

# Developing an appropriate textbook for mathematics curriculum analysis course

*By Afit Istiandaru*

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To cite this article: V Istihapsari *et al* 2019 *J. Phys.: Conf. Ser.* **1321** 022133View the [article online](#) for updates and enhancements.

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## Developing an appropriate textbook for mathematics curriculum analysis course

V Istihapsari\*, A Istiandaru and S N Rohmah

Universitas Ahmad Dahlan, Jl. Ringroad Selatan, Tamanan, Bantul, DIY Indonesia

\*Corresponding author: vita.istihapsari@pmat.uad.ac.id

**Abstract.** Pre-service mathematics teachers need to understand the school mathematics curriculum in order to ensure their capability as future teachers. As a learning planner, they have to possess an adequate understanding of what and how the school mathematics materials should be organized to fit the students' need. The current Indonesian curriculum challenges the teachers to design mathematics learning which integrates four domains of competence, namely the spiritual attitude, the social attitude, the knowledge, and the skill. However, there has been no textbook available to guide the pre-service mathematics teacher designing the desired mathematics learning better. This research aims to develop a textbook for mathematics curriculum analysis, especially for senior high school level. It was an R&D using Plomp model stages, including initial investigation, design, construction, and test, evaluation, and revision. In the final stage, we have successfully developed a valid project-based learning textbook for mathematics curriculum analysis.

### 1. Introduction

An appropriate textbook is important to support learning [1,2], especially for pre-service mathematics teachers. Some argue that textbook will only make the pre-service teachers rely on it and restrict their innovation [3–5], while the others believe that the absence of textbook will make the pre-service teachers lack the knowledge needed to conduct an appropriate teaching practice [6,7]. The textbook is important mainly because it provides comprehensive material and guidance for the pre-service teachers to implement a good teaching practice as well allows them to develop better material. Thus, in the context of the pre-service mathematics teachers' need, a textbook is important for their teaching preparation.

The Indonesian education system is now imposing the 2013 curriculum. The Indonesian curriculum has evolved to adapt the need of the society's demand [8]. A long time ago, the curriculum was reviewed and revised every decade [9], bringing the new ideas to adapt the national purposes. A massive change happened in the last ten years, namely the curriculum changed from the competency-based curriculum in 2004, school-based curriculum in 2006, and the newest one commenced in 2013. Furthermore, the 2013 curriculum was also adjusted through some commencement of the regulations of the Indonesian Ministry of Education and Culture in 2013, 2014, and the last was in 2016. All the changes promise a the betterment for the education system, but many argue that it also shock the teachers, especially in mathematics subject.

The 2013 curriculum provides a new perspective of educational reform in Indonesia. It offers the balance among the three domains of competence, namely the attitude, the knowledge, and the skill



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[10]. In the case of mathematics, the balance of attitude, knowledge, and skills will benefit the students' learning results. Students will not only be able to solve various mathematical problems, but also possess the attitude of logical, critical, and creative. These attitudes are the required attitudes for the future of the students. Moreover, the new paradigm of the curriculum is that the teachers need to foster the higher order mathematics thinking skills according to the revised Bloom's taxonomy [11]. Using the given information to solve a routine problem, as usually happens in the Indonesian mathematics learning, is not enough to exercise the higher order thinking skills [12].

The higher demand of the curriculum, the bigger effort needs to be done by the teachers. The mathematics teacher is the one who has the responsibility to facilitate the students to meet what the curriculum demands. Figure 1 is the illustration of one of the topics which teachers need to understand regarding the curriculum.

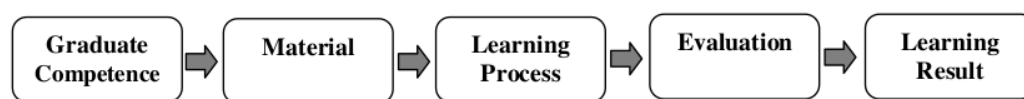


Figure 1. The relation of the standards in the 2013 curriculum documents.

In Figure 1, the teachers have to understand what to achieve, what material to deliver, how to deliver the material, and how to measure the achievement. For instance, mathematics teachers need to understand the profile of mathematics competence in a certain level of education. Then, they have to understand the topics which should be delivered in the level and how to create a learning which can foster the students' higher order thinking skills based on the curriculum standard. This curriculum understanding is the professional competence which pre-service teachers need to exercise during their teacher education process.

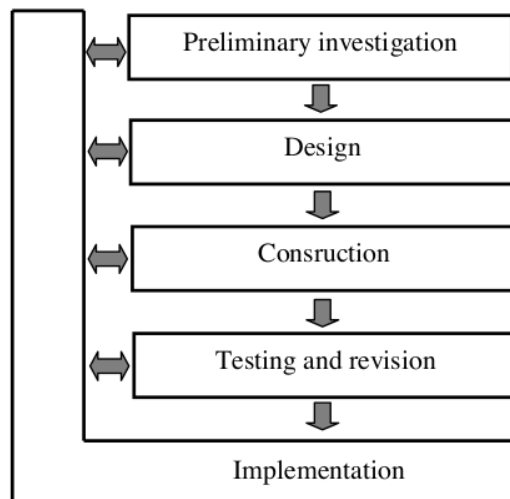
In order to understand the curriculum, the pre-service mathematics teachers need to study the regulations and documents related to the curriculum [6]. Studying the documents of the 2013 curriculum is also challenging because it is not only one document to study, but some documents connected to each other. A comprehensive analysis of the documents needs to be compiled in a textbook. In the present time, some modules of curriculum analysis have been produced. However, the documents are not published or easily accessed by pre-service teachers to study. It was usually in a form of powerpoint presentation about how to analyze the graduate skill standard, the material, and the learning process in a separated presentation. So far, we have not found a comprehensive textbook compiling all the analysis into an easy read document. Therefore, this research aims to develop a textbook for mathematics curriculum analysis, especially for senior high school level.

## 2. Methods

This is an R&D research following the model addressed by Plomp [13]. The stages of the model are (1) initial investigation, (2) design, (3) construction, (4) testing and revision, and (5) final product. This research presents the results until the testing and revision stage as presented in Figure 2.

We started the research by investigating the need of the pre-service mathematics teachers and the lecturers in the school mathematics curriculum analysis subject. We asked 27 students and three lecturers in the mathematics education department of Universitas Ahmad Dahlan Yogyakarta Indonesia on two specific questions whether there has been a comprehensive textbook for the mathematics curriculum analysis and whether they need such a textbook or not. Furthermore, we also asked about the specification of the textbook according to what they need.

In order to confirm the validity of the findings in the initial investigation stage, we also asked about the same questions to 25 in-service mathematics teachers from various schools in Yogyakarta. It is important to confirm the findings in order to get the valid information about what the mathematics teachers need regarding the mathematics curriculum analysis.



**Figure 2.** The development research model by Plomp.

In the design stage, we developed a design of the textbook based on the results of the need analysis. It is important to make sure the design is suitable with the need by undergoing rounds of discussion with the lecturers and listened to their feedback. Further, in the construction stage, we conducted workshops to write the textbook. The textbook writing was conducted in a cycle of writing, reading, and revising. We wrote chapter by chapter in order to make sure each chapter would be coherently structured.

In the testing and revision stage, we asked for three validators to give an opinion about the textbook quality. They are (1) a mathematics curriculum expert, (2) a practitioner expert, and (3) a language expert. The expert of mathematics curriculum has a great track record in developing and reviewing the Indonesian curriculum, especially the mathematics curriculum. The practitioner expert is the lecturer teaching school mathematics curriculum analysis subject, while the language expert is the Bahasa Indonesia lecturer who has experienced in writing many textbooks as the developed textbook is written in Bahasa. The results of the validation stage were used to revise the textbook such that it is ready to be used in the field testing.

The validation used an instrument of validation consisting of 12 items, namely: (1) the numbering of the textbook, (2) type and size of the font used, (3) layout, (4) visual appearance, (5) relevant to the purposes of learning, (6) validity of concepts, (7) order of topics, (8) the application of concepts and projects, (9) material, (10), completeness of the scope of topic, (11) appropriateness of the Bahasa used, and (12) appropriateness of the language based on the students' thinking level. Each item will be scored from 1 to 5. One would be the least score representing the poor quality suggested in the item, while five was the highest score representing the best quality of the items.

### 3. Results and Discussion

The following is the presentation of this research findings and we discuss it integratively in every subchapter.

#### 3.1. Initial investigation stage

We addressed two questions whether there has been a comprehensive textbook for the mathematics curriculum analysis and whether they need such a textbook or not. Interestingly, all of the respondents said that they need a comprehensive textbook which could practically guide them to analyze the

school mathematics curriculum, however, there was no such textbook available. When we asked the lecturers about the specification of the textbook, they said that the textbook should allow the students to engage in the project-based activities.

These findings are also confirmed by the testimony from the 25 in-service mathematics teachers from various schools in Yogyakarta. They were oftenly confused to prepare the lesson plan and the assessment according to the current revised curriculum demand. This is also inline with some studies confirming that the teachers found difficult to deal with how the lesson and the assessment should run based on the 2013 curriculum [14], especially in implementing the performance-based assessment [15]. A textbook with a comprehensive explanation about the related regulations of the 2013 curriculum would be helpful for the mathematics teachers to prepare their lessons.

### 8 3.2. Design stage

In the design stage, we discussed the learning approach suitable for the textbook. Based on the investigation findings, we agreed to use the project-based learning approach to make the students engaged in the various project while using the textbook. Each chapter is equipped with a project the students have to finish before continuing to the next chapter.

We designed the book in eleven chapters, including: (1) definition of curriculum, (2) the development of Indonesian curriculum from time to time, (3) basic framework of the 2013 curriculum, (4) structure of the high school curriculum, (5) analysis of graduate competence in senior high school mathematics, (6) analysis of the core competence and the basic competence, (7) analysis of the mathematics content standard in the senior high school level, (8) analysis of the mathematics learning process in the senior high school level, (9) syllabus, (10) lesson plan, and (11) semester program. These eleven chapters are the essential knowledge and skills which the preservice mathematics teachers need to understand.

### 3.3. Construction stage

In the construction stage, we finally arrived at the textbook with nine chapters. They are: (1) understanding the curriculum analysis, (2) the development of Indonesian curriculum from time to time, (3) basic framework and structure of the high school curriculum, (4) graduate competence in senior high school mathematics, (5) analysis on the graduate competence, the core competence, and the basic competence, (6) analysis of the mathematics material in the senior high school level, (7) analysis of the mathematics learning process in the senior high school level, (8) syllabus and lesson plan, and (9) semester program. We adjusted and combined some chapters to effectively presented in the textbook.

### 3.4. Testing and revision stage

The results of the validation gave the average score of 4.08 among experts and items validation. The score means that the textbook validated was in a valid condition. Valid means that the textbook was theoretically good for the use in the school mathematics curriculum analysis subject. The detail of the validation process is presented in Table 1.

Table 1. Validation results of the mathematics textbook.

No	Aspects	Expert 1	Expert 2	Expert 3	Average Score
1	The numbering of the textbook	4	4	4	4
2	The type and size of the font used	5	5	5	5
3	The layout	4	4	4	4
4	The visual appearance	3	3	5	3,67
5	The textbook is relevant to the purposes of learning.	4	4	4	4
6	The validity of concepts	4	4	4	4
7	The order of topics	5	4	5	4,67
8	The application of concepts and projects	4	4	4	4
9	The material	3	4	5	4
10	The completeness of the scope of the topic	3	4	4	3,67
11	The appropriateness of the Bahasa used	4	4	4	4
12	The appropriateness of the language based on the students' thinking level	4	4	4	4
Average score					4,08

Based on the validation score criteria that the scale of 1 to 5 representing the quality from Poor to Excellent, then the textbook validity is at the good quality and is ready to be used for the field testing.

Nevertheless, the experts also gave some feedback for the textbook revision. They are: (1) that the textbook contains some terminologies which have to be replaced with the more understandable ones based on the appropriateness of Bahasa, (2) the project needs to be detailed with clear instruction, and it was not only a question which needs to be answered, (3) the textbook needs to be equipped with an index and a glossary, and (4) the projects needs to be relevant to the material presented.

#### 4. Conclusion

Based on the results and discussion, we can conclude that the textbook for school mathematics curriculum analysis is valid to be used for the learning. The development of the textbook has accommodated the needs of the pre-service mathematics teachers to have a textbook which can technically guide them analyzing the school mathematics curriculum.

#### Acknowledgement

We thank the Directorate General of Research Empowerment and Development of the Indonesian Ministry of Research Technology and Higher Education for the support to the success of this research.

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