physical system, living systems, earth system and space; 2) procedural knowledge is a knowledge of the scientist standard procedures use to obtain valid and reliable data; 3) epistemic knowledge provides a rationale for procedures and practice in which scientist engage, a knowledge of the structures and defining features that guided scientific enquiry, and the foundation for the basis of belief in the claims that science makes about the natural world. Competencies aspect is the ability to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically. Attitudes aspects include students' interest in science, liking scientific discovery activities, and motivation to be ready to be responsible for natural resource and the environment [14]. Indicator of each aspects of scientific literacy skills' can be seen in the table below. Inter-relations between the four aspect of science literacy can be seeing in figure 1.

Table 1. Indicators of Scientific Literacy

Aspect	Indicators
Context	Involves important issues in daily life
Knowledge	Content knowledge Procedural knowledge Epistemic knowledge
Competencies	Identifying issues scientifically Explaining phenomenon scientifically Using scientific evidence
Attitudes	Interests' in science Appreciate/assess scientific approach if needed Awareness and concern for environmental problems.

**Figure 1.** Inter-relations between the four aspect of science literacy

In conclude, scientific literacy is an ability of students competency to explain, to designing experimental, and to construe data scientifically so they can solve the problems or issues in context personal, local, national and global. Student are able to achieve these competencies if they have a good attitude and knowledge in science.

2.2. Interactive E-book

An e-book is text in digital form of a computer file, an electronic file in the form of words and images displayed on the display window of an electronic device that aims to provide a more enjoyable experience for e-book readers [15]. E-book are a combination of software specifically designed for reading material through electronic media such as computers [16]. E-book is an abbreviation of electronic book or electronic book, is a book that can be opened electronically through a computer. An electronic book is a digital version of a book that generally consists of a collection of papers containing text or images. The e-book itself makes the text and images in the form of digital information both in

plain text format, images with interesting visualizations, as well as multimedia content that can be integrated in the e-book. If examined deeper, e-books can be interpreted as one of the technologies that use computers to display multimedia information in a concise and dynamic form. E-books are able to integrate animated shows, images, graphics, sound, and video so that the information presented is richer than conventional books.

Each learning resources has its own provisions which are used as a geode or reference for manufacture. These reference are the assessment of the feasibility of learning resources to be made. Butcher, Davies, and Highton explain the instruction for making e-books, there are: using font 12; using font that easy to read, using justify text, using bold font for important information, use picture clear, and giving information in each pictures [17]. In the other hands, the ministry of national education in Indonesia evaluate a component that needed in e-book which are: introduction, material, students work sheet, quiz, and reference list [18].

Interactive has the nature of mutual active and influence each other. Interactive concepts are closely related to computer-based media. Interactive referred to in this case is an interaction activity between the media and media users [19]. In the other hand, Interactive learning defined 4 level of interactivity, that is: 1) level 1: the student acts solely as a receiver of information; 2) level 2: the student makes simple responses to instructional cues; 3) level 3: the student makes a variety of responses using varied techniques in response to instructional cues; 4) level 4: the students are directly involved in a life-like set of complex cues and responses [15].

In 2011, Mata introduced next generation of e-book, it called interactive e-book. He introduces some features of the interactive e-book: 1) interaction occurs in multi-channels; 2) interactions are among user, digital book, and environment, the book elements interest among themselves; 40 interaction occur synchronously among many component [17]. The presence of multimedia (such as pictures and audio / sound) in e-books can attract respondents to use e-books [20]. Features that can be added in e-books include: automatic search, page reversal, virtual location markers, bookmarks, annotations, hyperlinks (direct links), multimedia, automatic identification of synonyms (synonyms), foreign term searches using encyclopaedias online, and can automatically index the end of the book [21].

Interactive e-book is essentially digital book format in which the user, the digital book, and the environment can interact reciprocally at a high level; digital book elements can communicate and interact among themselves and environment as well as users, and many communication channels are put in use at one the same time (The interaction in interactive e-book can see on figure 2) [15]. According to the pictures, it can see that there are four type of interaction that happened in interactive e-book.: 1) interaction among digital the book elements; 2) Interaction between environments; 3) Interaction between digital book and user; 4) interaction with other users/online communities.

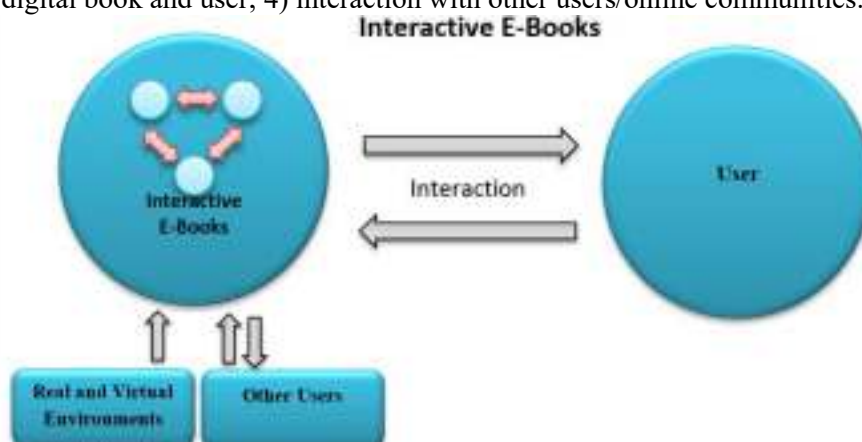


Figure 2. interaction in interactive e-book.

Based on the text, we can conclude that interactive e-book is an electronic book that is interactive in which there are features that are combined in a complex file or software so that it can form interactions

between users (users) with the media (programs). Interactive e-book is a form of interactive multimedia. therefore, in an interactive e-book there are various kinds of media that can be combined in one container so that readers not only get information from one source, but also from other sources. E-books can be said to be interactive when it has a high level of interaction that is where complex interactions occur between users with programs, other users, and their environment.

2.3. *Improving scientific literacy through an interactive e-book*

As we discuss in top that the factor influence in students' scientific literacy is student attitudes toward science, science learning process at school, and student's interest and motivation in learning science [5]. The three factors can be solved by using interactive e-book as a sources of student learning. Developing interactive e-book can help educators to teach science.

Interactive e-book is a kind of multimedia interactive and new generation of e-book. Interactive e-book consists of a text, video, picture, graphics, audios, and multimedia programs others. Interactive e-book also can add some hyperlink or external link to study in the other platform. All of content in interactive e-book can give students experience when they study science. Giving video motivation, animation, or picture in good resolution can be improve pupils' motivation to study science. It relevant with a research by Nugraha which is the students' motivation improved after study by using interactive e-book [22]. The content in interactive e-book also can change students' attitudes towards science for the better. Interaction and communication between student and program, such a solicitation sentence in interactive e-book, or article issue and video issue, can motivation student to improve their attitude. Using interactive e-book also can provide an interesting learning science to student.

We have been discussed that students' competency which is related issues social are influence from attitude aspect and knowledge. All of content or multimedia in interactive e-book can trains students to study science more deeply and more contextual so it can be improved students' scientific literacy. It related with result of research by Latip that is multimedia improved scientific literacy because in the multimedia the learning based on science literacy which has knowledge aspect that showed a picture and animation of material technology [9].

Thus, the content that needed in an interactive e-book to improve indicators scientific literacy can be seen on the table below.

Table 2. Content that needed to improve scientific literacy.

Content	Explanation
Picture such as animation, graphic, table, etc.	Pictures such as animation can help student to enhance students' motivation. So, student interest to study science.
Video	Video can help student to explore science deeply. Interaction that shown in video can make an interactive e-book more interactive. The content of video will help student understand the matter easily. Giving video based on case can help student to understanding the problem in their surrounds.
Hyperlink	Hyperlink to explore an article will help student to get a social issue. With this social issues, teacher can direct student to solve the problems scientifically.
Interactive question	Interactive question that given after the video, picture, or hyperlink give more interaction in the interactive e-book. This question can direct based on indicators of scientific literacy.

Students' worksheet	Students' worksheet will help student to improve their competence in aspect competency. Giving worksheet also can increase students' attitude in science.
Evaluation	Giving question as evaluation based on indicators of scientific literacy can train students to take on scientific literacy test items.

3. Conclusion

Scientific literacy can improve using interactive e-book. The content of interactive e-book can help educator to increase student's attitude, motivation, and deeply of learning matter. Interactive e-book also gives student learning experience because student can study by herself. These four things are influence to improve students' scientific literacy.

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