

A Hypothetical Design of the Contextual Science Book to Develop Generic Skills

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Abstract. The implementation of innovation results in life can bring progress, on the contrary it can also disrupt the conditions that have been considered established. Because of the implementation of innovation, jobs that have been established for a long time suddenly diminished and even disappeared. This kind of innovation is called disruptive innovation. In order to anticipate this era, human resources need to be developed to have generic skills, that is skills that can be used in various fields. Purpose: This paper presents the design of a contextual science book that can be used in the learning to develop the generic skills of junior high school students. Method: The design of contextual science book begins with literature studies, and field studies related science books used in Junior High Schools in Demak Regency, Central Java, Indonesia. The literature studies are carried out by; (1) analyzing core competencies and basic competencies, (2) analyzing 7th grade science books, (3) analyzing generic skills developed in 7th grade science books, and (4) analyzing research findings related to science books and generic skills. Result: Contextual science book are textbook that are based on a contextual approach. The product developed in this study is a science book model for 7th grade Junior High School students which use a contextual approach to develop generic skills. Conclusion: The contextual science book can develop generic skills are collaborative, communicative, creative, critical thinking, information and technology, numeric skills, problem solving, self-management, and investigating. To facilitate the development of these generic skills, contextual science book model are designed by integrating aspects of constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment into chapter material, experimental activities, observation, discussion, group assignments, questions, reflection, attitude assessment, knowledge assessment, and skills assessment.

Keyword: Design, Contextual, Science Book, Generic Skills

1. Introduction

Science and technology are growing very rapidly, especially information and communication technology. The rapid development of technology has a very broad impact on people's lives. Many innovations that occur in various fields, related to the development of information and communication technology. The implementation of innovation results in life can bring progress, but it can also interfere with the conditions that have been considered established. Because of the application of innovation, the work that has been established for a long time suddenly diminishes and even disappears. This kind of innovation is called

disruption innovation. To anticipate this era, human resources need to be developed in order to have generic skills, that is skills that can be used in various fields.

Very effective generic skills are developed through contextual textbook used in learning. Mobile phone-based learning design can support contextual learning, which can be carried out inside and outside the classroom. This learning activity can be used as material to design the layout of the book's contents (Kwon: 2010; Zhang: 2010). Hong (2009) states that efficient learning design must be innovative and oriented to the level of knowledge to create so that learning outcomes are meaningful for students.

Textbook design has an important role in the success of learning. Presenting the structure of text and images in textbooks as a medium of visual communication is a challenge in the success of learning (Behnke: 2016). Critical thinking skills can be developed through experimental activities. Lai (2011) proves that experiment in learning can develop various generic skills, including; information technology skills, collaboration skills, and organizational skills. Creative thinking skills, collaboration skills, communication skills, problem solving skills also include generic skills that can be developed through learning with the Science Technology Engineering and Mathematic (STEM) approach that can be used to live and work in a global society (Marino: 2013).

The fact shows that there are textbooks that do not encourage students to communicate and do an experiment, do not apply cooperation in groups, do not motivate students, and do not provide opportunities for students to practice (Tok: 2010). This type of textbook cannot develop students' generic skills that are very much needed in their lives.

Ahmed (2011) states that textbooks need to represent culture, and present images on subject matter that is related to culture, so that students can relate the knowledge learned from the culture in society.

A good textbook can be made based on the results of research involving various components. Pardo (2009) states that the development of textbooks that are designed based on the results of the research; (1) according to the context and content of learning, (2) according to student needs, and (3) learning can be done optimally. Willison (2010) states that research skills can be developed through asking research questions, evaluating reading critically, and communicating research results. Research skills are related to the future work of students.

Students generally like large-sized book titles, large and clear illustrations more. Information presented in pictures, tables and schemes is very helpful in summarizing text, students prefer textbooks that present many experiments and tests so students are more active, happy, and have high motivation in learning (Piht: 2016).

Well-developed science textbooks are effective for enhancing students' scientific literacy, while information literacy can be developed in learning and learning experiences through observation, data collection, and student reflection (Rusilowati: 2016; Nazari: 2011). Reading diagrams is a high level of cognitive activity carried out by students who need more time (Cromley: 2010).

Based on the explanation previously described, the author designs a contextual science book model to develop the generic skills of junior high school students. Through the contextual science book model that has been studied, students are expected to develop generic skills, and can solve problems in daily life.

The purpose of writing this paper is to present the design of a contextual science book that can be used in learning to develop the generic skills of junior high school students. The benefits of writing this paper are to provide input to the author to create contextual science books that facilitate the development of generic skills of students that are needed to face the disruption era.

2. Method

The design of contextual science book begins with literature studies, and field studies related science books used in Junior High Schools in Demak Regency, Central Java, Indonesia. The literature studies are carried out by; (1) analyzing core competencies and basic competencies, (2) analyzing 7th grade science books, (3) analyzing generic skills developed in 7th grade science books, and (4) analyzing research findings related to science books and generic skills.

The analysis of the core competencies and basic competencies include aspects of attitudes, knowledge, and skills. The analysis of science books include learning material components, discussion activities, observations, experiments, test questions, project assessments, and product assessments. Generic skills analysis include collaboration skills, communication skills, creative skills, critical thinking skills, information technology, numerical skills, self-management skills, problem solving skills, and investigating skills, while relevant research analysis is related to the facilitation of contextual learning approaches in book and generic skills that can be developed.

3. Results and Discussion

3.1 Results

Contextual science book are textbook that are based on a contextual approach consisting of seven (7) components namely; constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment. The aspects of contextual science textbook model that will be developed by the author are;

Constructivism. The features of science books that facilitate constructivism are concept mapping (*Peta Konsep*), and checking knowledge early (*Cek Pengetahuan Awal*). These component are presented at the beginning of the chapter in the science book

1. Unsur

Peralatan yang ada di rumah dan di sekitar kita terbuat dari berbagai bahan. Misalnya, tabung gas elpiji terbuat dari bahan besi, panci dan alat penggorengan terbuat dari bahan aluminium, kabel instalasi listrik, kabel setrika terbuat dari bahan tembaga, selongsong baterai jam dinding terbuat dari seng, dan lain-lain. Besi, aluminium, tembaga, dan seng merupakan beberapa contoh unsur. Adakah unsur-unsur lain dalam kehidupan sehari-hari yang dimanfaatkan oleh manusia? Apakah semua unsur berwujud padat? Unsur-unsur apakah yang berwujud cair, dan gas?

Peta konsep

Cek pengetahuan awal

Sebelum kamu mempelajari bab ini, buatlah format pada buku catatamu seperti gambar di samping. Buatlah sebuah garis pada lembar bukumu sehingga menjadi dua bagian yang sama, kemudian tuliskan pengetahuan yang telah kamu ketahui yang berkaitan dengan Energi, Transformasi Energi, dan Metabolisme! Tuliskan pula pengetahuan yang belum kamu ketahui, dan akan kamu pelajari dalam bab ini.

Figure 1. Book features to facilitate aspects of constructivism

Inquiry. The science book feature that facilitates inquiry is “Concept Exploration” (*Jelajah Konsep*), and “Mini Lab” (*Lab Mini*). These component are presented in each section in the science book.

Jelajah konsep 5.2

Lakukan percobaan secara berkelompok dengan anggota 3-5 orang. Lakukan percobaan berikut ini dengan teliti, dan cermat. Analisislah data hasil percobaan melalui diskusi, kemudian hasilnya presentasikan di depan kelas!

Perubahan Energi

I. Tujuan percobaan:
Mengidentifikasi perubahan energi dalam kehidupan sehari-hari

II. Alat dan bahan:

- Solder listrik (1 buah)
- Kipas angin (1 buah)

Lab Mini

MEMBUKTIKAN ENERGI PADA PEGAS

Siapkan karet gelang, kemudian tariklah dengan kedua tanganmu. Amati apa yang terjadi?
Lepaskan salah satu tangan yang memegang karet gelang, amati apa yang terjadi?
Siapkan sebuah pegas yang dapat kamu ambil dari bolpen. Tekan pegas tersebut dengan jari telunjuk dan ibu jarimu. Amati apa yang terjadi?
Lepaskan kedua jarimu dari kedua ujung pegas. Amati, apa yang terjadi?
Apa yang kamu ketahui tentang energi pegas?

Figure 2. Book features to facilitate the inquiry aspects

Questioning. The part of the science book that facilitates students to ask is the section that presents a phenomenon to motivate students to ask questions. This phenomenon can also be found in the “Concept Cartoon” (*Kartun Konsep*), and “Online Science” (*IPA Online*).



Figure 3. Book features to facilitate questioning aspects

Learning Community. The science book features that facilitate learning communities are “Concept Exploration” (*Jelajah Konsep*), and “Product Assessment” (*Penilaian Produk*).



Figure 4. Book features to facilitate aspects of learning community

Modelling. The features of the science book that facilitate modelling are “Questions and Its solution” (*Soal dan Pembahasannya*), “Star of Science” (*Bintang Sains*), and “Integrated Science” (*IPA Terpadu*).

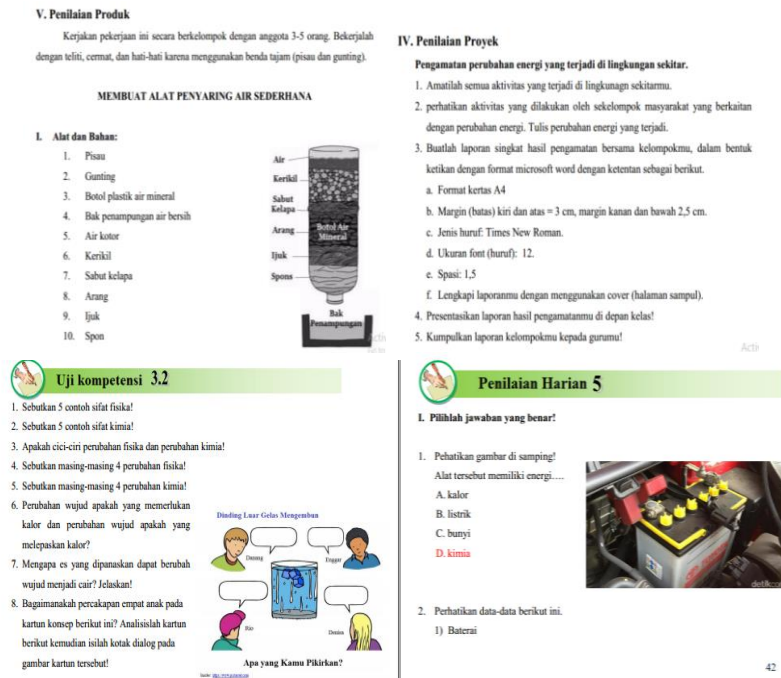


Figure 7. Book features to facilitate the authentic assessment aspects

3.2 Discussion

The product developed in this study is a science book model for 7th grade Junior High School students which use a contextual approach to develop generic skills (collaboration skills, communication skills, creativity, critical thinking, information and technology, numeracy skills, problem solving skills, self-management skills, and investigating skills) to face the disruption era.

Constructivism. The contextual science book developed invites students to build their own knowledge. This can be presented in the form of: (a) the initial picture of the chapter, (b) conducting a review of the learning material that has been done in the previous class/previous chapter/knowledge that has been possessed by the students discussed through "Checking the Initial Knowledge", (c) the contact paragraph between the branches, and (d) the description presented in the image, so that the image becomes meaningful. The component of constructivism can develop self-management skills, that is building knowledge that is already possessed by the knowledge being studied.

Inquiry. The contextual science book model developed contains inquiry activities that invite students to carry out experiments on the activities of " Science Exploration", and "Mini Lab" which includes activities; observation, asking questions, hypotheses, data collecting, data analyzing, and making conclusion. Inquiry activities can develop investigating skills through observation and experiment. In this activity students can also develop their self-management skills (disciplined, honest, objective, and skeptical).

Questioning. The contextual science book model developed presents phenomena in everyday life that can motivate students to ask questions. These phenomena are presented in each section in the contextual science book model. These questions function to develop knowledge, dig up information, explore understanding, develop responses, find out curiosity, and focus attention and develop further questions. Concept Cartoons (*Kartun Konsep*) present phenomena in everyday life that are related to the concepts learned, while “Online Science” (*IPA Online*) presents concepts, images, or videos that relate to the concepts learned that can be accessed via the internet by scanning the code on the feature. Questioning can develop critical thinking skills, problem solving skills, and self-management skills.

Learning Community. The contextual science book model developed presents activities that require students to learn in groups to form characters; collaboration, respect other people's opinions, and respect others. The learning community is implemented in activities such as group experiments, observations in " Science Exploration" (*Jelajah Konsep*), discussions, and exchange opinions on presentation activities. Learning communities can develop collaborative skills, and communication skills.

Modelling. The contextual science book model developed presents examples as models that can be replicated by students so that having the curiosity and material of science that is learned is easy to understand. Modelling in this science book is presented in the form of pictures, diagrams, graphs, questions and discussion, profession that is relevant to the learning material, technological results of tools related to the science concept being studied, "Star of Science" (*Bintang Sains*) which presents science experts who relating to the concepts learned, as well as examples of the application of science in everyday life to the "Integrated Science" feature. Modelling can develop numerical skills, critical thinking, and problem solving skills.

Reflection. The contextual science book model developed presents reflection activities as a vehicle for recalling all the subject matter learned by students. This reflection activity is presented at the end of the chapter before students complete the questions as a follow-up to the learning that has been done. Reflection activities such as messages and impressions of learning, responding to knowledge, assessing knowledge received by students, and reflecting on learning outcomes. Reflection is also carried out by students through activities on the feature "Checking Final Knowledge" (*Cek Pengetahuan Akhir*) which includes an invitation to students to make concept maps related to concepts that have been studied, and admire the majesty of God Almighty for all of His power and creation related to the concepts learned. Reflection activities can develop self-management skills that are building knowledge that has been learned with prior knowledge.

Authentic Assessment. The contextual science book model developed presents questions from various levels.

- a. Attitude assessment is carried out during the learning process takes place. This attitude assessment is related to the character that will be observed, for example discipline, responsibility, honesty, objectivity, and cooperation. This attitude assessment consists of spiritual attitudes assessment, and social attitudes assessment. This attitude assessment is carried out through observation journals. Social attitude assessment can be done through discussion activities, "Exploring Science" (*Jelajah IPA*), "Project Assessment" (*Penilaian Proyek*), and "Product Assessment" (*Penilaian Produk*).

- b. Knowledge assessment is carried out through "Competency Test" (*Uji Kompetensi*), and "Daily Assessment" (*Penilaian Harian*). The knowledge assessment related to problem solving about cases in everyday life related to the science concepts that have been studied. In this case it also relates to numerical skills, critical thinking, and creative thinking.
 - c. Skills assessment is carried out through practical assessment of the activities of "Exploring Science" (*Jelajah IPA*), "Project Assessment" (*Penilaian Proyek*), and "Product Assessment" (*Penilaian Produk*). Assessment of skills is related to critical thinking, and creative.
 - d. Problem solving is related to conceptual issues that have been studied with solutions in terms of sub-concepts of physics, biology and chemistry.
- In authentic assessment activities, students can develop self-management skills (social attitudes), creativity, critical thinking, collaboration, communication, information technology, problem solving, and numerical skills.

Table 1: Distribution of Generic Skills in Contextual Science Book Model

Features Book Model	Generic Skills Developed								
	Collabo ration	Commu nication	Critical Thinking	Crea tive	IT	Nume rical	Problem Solving	Self- Manage ment	Investi gating
Concept Mapping								✓	
Checking the Initial Knowledge								✓	
Question			✓				✓	✓	
Pictures and Graphics								✓	
Concept Exploration (Experiment)								✓	✓
Mini Lab								✓	✓
Star of Science								✓	
Questions and Its Solutions			✓			✓	✓		
Checking the Final Knowledge								✓	
Concept Cartoon			✓				✓	✓	
Competence Test			✓	✓		✓	✓		
Integrated Science			✓				✓		
Daily Test			✓	✓		✓	✓		
Project Assessment	✓	✓	✓	✓	✓				
Product Assessment	✓	✓	✓	✓					
Online Science			✓				✓	✓	

Table 2: Relationship of Generic Skills With Contextual Aspects

Contextual Aspects	Generic Skills								
	Collaboration	Communication	Critical Thinking	Creativity	IT	Numerical	Problem Solving	Self-Management	Investigating
Constructivism								✓	
Inquiry	✓	✓	✓	✓			✓		✓
Questioning		✓	✓				✓		✓
Learning Community	✓	✓						✓	
Modelling			✓	✓		✓		✓	
Reflection			✓					✓	
Authentic Assessment	✓	✓	✓	✓	✓	✓	✓	✓	

4. Conclusion

The contextual science book can develop generic skills are collaborative, communicative, creative, critical thinking, information and technology, numeric skills, problem solving, self-management, and investigating. To facilitate the development of these generic skills, contextual science book model are designed by integrating aspects of constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment into chapter material, experimental activities, observation, discussion, group assignments, questions, reflection, attitude assessment, knowledge assessment, and skills assessment.

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