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To cite this article: Sihabudin *et al* 2019 *J. Phys.: Conf. Ser.* **1315** 012088

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The development of teaching materials for secondary teachers based on 21st century skills

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Abstract. The purpose of this study was to produce Teaching Materials for secondary teachers based on 21st century skills especially for circle topic and to know the quality of teaching materials based on validity and practicability. This research is a development research that includes seven main steps, namely: needs analysis, the ability of researchers as developers, product design, product concepts, development, expert testing, and field trials. The feasibility of developing a teaching materials was obtained based on data from the questionnaire which was then analyzed descriptively quantitatively. The conclusion of this research is the teaching material for secondary teacher especially for circle topic based on 21st century skill fulfilling the minimum criteria and expressed very well from the validity aspects and in terms of practical aspects stated practical. Thus, the teaching materials for mathematics teachers based on 21st century skill can be used as a teacher's guide on the learning process.

1. Introduction

One of the challenges of education today is to build 21st century skills, namely information & communication technology literacy skill, critical thinking skill, problem solving skill, effective communication skill and collaborate skill. That skills is what the United Nations think is the hallmark of today's global society, the knowledgeable community [1].

The challenges of the 21st century have specific criteria characterized by hypercompetition, the succession of technological revolutions, dislocations, and social conflicts that will produce non-linear conditions and circumstances that cannot Expected from past and present times [2]. The complexity of global world problems, free competition, and the situation of unpredictable is an opportunity and challenge to be faced by each individual.

Realizing the complexity of the challenges of the future, the UNESCO Education Commission recommends four educational pillars that can serve as the foundation of education that consist of learning to know, learning to do, learning to be, and learning to live together in peace. But to achieve the national education objective, not enough with the four pillars, then in education in Indonesia plus the education pillars "learn to strengthen faith, piety, and noble morality" [3].

To face the challenges of the 21st century, every person must have life skills, among them life and career skills, learning and innovation skills and Information media and technology Skills [4]. Meanwhile The Partnership For 21st Century Learning develops a 21st century learning framework that demands learners to possess skills, knowledge and skills in technology, media and information, skills Learning and innovation and life and career skills [5]. The Framework also describes the skills, knowledge and expertise to be mastered so that students can succeed in their lives and work, because that is precisely



the 21st century learning trend aimed at 4 components: communication, Collaboration, Critical thinking & Problem solving, Creativity & Innovation [6].

The direction of this 21st century education is very relevant to the national education objective that serves to develop the ability and character and civilization of the nation dignified in order to educate the life of the nation, aims to Growing the potential of learners to become human beings who believe and fear the Almighty God, noble, healthy, knowledgeable, capable, creative, independent, and be a democratic citizen and responsible. Learning is aimed at creating an active, critical, analytical, and creative atmosphere in problem solving through the development of thinking abilities [7].

In line with that, BSNP formulates that the 21st century learning paradigm emphasizes students ability to find out from a variety of sources, formulate problems, analytical thinking and collaboration and collaborate in Solve the problem. While the 21st century learning frameworks are: (a) Critical thinking and problem solving skills; (b) Communication and collaboration skills; (c) Creativity and innovation skills; (d) Information and communications technology literacy; (e) Contextual learning skills, and (f) Information and media literacy skills. Therefore it takes an educational program that can develop these abilities and mathematics has enormous potential as a means or tools to develop those skills in the learning process [8].

In the present and in the future, in the era of sophisticated communication and technology, workers are more intelligent than harder workers [9]. The needs of workers who have been prepared to be able to digest new ideas, able to adapt to change, able to handle uncertainty, be able to find regularity, and be able to solve unusual problems. Accordingly, the NCTM, states that the school's mathematical standards include the standard of mathematical content and the mathematical processes [10]. Still according to NCTM, the process standards include problem solving, reasoning and proof, connections, communication, and representation. The standard of the process together is a fundamental skill and understanding of the much needed students in the 21st century.

In addition to the face of global competition in the 21st century the teacher's role is very important [8]. Teachers should be able to design a supportive learning of those 21st century faculties. Teachers are required to always innovate in carrying out the learning process. Innovation of teachers is for example in the selection of proper teaching materials. The teaching material is expected to change the learning conditions from the teacher centered to student centered.

Teaching materials are one of the important aspects and potential space to innovate in order to solve the various problems that occur [10]. According to teaching materials are all forms of materials used to help teachers or instructors to perform the learning process in the classroom [11]. Then some argue that the teaching materials are information, tools or text required by teachers or instructors for the planning and study of the implementation of learning [12].

Depdiknas states that the teaching material is a systematic set of learning materials, presenting a whole figure of competencies that students will master in the learning activities [13]. The material in question can be either written or unwritten material. The teaching materials can be text, audio, photo, video and animation, which can be used for learning. Teaching materials are one of the tools that need to be considered in order to improve the quality of learning [14]. The material is prepared with sequential and systematic. Good teaching materials must be through an expert validation, practical, easy to understand and effective to use in the learning process. The teaching materials are arranged in accordance with the concept of material and the purpose of learning so that students do not fall into the making [15]. In line with the Dick & Carey explained that good teaching materials at least four elements, namely (1) The presence of lesson content, (2) The presence of media used, (3) arranged to help students learn and reach the objectives Learning, and (4) the use of instructions [10].

2. Method

This type of research is research and development. The products developed are mathematics teaching materials for SMP students in the form of books based on the competence of the 21st century on the circle topic. The procedure of development research includes: (1) need analysis; (2) The ability of researchers as developers; (3) Product design; (4) Product concept; (5) Development; (6) Expert test and (7) field trials. The data collection instruments used a questionnaire. This instrument is used to collect

the review data from the need analysis, expert test and teacher response to the teaching book. Data is analyzed using quantitative descriptive analysis.

3. Result and Discussion

The development procedure of a circle teaching book based on the competency of 21st century is done by stages: need analysis, research skills as developer, product design, product concept, development, expert test, and field trials. Based on the development research conducted, obtained the following research results:

Need analysis, activities at this stage is to identify and explore the need, namely by spreading the questionnaire to the mathematics teacher, and studying the textbook of mathematics lessons used in schools. Based on the data, some information is obtained including: (1) The need for teaching materials is 78%, meaning that most teachers only use teacher handbook provided by the Government in the learning activities Mathematics in class.; (2) The need for students activity is 70%, meaning that students are less enthusiastic in following mathematics learning, because teachers have not fully engaged students actively in the learning process of mathematics in the classroom; (3) The need for the students worksheet and assessment instruments associated with the High Order Thinking Skills (HOTS) amounted to 80%, meaning that teachers in the mathematics learning process in the classroom need a student activity sheet that is oriented towards the 21st century competencies and Requires a HOTS assessment instrument; and (4) the interest in the teachers teaching books that are oriented towards the 21st century competence of 100%, which means that teachers desperately need teacher-teaching materials equipped with student activity sheets and assessment instruments based on the competence of the 21st century. As for the study of mathematics books, especially in sub chapters, it can be described that the presentation of the material has seen the process to acquire the competence capability of the 21st century, but the acquisition of this 21st century competence not presented in writing. Then studied in terms of student activity sheet, there have been activities that can build the competency of 21st century, and the study of assessment instruments, that the book has used the High Order Thinking Skills (HOTS) Assessment instruments although still Not much. Therefore, teaching materials are needed to develop the competence of the 21st century.

The ability of the researcher as a developer, ability in product development to answer a need is important for the right product to be realized. In this research researchers develop products independently with the help of the Mc. Word application and in creating cover book researchers also use the help of online application Canva with the address https://www.canva.com/id_id/membuat/cover-buku/.

Product design, the design phase of this product include (a) the formulation of basic competencies and competence achievement indicators: formulation of basic competencies derived from core competencies and indicators derived from basic competencies; (b) Drafting material: to compose this teaching book required various references to the materials developed. and (c) drafting the design of teaching books: Some of the components listed include cover, book Guide, preface, table of Contents, Material introduction page, concept map, core competencies, basic competencies and indicators, material display, Summarizes, competency tests, enrichment, remedial, flat libraries and glossary.

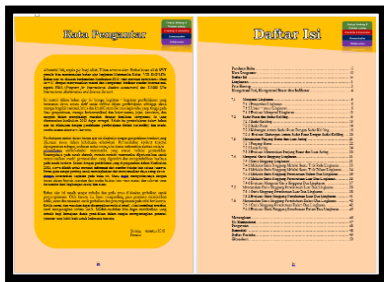
Product concept, concept development is done by identifying the materials, and competence of the 21st century. The material on this product about the circle. The concept of this teaching material is as follows: (a) on each sub-subject is always done the observing process, after which the teacher gives a question that can develop the competence of the 21st century; (b) On each sub subject there are tasks that can develop the competence of the 21st century; (c) on each sub point in the Create a student activity sheet that can build the competence of the 21st century; (d) Examples of problems given are examples of High Order Thinking Skills (HOTS); (e) At the end of the sub-subject is given the practice of High Order Thinking Skills (HOTS); (f) At the end of the chapter there is a student competency test in which the issue is about High Order Thinking Skills (HOTS); (g) Any material, example of questions, exercises, assignments and activities of the students is given the emphasis of competency that can be developed by writing down and printing the competencies.; and (h) as motivation at the beginning of the chapter is given images and narratives relating to the material to be studied.

Development, in general, the development of teaching books can be seen as the following:

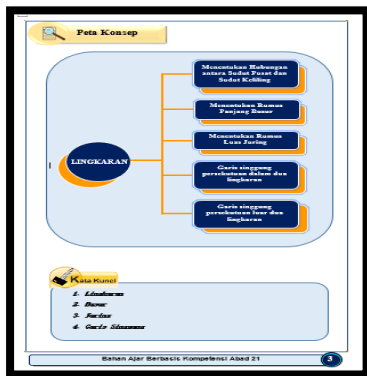
Book of Cover



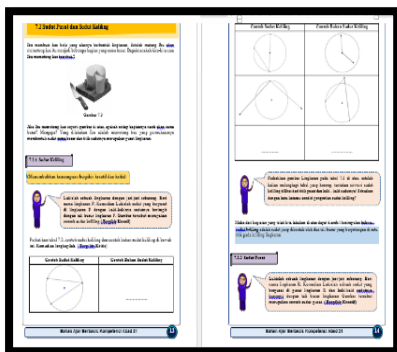
Preface and Table of Content



Mind Map



Content

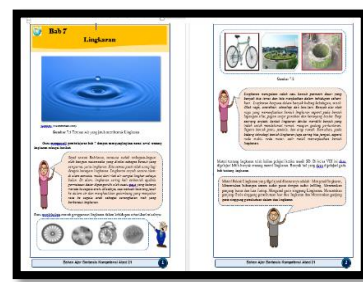


Exercise

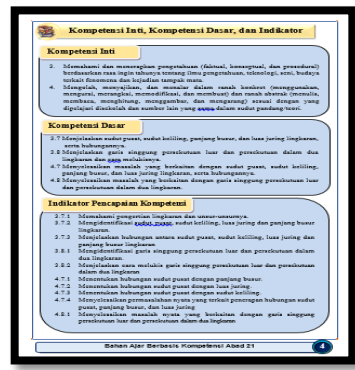
Guide Book



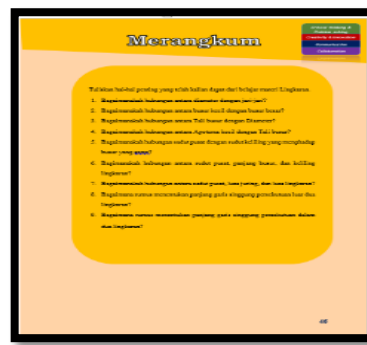
Introduction



Competencies Standard



Summary



Enrichment

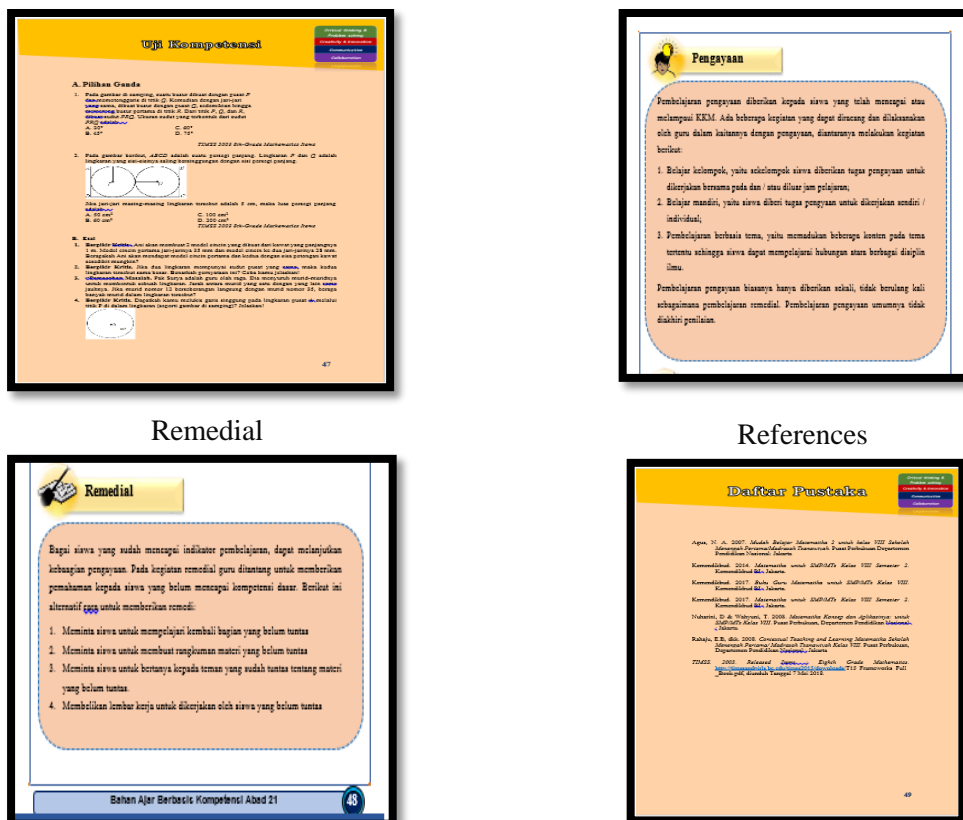


Figure 1. Book View

In the teaching book titled "Circles" based on the competence of the 21st century for the class VIII mathematics teacher SMP/MTs who developed the researcher using the typeface Bookman Old Style (great title of teaching materials), Elephant (Body) (Description right corner on the cover Teaching materials and class description), and Calibri (author). Elephant letters for each chapter, the letter Arial Narrow on the field description grows the competence of the 21st century, and the Times New Roman letters for material and activity in the teaching materials. The overall use of this typeface aims to vary the letters to the teaching materials and facilitate the students to read or use the teaching book that researchers developed. Later, the use of simple, communicative language in researchers-developed teaching books makes it easier for students to understand the material. Furthermore, the size of the teaching book is based on ISO size, 210 x 297 mm.

Test the experts, to see the extent to which the products made can achieve the objectives and objectives. The activity of eligibility test is done at this stage. Table 1 is test results of material experts, media experts and linguists.

Table 1. Data of Validation Expert Result

Expert	Aspects	Persentase
Linguistics	Linguistics Assessment	88,46 %
Media	Graphics	85,00 %
	Material	77,38 %
Content	View	81,00 %
	21st Competencies Assessment	75,00 %
Average		81,37 %

Based on a percentage table of aspects assessed by linguists, media experts and content experts, it can be concluded that the overall assessment of that aspect amounted to 81.37% with the excellent

category. This means that the teaching materials based on the competence of the 21st century for the mathematics teacher in grade VIII SMP/MTs is declared worth using in the field.

Field trials, the teaching material trials developed are limited to the response or the math teacher's response to the book. The purpose of this field trial is to see the practicality of a product on the field based on the response teachers have given after using this book. The following data of class VIII Mathematics teacher assessment towards developed teaching book (Table 2).

Table 2. Teacher's Responses

No	Indicators	Score
1	Linguistics	218
2	Content	240
3	Ilustration/Figure	214
4	Fit of 21st competencies	419
5	Usefull	492
Total		1583
Percentage		89,94 %

The teacher's response to the teaching book has been used to show excellent response. This indicates that the use of the book is assessed to make a good contribution for teachers and students.

4. Conclusion

The resulting 21st-century competency book is produced that meets excellent quality. Based on the results of the study, the advice that researchers can convey is that the teaching book developed by researchers is limited to the material of the circle. Therefore, for readers interested in conducting related research it is advisable to develop the teaching book on other materials in accordance with the procedures of teaching books for mathematics teachers based on the competency of 21st century class VIII SMP/MTs in this study.

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