



## Study Literature of Development Model of Mathematics Curriculum in Queensland

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### Abstract

Australia grants individual states autonomy to develop school mathematics curricula. This article aims to find out a model for developing a school mathematics curriculum in Queensland. The method used in this research is Systematic Literature Review (SLR). This SLR method can be used to identify, review, evaluate, and interpret studies related to the topics discussed in this study, with specific relevant research questions. The SLR method in this research is carried out by systematically reviewing and identifying journals, which follow the steps or protocols that have been set in each process. The documents studied and researched include journals and professional scientific papers and Queensland mathematics curriculum documents for grades 11 and 12, namely the Queensland Curriculum & Assessment Authority (QCAA). Based on the results of the literature review, it was found that in Queensland, the mathematics curriculum in grades 11 and 12 is divided into three types, namely Mathematics A curriculum, Mathematics B curriculum, and Mathematics C curriculum. Each type of curriculum is developed according to the conditions and skills required by students.

**Keywords:** developing model, mathematics curriculum, Queensland

### INTRODUCTION

The development and improvement of human resources in the field of education and work skills are essential to be able to compete in the 21st century. In addition, increasing human resources is also helpful in preparing quality educators in the era of industrial revolution 4.0. government regulations contained in Undang-Undang No. 20 of 2003 concerning the National Education system and Undang-Undang No. 14 of 2005 concerning Teachers and Lecturers explain that educators and education personnel are required to develop themselves through continuous competency development constantly. The competence development in question can be carried out independently or collectively by participating in training organized by the government or related agencies. Through continuous professional development activities and increasing self-competence, professional teachers will realize who have substantial

knowledge and a mature, strong and balanced personality.

Curriculum development is needed in the education system to be strong and quality at every level of education (Marsigit et al., 2018). Whenever there is a need for curriculum development, the role and involvement of teachers become a necessity (Carl, 2012).

STEM (Science, Technology, Engineering, and Math) is a focus learned during study assignments in Australia, especially Queensland. The STEM approach itself has not been implemented in Indonesia. The majority of schools in Indonesia do not yet understand the concept of STEM and its application to students, especially in learning mathematics. Differences in culture, facilities, and infrastructure are one of the inhibiting actors for the progress and application of STEM in Indonesia.

STEM is an approach that can use 5E, namely Engage, Explore, Elaborate, Explain, Evaluate (Cheng & Mui So, 2020). STEM is a learning framework implemented in an integrated manner between science, technology, engineering and mathematics. Meanwhile, in Indonesia, science, technology, engineering, and mathematics are still carried out separately. Through STEM, students can develop skills that involve problem-solving, creativity, critical analysis, teamwork, independent thinking, developing ideas, communication, and digital literacy.

## **METHOD**

This study uses a qualitative approach, namely an approach that in data processing since reducing, presenting, verifying, and concluding data, does not use mathematical and statistical calculations, but emphasises on interpretative studies (Carl, 2012).

The technique of collecting data and information in this study was carried out by studying literature. This literature study is intended to reveal various theories that are relevant to the problem being researched, namely the school mathematics curriculum in Queensland. This technique is done by reading, studying, and reviewing the literature related to the school mathematics curriculum in Queensland.

The literature review for this research is in the form of technical and non-technical literature (Moleong, 2007). The technical literature in question is research studies and professional or disciplinary writings in the form of theoretical or philosophical papers. Meanwhile, the non-technical literature referred to in this study is a curriculum document for school mathematics in Queensland. The results of the literature study can be used as input and basis in explaining and detailing the problems to be studied, such as the background of the problem that is important to research.

The data analysis technique is the process of collecting data systematically to facilitate researchers in obtaining conclusions.

According to Miles and Huberman (1992), the analysis consists of three activity flows that coincide: data reduction, data presentation, conclusion drawing or verification.

## **RESULT AND DISCUSSION**

The development of the mathematics curriculum in Queensland differs from state to state in Australia. Each state in Australia has the authority to develop its curriculum. However, every curriculum in Australia has implemented STEM in its learning. Queensland's senior mathematics curriculum (Grades 11 and 12) is divided into three sections, namely Mathematics Curriculum A, Mathematics Curriculum B, and Mathematics C Curriculum.

### **Mathematics A**

The Mathematics A curriculum covers more practical topics than the Mathematics B and C Curricula. The algebra topics in the Mathematics A curriculum are fewer and in line with students struggling with mathematics in Grade 10. In other words, they do not require in-depth knowledge of abstract mathematics. The Mathematics A curriculum is designed to help students develop an appreciation of the value of mathematics for everyday life. Students are provided with how mathematical concepts can be applied to various life situations, including business and recreational activities. The skills provided by the Mathematics A Curriculum are suitable for various careers, such as trade, technical, business, and so on. The assessments carried out in the early Mathematics A curriculum includes formative and summative written tests, assignments and practical work. These items are assessed in the categories: Knowledge & Procedure (KAP), Modeling and Problem Solving (MAP), and Communication and Justification (CAP) (QCAA, 2017). Mathematics A curriculum is not a prerequisite. However, the composition of the curriculum is suitable for admission to many tertiary study programs. The travel time for the Mathematics A Curriculum is divided into four

semesters. The distribution of mathematical material in the Mathematics A curriculum is presented in Table 1 as follows.

Table 1. Distribution of Materials in the Mathematics Curriculum A

| Semester             | Topic  |
|----------------------|--|
| Semester 1 (Year 11) | <ul style="list-style-type: none"> <li>Data analysis</li> <li>Money management</li> <li>Applied geometry</li> <li>2-dimensional and 3-dimensional relationships</li> </ul> |
| Semester 2 (Year 11) | <ul style="list-style-type: none"> <li>Land measurement</li> <li>Applied geometry</li> <li>Statistics</li> <li>Money management</li> </ul>                                 |
| Semester 3 (Year 12) | <ul style="list-style-type: none"> <li>Money management</li> <li>Land measurement</li> <li>Data analysis</li> <li>Search operations</li> </ul>                             |
| Semester 4 (Year 12) | <ul style="list-style-type: none"> <li>Statistics</li> <li>Land measurement</li> <li>Navigation</li> <li>Selected topics about data</li> </ul>                             |

**Mathematics B**

The Mathematics B curriculum is much more theoretical than the Mathematics A curriculum. Mathematics B requires advanced algebraic abilities and skills to complete successfully. This Mathematics B is a general prerequisite for the University of Queensland's Science and Engineering program of study. In some schools, the application of Mathematics B can be studied simultaneously with Mathematics A or Mathematics C, but not both. Mathematics B provides students with an understanding of mathematical methods and principles. In addition, Mathematics B also provides the ability to apply it in everyday life situations in the context of pure mathematics, such as the following.

- The capacity to model actual situations and infer the properties of a model.
- Interest and ability in framing and testing mathematical hypotheses.
- Ability to express and communicate any results obtained.
- Some knowledge of the history of mathematics.
- Encouragement to think independently and creatively.

The assessment conducted by Mathematics B is the same as that of Mathematics A, which includes formative tests conducted in Semester 1, summative tests conducted in Semesters 2, 3, and 4, written tests, assignments, and post-tests. These are assessed in three categories, namely Knowledge and Procedure (KAP), Modeling and Problem Solving (MAPS), Communication and Justification (CAJ) (QCAA, 2017). Mathematics B is a prerequisite for any tertiary course that deals with or uses mathematics and/or science. The Mathematics B program is divided into four semesters. The division of mathematical skills learned in each semester is presented in Table 2 as follows.

Table 2. Distribution of Materials in the Mathematics Curriculum B

| Semester             | Topic   |
|----------------------|---|
| Semester 1 (Year 11) | <ul style="list-style-type: none"> <li>Functions (linear, square, absolute value)</li> <li>Periodic functions (trigonometric functions, sine functions and cosine functions)</li> <li>Applied statistics (mean, median, mode, lie factor)</li> <li>Applied statistics 2 (linear regression, quadratic regression, residual plot)</li> </ul> |
| Semester 2 (Year 11) | <ul style="list-style-type: none"> <li>Exploring data/statistics</li> <li>Indices and logarithms or exponential functions</li> <li>Limits and differential calculus 1</li> </ul>  |
| Semester 3 (Year 12) | <ul style="list-style-type: none"> <li>Exponential and log functions</li> <li>Optimization using derivatives</li> <li>Integration</li> <li>Integral calculus</li> </ul>   |
| Semester 4 (Year 12) | <ul style="list-style-type: none"> <li>Applied statistical analysis</li> <li>Integration</li> <li>Differential calculus 2</li> <li>Optimization (other methods)</li> </ul>  |

**Mathematics C**

The Mathematics C curriculum extends the topics taught in Mathematics B. The material in Mathematics includes additional pure mathematics topics, such as the following.

- Complex number
- Matrix
- Vector

d. Advanced Calculus

e. Number theory

Although it is not necessarily more difficult than Mathematics B, it should be studied in conjunction with Mathematics B. Mathematics C provides students with an understanding of mathematical methods and principles. In addition, Mathematics C also gives students the ability to apply mathematical methods and principles in everyday life situations in the context of pure mathematics as follows.

- a. The capacity to model actual situations and infer properties of a model.
- b. Interest and ability in framing and testing mathematical hypotheses.
- c. Ability to express and communicate any results obtained.
- d. Some knowledge of the history of mathematics.
- e. Encouragement to think independently and creatively.

The assessment carried out in Mathematics C is the same as in Mathematics A and Mathematics B, namely formative and summative written tests, assignments, and practical work. Students are assessed in Knowledge and Procedure, Modeling and Problem Solving, Communication and Justification (QCAA, 2017). Math C can be a prerequisite for tertiary study programs that require in-depth math or science foundations. Some of the skills learned in Math C will be found in business and economics degrees. Mathematics C travel time is divided into four semesters. The areas and skills learned during Mathematics C are presented in Table 3 as follows.

Table 3. Distribution of Materials in the Mathematics Curriculum C

| Semester             | Topic  |
|----------------------|--|
| Semester 1 (Year 11) | <ul style="list-style-type: none"> <li>• Real numbers and complex numbers</li> <li>• Matrix</li> <li>• Vector</li> <li>• Groups</li> </ul> |
| Semester 2 (Year 11) | <ul style="list-style-type: none"> <li>• Matrix application</li> <li>• Vector</li> </ul>   |

|                      |  |
|----------------------|--|
|                      | <ul style="list-style-type: none"> <li>• Real numbers and complex numbers</li> <li>• Dynamics</li> <li>• Structure and pattern</li> </ul>  |
| Semester 3 (Year 12) | <ul style="list-style-type: none"> <li>• Structure and pattern</li> <li>• Real numbers and complex numbers</li> <li>• Matrix</li> <li>• Periodic function</li> <li>• Calculus</li> <li>• Options I and II</li> </ul> |
| Semester 4 (Year 12) | <ul style="list-style-type: none"> <li>• Vector</li> <li>• Calculus</li> <li>• Dynamics</li> <li>• Vector</li> <li>• Options 1 and II</li> </ul>   |

Queensland School Mathematics Curriculum (Queensland Curriculum & Assessment Authority / QCAA) has developed an elaboration standard based on the Australian Curriculum standard. This curriculum attainment provides teachers with tools to make consistent and comparable assessments of how well students demonstrate what they know, understand, and do on a five-point scale (QCAA, 2017).

The mathematics curriculum in Queensland is different from the curriculum in Indonesia. The use of the mathematics curriculum for students in Queensland is based on each student's abilities. Each type of curriculum in Queensland (Mathematics A, B, or C) has different characteristics, material components, and objectives. In contrast, the mathematics curriculum in Indonesia does not focus on the differences in the abilities of each student. All students get the same portion of learning to avoid inequality in education. The population of Indonesia is very diverse, spread over various islands with different characteristics of customs, making it difficult to use different curricula in learning.

## CONCLUSION

Australia gives the autonomy of the states to develop their curricula. However, every country on the Australian continent applies STEM to its curriculum. The curriculum provides an overview of the knowledge, skills, and values that are worth

learning in schools. The school mathematics curriculum in Grades 11 and 12 is prepared for different student conditions. Queensland's Grades 11 and 12 school mathematics curriculum consists of three types, namely Mathematics A, Mathematics B, and Mathematics C. Each type of curriculum has different materials and characteristics.

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