Comparison of Indonesia and Singapore Middle School Mathematics Material Mapping

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**Abstract**. A Curriculum is a fundamental element of a country’s education. Learning material is one of the important parts of the curriculum that can affect the quality of education. Indonesia and Singapore are countries with close geographical location. However, both have differences and similarities in mapping learning material. The purpose of this research is to compare Indonesia and Singapore's high school mathematics material mapping. This study is a comparative study with qualitative approaches methodologically, which carried out an in-depth analysis of curriculum documents from both countries. The analysis showed that the materials taught in both countries are at the same grade for numbers, percentage, indices, perimeter and area of triangles and polygons, angles, Pythagoras’ theorem, probability, cartesian coordinate, linear equations in two variables, and quadratic equations. The differences in material mapping found in terms of the distribution of materials, the sequence of materials, the depth of materials, the number of materials, and the school system

**Keywords**. curriculum, Indonesia, Singapore, material mapping

1. Preliminary

A curriculum is a fundamental element of a country’s education. Indonesia has implemented the curriculum 2013 as its education since 2013. During seven years of implementation, the curriculum has gone through several revisions to improve its quality. Learning approach, basic competency, and assessment system are some curriculum components that receive great attention to experience some revisions in the implementation of curriculum 2013. To find out the curriculum implementation result, Indonesia does some assessments on students’ abilities. Besides that, Indonesia also follows some international assessments to see the comparison of Indonesia education and other countries.

TIMSS and PISA are international assessments of student achievement actively followed by Indonesia. TIMMS is an international assessment for mathematics and science in 4th and 8th grade [1], held every four years since 1995. Meanwhile, PISA is an international triennial survey of 15-year-old students to measure their reading, mathematics, and science literacy [2]. Based on these assessments, the mathematics scores of 4th-grade Indonesian students were 397 at TIMSS 2015 [1] and the result of the Indonesian mathematical ability score at PISA 2018 was 379 [2]. On the other hand, one of Indonesia’s neighbors, Singapore, is one of the countries with the best score in these international assessments. At TIMSS 2015 [1], Singapore students got a math score of 618 for 4th grade and 621 for 8th grade. Then at PISA 2018 [2], Singaporean students received a math score of 569.

According to B. Kaur et al [3], the success of Singapore students in TIMSS and PISA supported by the education system and mathematics curriculum used. Curriculum Singapore adopted the CPA approach since 1981, which provides learning experiences in a meaningful context, and using pictorial representations and tangible objects to build abstract knowledge. Singapore learning also requires students through exploration, clarification, practice, and application from time to time representing mathematics concepts in various ways and apply it to solve problems in an unknown situation. Besides, the Singapore curriculum guide emphasizes space the scope and sequence of topics taught at each grade level. This matter clarifies the nature of the spiral curriculum and student-centered learning experiences that are needed to gain deep mathematical knowledge.

The mathematical pathway for students is built through a mathematics curriculum [4]. Due to the diverse needs of students, the Singapore mathematics curriculum provides multiple pathways to facilitate the diverse needs of students. This causes Singapore to have various types of mathematics syllabus which are adapted to the various types of course that exist. There are three types of syllabus in the Singapore mathematics curriculum for middle school [5], namely: 1)O-Level Mathematics syllabus which is built on Standard Mathematics Syllabus; 2)N(A)-level Mathematics syllabus which is a subset of O-Level Mathematics; 3) and N(T)-Level Mathematics syllabus which is built on Basic Mathematics Syllabus.

Different from Singapore, Indonesia only has one type of material mapping for middle school. The middle school mathematics material is contained in basic competencies in PERMENDIKBUD No. 38 2018. Basic competence contains verbs that indicate competencies that must be mastered and materials that indicate the minimum material that must be mastered. Basic competencies include the basic competencies of attitude, the basic competencies of knowledge, and the basic competencies of skills [6]. Basic competencies for middle school mathematics are advanced competencies from basic competencies in elementary mathematics.

The mapping of mathematical material is an important part of the curriculum, where it determines how much breadth and depth of concepts are taught [7]. Indonesia and the Singapore curriculum certainly have differences in system learning, material mapping, and assessment. Comparative study of curriculum between Indonesia and Singapore will be very useful for knowing curriculum differences and similarities between the two countries. So the differences and similarities found can be learned further to improve the curriculum of the two countries. Therefore it is a comparative study of the analysis of differences in the mapping of material between the two the state is an important part of curriculum comparison to doing. Based on the explanation above, this research will examine the comparison of material mapping in Indonesia and Singapore curriculum to find out more about the differences and similarities in mathematics material mapping from the two countries.

1. Methodology

The purpose of this study is to compare the mapping of materials in the curriculum of Indonesia and Singapore high school mathematics. Based on these objectives, then an in-depth document search will be carried out related to the Indonesian and Singapore curriculum to find out more about the differences and similarities between the material mapping curriculum of the two countries. Therefore this research is a comparative study with a qualitative approach methodologically. This research used curriculum framework documents as a primary data collection tool. The document of the Indonesia curriculum is PERMENDIKBUD No. 37 2018 which can be accessed openly, while the Singapore curriculum document is Mathematics Syllabuses secondary One to Four: Express Course, Normal (Academic Course) 2020 which has been obtained through the Singapore Ministry of Education website.

1. Results and Discussion

Indonesian curriculum has eight national education standards with learning material is the content standard. Based on Permendikbud No 21 2016 [8], the content standard is criteria regarding the scope of material and the level of competency for achieving graduate competencies at certain levels and types of education. The material scope is formulated based on the mandatory load criteria determined following the provisions laws, scientific concept, and characteristics of education units and programs. The competency level is formulated based on student development criteria, Indonesia competency qualification, and mastery of tiered competencies. Furthermore, the competency and scope of the material are used to determine basic competency on developing curriculum on the unit level and education level.

Mathematics material of the Indonesia curriculum in this study is based on the basic competencies of junior high school mathematics listed on PEMENDIKBUD No. 37 2018. One learning material consists of several basic competencies. For example, algebra consists of two basic competencies, namely one basic competency of knowledge and one basic competency of skills. Other than that, some materials have the same basic competencies. For example, linear equations in one variable and linear inequality in one variable have the same basic competency of knowledge, namely "explaining linear equality and inequality in one variable and its solution".

Mathematics material of the Singapore curriculum in this study is based on details of the content by levels section contained in the N(A)-Level Mathematics syllabus. Content by levels on N(A)-Level Mathematics syllabus is divided into three levels, secondary one, secondary two, and secondary three or four. In this study, the secondary one is equated with 7th-grade, secondary two is equivalent to 8th-grade, and secondary three or four is equivalent to 9th-grade.

Based on the result of the analysis, the detailed mapping of mathematical material between Indonesia and Singapore curriculum is presented in the table below:

Table 1. Learning Material Mapping of Indonesia and Singapore Curriculum

|  |  |  |  |
| --- | --- | --- | --- |
| Topic | 7th Grade | 8th Grade | 9th Grade |
| **Number** |  |  |  |
| Number  Ratio and Proportion  Percentage  Factors and Multiples  Rate and Speed  Number Patterns  Indices | ID,SG  ID  ID,SG  SG  SG  SG | SG  ID | ID,SG |
| **Measurement** |  |  |  |
| Perimeter and Area of Triangles and Polygons  Perimeter and Area of A Circle  Volume and Surface Area of Solids | ID,SG  SG | ID  ID,SG | SG  ID |
| **Geometry** |  |  |  |
| Angles  Triangles and Polygons  Pythagoras’ Theorem  Circles  Geometric Transformation  Congruence and Similarity  Solids  Trigonometry | ID,SG  ID,SG  SG | SG  ID,SG  ID  SG  ID,SG | SG  ID  ID,SG  ID  SG |
| **Statistics and Probability** |  |  |  |
| Data Handling and Analysis  Probability | ID,SG | ID,SG  ID,SG | SG |
| **Algebra** |  |  |  |
| Sets  Algebraic Expressions  Linear Equations in One Variable  Linear Inequalities in One Variable  Cartesian Coordinates  Relations and Functions  Straight Line Equations  Linear Equations in Two Variables  Quadratic Equations | ID  ID,SG  ID,SG  ID | SG  SG  SG  ID,SG  ID  ID  ID,SG | SG  SG  SG  ID,SG |

*ID: Indonesia Curriculum, SG: Singapore Curriculum*

Based on the analysis (see table 1), the similarities between the material mapping of Indonesia and Singapura is the learning material mapping on numbers, percentage, indices, perimeter and area of triangles and polygons, angles, Pythagoras’ theorem, probability, cartesian coordinate, linear equations in two variables, and the quadratic equation are taught in the same grade for both countries. Numbers, percentage, perimeter and area of triangles and polygons, and angles are taught in 7th-grade. Pythagoras’ theorem, probability, cartesian coordinate, and linear equations in two variables are taught in 8th-grade. Indices and quadratic equations are taught in 9th-grade. On the learning material mapping (see table 1), it was found that there were 26 topics on the Indonesian mathematics curriculum and 28 topics on the Singapore mathematics curriculum for middle school. The difference in the number of materials that cause some materials only available in one curriculum and not available in another curriculum. The sets topic is only available in the Indonesia curriculum, while the factors and multiples, rate and speed, and trigonometry are only available in the Singapore curriculum.

Besides that, there is another difference in the material mapping between Indonesia and Singapore curriculum The most noticeable difference is there are more topics in the Singapore curriculum which spread over different grade levels. In the Singapore curriculum, there are seven topics spread over two or three different grade levels. Whereas in the Indonesian curriculum, there are only three topics that spread out at different grade levels. This difference shows that in the Indonesian mathematics curriculum, a mathematical topic tends to be studied only at one grade level. whereas in the Singapore curriculum, more topics are broken down into sections and taught at different grade levels. This can be caused by many several reasons, including differences in materials distribution systems, differences in the materials order, differences in depth of the material, and differences in school system.

Firstly, Indonesia and Singapore's curriculum has a different material distribution system. An example of these differences can be seen in the triangles and polygons topic. In the Indonesian curriculum, the topic of triangles and polygons is taught only in 7th-grade. The Singapore curriculum divides the topic of triangles and polygons into two different grade levels, namely triangles in 7th-grade and polygons in 8th-grade. The difference in the material distribution system is also seen in the topic of solid, which is divided into two grade levels in both countries but divided in different ways. Indonesia curriculum teaches solids in two different grade levels based on their sides, which are solids with flat sides in 8th-grade and solids with curved sides in 9th-grade. However, curriculum Singapore divides the solids topic into prism and cylinder in 7th-grade and pyramid, cone, and sphere in 8th-grade. If we look closely, prism and cylinder are classified as prisms. Whereas, pyramid, cone, and spheres are classified as non-prisms. This distribution can cause the Singapore curriculum to have different delivery systems related to the volume of solids.

Second, the difference in material order is found in the material mapping between Indonesia and Singapore. An example of this difference is in the topic of equality and inequality. Indonesia's curriculum chooses to teach material equality and inequality based on sequence variables, namely by teaching linear equations and inequalities of one variable first in 7th-grade and continued with the material linear equations of two variables in grade 8. While the Singapore curriculum teaches linear variables of one variable in 7th-grade, two-variable linear equations in 8th-grade, and then linear inequality one variable in 9th-grade.

Third, Indonesia's curriculum material is derived from basic competencies, while the material of Singapore's curriculum is derived from the details of the content. This makes the material charge must be achieved in the Singapore curriculum to be deeper and detailed so that the material is broken down into more parts than the material in the Indonesia curriculum. For example, the algebraic expressions topic in the Indonesia curriculum is taught in 7th-grade with two basic competencies of knowledge and skills, namely "explain the form of algebra and perform operations on the form of algebra (summation, reduction, multiplication, and division)" and "solving related problems with algebraic forms and operations on algebraic forms". On the other hand, the Singapore curriculum teaches algebraic expressions in 7th-grade with the details of content: "use letters to represent numbers, interpreting notations, evaluating of algebraic expressions and formulae, and translating real-world situations into algebraic expressions, and addition and subtraction of algebra", 8th-grade with the details of content: "simplifying algebra, multiplication, and division of algebra”, and 9th-grade with the details of content: “evaluating the amount that is not known in the formula, and change the subject of the formula".

The last, the difference in the school system is also a factor in the difference in material mapping. The school system in Indonesia is three years in middle school and then continue for three years in high school or vocational high school. Whereas the school system in Singapore is four to five years in secondary school (special education school, express school, normal academic school, school engineering, and specialized schools) and then proceed to preparatory school to enter College. This causes 9th-grade Singaporean students do not need to prepare for a graduation exam. So that Singapore students can learn more material in 9th-grade.

Both, Indonesian and Singapore curriculum have their material mapping systems each. The Indonesian curriculum presents material hierarchically, a material is taught in-depth at one time and continue with the material others with higher levels of difficulty. The Singapore curriculum also presents material hierarchically, but the depth of the material is taught gradually at the grade level different while studying other material at the same grade level. Although the material the learning in the two curriculums is the same as the majority, the material details are in the second curriculum is different, where the Indonesian curriculum presents basic competencies and the Singapore curriculum directly outlines the details of the material that must be achieved.

1. Conclusion

Mapping secondary school mathematics learning material between Indonesian countries and Singapore has more differences than similarities. Based on The analysis found that the amount of learning material taught at one level classes in Indonesia is generally taught at two different grade levels in Singapore. Thing This is caused by several things, including due to differences in the material solving system, differences in the ordering of materials, and differences in the depth and detail of material loads. Another difference found is the difference in the amount of material taught. Equation learning material between the two curriculums is found in statistical content and opportunities, where the material and grade level are taught the same.

Based on the discussion it is known that the curriculum of Indonesia and Singapore have a mapping system for each learning material. Both countries present learning material in a hierarchical but delivery system different material depths. The Indonesian curriculum teaches the material in-depth at one time and continues with other materials with more difficulty high. Whereas the Singapore curriculum teaches the depth of material gradually on different grade levels while studying other material at the same grade level. Although the majority of the learning materials in the two curricula are the same, the details of the material in the two different curriculums, where the Indonesian curriculum presents basic competencies and the Singapore curriculum directly outlines the details of the material that must be achieved.

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