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ELEMENTS ACROSS THE CURRICULUM IN PRIMARY SCHOOL MATHEMATICS TEXTBOOKS: A MALAYSIAN PERSPECTIVE

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Abstract

We analyse typical primary school mathematics textbooks in Malaysia from the perspective of elements across the curriculum, important to develop the capacity of mathematical thought as well as to enhance pupils' awareness to become a good citizen and meaningful learning. This paper will give deeper understanding of what elements across the curriculum was presented in mathematics textbooks on the topic of fractions. We also provide how teaching and learning fractions suggested in mathematics' textbooks aims not only knowledge and mathematical skills, but appreciate the values adapted for national unity and well-being in the perspective of multicultural in Malaysia. These latent messages match with National Education Philosophy, providing a balanced student in terms of physical, emotional, spiritual, and intellect. Textbooks also provide all children with elements across curriculum which enable pupils to have divergent thinking, encourage links and connection at a level of consciousness coming with more creative solutions and ideas for future problems may arise. When the pupils clear the meaning of learning mathematics, the highest function of education has achieved. This paper provides insight into the opportunity to learn encompasses wider educational and social contexts. Finally, we hope it's stimulated others to realize how textbooks play a crucial role especially in connection to different fields.

Keywords: Mathematics, textbooks, fractions, elements across the curriculum, interdisciplinary.

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1. Introduction

In 2017, a new shift in the education system in Malaysia led to changes in textbook content structure and student assessment. Textbooks' content should be integrated with National Philosophy of Education (NPE) to produce intellectual, spiritual, emotional and physical balanced individuals (Ministry of Education Malaysia [MOE], 2016). Aminuddin and Sim (2013) analyze NPE according to the branch of philosophy: metaphysics, epistemology, axiology and logic. Metaphysics relate with integrated and holistic, involve the responsibility of the teacher to understand pupils' knowledge, talent and abilities. The important way to develop pupils potential through the process of gaining knowledge, adapting new strategies or new knowledge and continuously make improvement which refer to epistemology. Axiology pointed individual relationship with god as creator and Al-mighty through practices of moral values and ethics in daily life. From the perspective of logic, important of being competent, reasoning for good and systematic procedure.

Therefore, the aspect of acquiring knowledge and skills through learning experiences and activities should be emphasized (Roslan Rasip, 2009). The changes in primary school the topic of fractions involve integration with decimal topic to achieve close connection between different constructs of fractions. The changes include improvements to the cross-curriculum elements that underpin fractions content knowledge. The relationship content of fractions with elements across the curriculum proves that actual context is inseparable from the acquisition of mathematical knowledge so that pupils are clear about the meaning of mathematical learning.

Elements across the curriculum or interdisciplinary share the same meaning, but the application may vary according to the country's education policy. From the point of view of MOE (2016), elements across the curriculum defined as support values embedded in teaching and learning as well as content knowledge set in curriculum specifications. The main purpose is to provide pupils with future challenges. In Malaysia context, there are 10 cross curricular elements applied in the content standard. These involve language, environmental sustainability, values, science and technology, patriotism, creativity and innovation, entrepreneurship, information and communications technology (ICT), global sustainability and finance education.

In other country such as Brazil, elements across the curriculum also embedded in their mathematics textbooks. Silva and Valero (2018) reveal the application of financial and citizenship elements so prominently in their mathematics textbooks. They analysed how financial mathematics and interdisciplinary suggested in the textbooks bring clear utility of mathematics learning and increase awareness of consuming and caring citizen. Besides, the study of value applying has been linked to mathematics such as Dede (2006), Nicholls (1983), Silva and Valero (2018). They explain how mathematical content applies value elements such as rationalism, control and openness (Dede, 2006), social life (Nicholls, 1983), as well as concern and caring citizens (Silva & Valero, 2018).

Learning from half century ago in Japan, across curriculums highlighted in the context of the country's political history (Ju, Moon, & Song, 2016). In order to convey national history, especially the history of war and colonialism is quite critical as it involves sensitive issues in the country and region. For examples, History of Asia-Pacific War provoked nationalist protests in Japan in the late 1970s and the mid-1990s; their historical textbooks are touched by their sensitivity (Selden & Nozaki, 2009). Selden and Nozaki (2009) in their study of Japanese textbook controversies, made an analogy of the role of textbooks

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in the context of conveying history as an important mass media weapon. This is due to the fact that the textbooks can 'speak' not only to the youths and citizens, but also people of other countries. Received messages can be negative or positive, depending on the way they were written. Authors of historical textbooks are reminded to be aware of sensitive issues especially when engaging in warfare. The presentation of textbooks needs to be of more storytelling rather than generating negative emotions that may threaten domestic and international political harmony. Therefore, textbooks play the important role in translating education policy through elements across the curriculum presented.

2. Problem Statement

According to Bloom Taxonomy, to understand the topic, need to grasp the factual knowledge of that topics such as knowledge about specific details and elements. It is related to the main facts of certain cultures, societies, health, citizenship, and all other human needs and concerns (Anderson et al., 2001). This is why elements across the curriculums important to embedded in Mathematics textbooks content representations.

In practice, teaching specific topics or skills, especially the topic of fractions is challenging not only to primary pupils but also pupils at the higher level (Behr, Lesh, Post, & Silver, 1983; Hoch, Reinhold, Werner, Richter-Gebert, & Reiss, 2018). Without clear connections with real life context, difficult for pupils to generalize from what knowledge they have learnt to upcoming situations (Bruner, 1978). Elements across the curriculum presented in mathematics' textbooks should be integrated with innovative teaching and learning process. Strategies include incorporating content knowledge with procedural knowledge through collaborative activities and quality assessment to complement the concept and exercises in textbooks which not parallel with constructivism perspective (Cagelosi, 2003; Burmistrova, Kormiltseva, Shmakova, & Loshchilova, 2017).

Current emphasized on Science, Technology, Engineering and Mathematics (STEM) and industrial revolution 4.0 (IR 4.0) required the creative strategies to create balance pupils through elements across the curriculum presented in mathematics textbooks. However, to this day, such initiatives still vague in terms of definition and implementation in teaching and learning. Furthermore, with review of elements across the curriculum has been detailed, an analysis of the textbooks' representation related to elements across the curriculum which support physical, emotional, spiritual, and intellect pupils have not well documented.

3. Research Questions

This preliminary study was guided by several questions as follows:

- What types of elements across the curriculum presented in primary mathematics textbooks?
- What are examples of elements across the curriculums in primary mathematics' textbooks in terms of promoting balance pupils.

4. Purpose of the Study

This study was implement:

-To determine types of elements across the curriculum presented in primary mathematics textbooks.

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-To determine examples of elements across the curriculums' in primary mathematics' textbooks in terms of promoting balance pupils.

5. Research Methods

Prior to choosing primary two mathematics textbooks on the topic of fractions, textbooks used by pupils in national schools were chosen because they represent most schools in Malaysia and analysed in terms of elements across the curriculum presented in examples, exercises and teachers' note.

6. Findings

The question related to types of elements across the curriculum in primary mathematics' textbooks using content analysis, including mathematics' syllabus and textbooks.

6.1. Types of elements across the curriculum in primary mathematics' textbooks and research related to the elements

This section provides the definitions *of elements across the curriculum in primary mathematics' textbooks and supported research around the elements.* Cross curricular elements applied in the content standard involve language, environmental sustainability, values, science and technology, patriotism, creativity and innovation, entrepreneurship, information and communications technology (ICT), global sustainability and finance education.

First, the element of language. It refers to correctly use pronunciation, terminology, sentence, structure and grammar that motivate pupils in communication and organization of ideas. In the classroom situation, the use of mathematical terms and meaning are emphasized not only in *Bahasa Malaysia*, but also in English language especially for Dual Language Program (DLP) class that learning mathematics, science and information communication and technology subject in English. Besides the important for subject matter to contain knowledge, concept, ideas, facts and principles, language used in textbooks also support and highlights given texts, provide clear presentation, systematic and logical content as well as effective writing styles. Writing style was also discussed by Britton, Woodward, and Binkley (1993) through their study of two groups of pupils; whereby, one group was given original regular textbooks (control) and the other group was given altered textbooks as its writing style was changed (treatment). The findings indicated that there was an improvement in problem solving for the treatment group. Therefore, good writing style factors have been proven to improve student learning.

Next, environmental sustainability, the important country's agenda to shape pupils' ethics in appreciating nature, such awareness of environmental pollution and application of recycle and systematic waste disposal. This element brings practical values for safety and health of residents as well as improve spirituality, humanity and national and global citizenship. However, the level of knowledge and sustainability practice seems unsatisfied among the citizen, 80% respondents found to have a high level of knowledge and attitude, however in terms of practical issue, it has shown low abilities (Mohd Azlan et al., 2012).

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Align with industrial revolution 4.0, integration of science and technology is another important element. Emphasize on both science and technology prepare pupils with knowledge of facts, principles and concept. Scientific skills provide with thinking and manipulative skills while scientific attitudes build student attitude related to accuracy, honestly and security. Besides, one of the key themes of cities 4.0 as government agenda should be technology equipped and smart, therefore begin from primary pupils emphasize should be given to the use of technology in order to increase interest, scientific and technology literacy and contribute to effective learning. Elements of science and technology presented in textbooks involving the use of knowledge and skill are using stopwatches, counsellor or beaker.

Element values also emphasized to ensure pupils aware and practice them in daily life. The values include spirituality, humanity or even national and global citizenship. Values presented in textbooks through cooperative and collaborative work, brave and willing to present at the front of the class and honestly in measuring and using the scale. However, in teaching and learning situation, the element values in mathematics' classroom explicitly less emphasized (Mohd Uzi & Lim, 2009).

While connectivity through advance, digital technology, the engagement with sports, co-curricular activities and community services can be nurtured. This led to the spirit of patriotism and pride as Malaysians among pupils. Elements of patriotism was presented in mathematics textbooks through the picture of pupils carry out mural activities, painting the school wall, visual representation of the national flag and representation of various culture such as traditional games and traditional delicacies. Besides, in order to raise the spirit of patriotism, questions and issues that undermine the sentiments of multiracial society and the application of historical elements within each student such as providing activities for building scrapbooks related to mathematics history and the Malaysian history need to be incorporated into textbooks (Mohd Rodzi, 2009).

Besides, creativity and innovation are also encouraged in teaching and learning. Creativity defines as the ability to use reasoning in collecting, analysing and synthesizing information or creating indigenous ideas. Otherwise, innovation more on the use of creativity through modification and practice improvement ideas. Examples of activity to create creativity among pupils related to collage, creating a model using plasticine and folding paper activities.

Next, creative minds and innovative ideas can be nurtured through entrepreneurship. In order to develop habits, characteristics, and culture of good entrepreneur, entrepreneurial attributes, foster diligence, honesty, trustworthiness and responsibility pupils through teaching and learning activities. The previous study among prospective teacher cause to worry since characteristics of entrepreneur competence shows lack of intrinsic motivation. It represents a higher percentage of pupils with low own initiative to do work without being pushed or forced (Norhiza Mohd, Che Omar, & Karim, 2017).

The 21st century pupils should apply information and communication technology elements to strengthen their basic knowledge and skills. Based on appropriate topics to be taught, the application of ICT in the classroom enhance pupils' motivation, stimulate interest, enjoyment and increase understanding of the subject content. Consequently, teaching and learning also improved. Mathematics primary school textbooks presented suggested the web site for learning the topics through website address or QR code. This is very fruitful not even for the teacher but parents and pupils as well.

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Another important cross curricular element is global sustainability, aim to develop pupils with sustainable thinking and highly responsive attitude towards the environment through Sustainable Consumption and Production, Solidarity and Global Citizenship. These elements are taught in related subjects directly and indirectly to prepare pupils with multi-level issues involving local, national and global challenges.

The final emphasize also not the least is finance education. The financial education refers to the process of consumers enhance their knowledge of financial products and concept, increase the confidence as well as the skill to realise of financial opportunities besides risks, make decision and actions effectively (Sood, Coundhary, & Singh, 2012). Several measures to improve financial awareness are suggested to help pupils gain profound knowledge related to personal financial for the holistic development of future technocrats include embedded elements of financial in mathematics textbooks. The elements aim in shaping future generation to make right financial decisions, financial management skills and ethical practice to manage the financial problems' responsibility and wisely. The quality of education in financial management has significant relationship with the level of financial literacy (Nor Syahidah & Norasmah, 2017). Figure 1 summarize the types of elements across the curriculum embedded in mathematics textbooks.

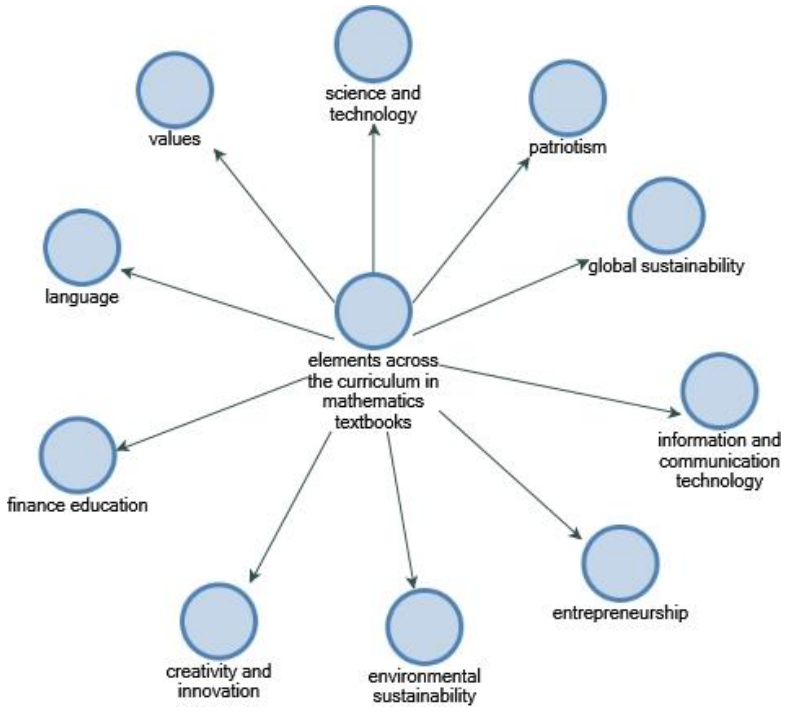

Figure 01. Types of elements across the curriculum embedded in mathematics textbooks

6.2. Analysis of the elements across the curriculum in primary two mathematics textbooks on the topic of fractions

A total of 69 items consist of examples, exercises and teachers' note presented in primary two mathematics textbooks were examined in terms of elements across the curriculum explained in the previous section. This section provides analysis of each cross curricular elements in the content standard which consist of language, environmental sustainability, values, science and technology, patriotism, creativity and innovation, entrepreneurship, information and communications technology (ICT), global sustainability and

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finance education. Table 1 shows the percentage and types of elements across the curriculum detected in the topic of fractions.

Based on analysis, several important ideas were concluded. First, out of 69 items were analysed, 24 (or 100%) in examples, 19 (or 70%) in exercises and 13 (or 72%) in teachers' note were language element. The element of values was committed 20 times (or 83%) in examples, 6 (or 22%) in exercises and 6 (or 33%) in teachers' note. Under the category of creativity and innovation, 10 (or 42%) embedded in examples, 10 (or 37%) in exercises and 17 (or 94%) in teachers' note. The element of ICT emphasized more on teachers' note. Finally, except in teachers' note, the element of global sustainability found in 3 (or 54%) examples and 8 (or 30%) in exercises.

Second, out of 182 items analysed that consist of examples, exercises and teachers' note, 56 items were related to the element of language, 32 items contain elements of values and patriotism each, 37 items related to the element of creativity and innovation, 21 items related to the element of global sustainability and 4 items related to the element of information and communications technology.

Table 01. Elements across the curriculum detected in the topic of fractions (Number of items = 69)

Across curriculum elements	**Examples (N =24)**		**Exercises (N=27)**		**Teachers' note (N=18)**		**Total**
Language	Frequency	Percent	Frequency	Percent	Frequency	Percent	56
Environmental sustainability	24	100.00	19	70.00	13	72.00	0
Science and technology	0	0.00	0	0.00	0	0.00	0
Values	0	0.00	0	0.00	0	0.00	32
Patriotism	20	83.00	6	22.00	6	33.00	32
Creativity and innovation	24	100.00	8	30.00	0	0.00	37
Entrepreneurship	10	42.00	10	37.00	17	94.00	0
Information and communication technology	0	0.00	0	0.00	0	0.00	4
Global sustainability,	0	0.00	0	0.00	4	22.00	21
Finance education	13	54.00	8	30.00	0	0.00	0
Total							182

7. Conclusion

With regards of elements across the curriculum detected in the topic of fractions, there are several elements not emphasized such as environmental sustainability, science and technology, entrepreneurship and finance education. This is due to some reasons. First, the elements were presented in other topics and become the dominant focus for certain topics. For example, in the case element of finance education, it has been embedded in the special topic that is money. Besides, the element of entrepreneurship also nurtured since entrepreneurship and financial elements are closely related. The situation gives the reason why not

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all cross curricular elements presented in one single topic. However, teachers were encouraged to match the elements of the curriculum with the related topics.

The major emphasis is elements of language since it closely related to factual knowledge includes fraction terminology, such as denominator, numerator, comparing fractions and decimals. Basic knowledge pupils must know to solve problems or to know the discipline (Anderson et al., 2001). By referring to the idea of Bloom's taxonomy, revised by Anderson et al. (2001), the domain of creating was located on the highest level. Therefore, the element of creativity and innovation essential for achieving higher order thinking skills.

Next, the element of values and the patriotism share same number of items that shows both elements related to each other. Values and patriotism are the important affective domain to individual pupils. This shows that textbook also serves as a unity tool (Paul, 1973; Ju, Moon, & Song, 2016). In reflecting Malaysia historical several decades ago, multi-racial pupils are unified through textbooks by aligning similar contents for all states, schools and classrooms whereby values of community solidarity and National Philosophy (*Rukun Negara*) are conveyed for all subjects (Roslan Rasip, 2009). In learning similar content, unity is employed through simultaneous and centralized examinations in terms of questions, dates and times, as in the Malaysian certificate of education *(Sijil pelajaran Malaysia* [SPM]) (examination special for form 5 or 17 years old pupils). This uniform examination is a unity agenda to enable pupils to be evaluated fairly and equally (Tan, Zaleha, & Mardhiyana, 2018).

The next element emphasized is global sustainability, quite related to values and patriotism. From the perspectives the topic of fractions, representation detected through practicing of sharing pizza with sibling and sharing cakes with friends, important to create emotional intelligence among pupils. Besides, representation of equally learning opportunity among different races and gender create intellectual intelligence among learners.

The least emphasized in the topic of fractions is information and communications technology embedded through suggested web site addresses in teachers' note. Such supporting material leads to informative website can increase the mastery of topic content (Forsten, Grant, & Hollas, 2003). However, the use of technology needs to be carried out wisely. The World Wide Web system facilitates the information, programs and projects from one computer to another (Britton et al., 1993); but its function is not intended to perform the whole work. Thus, teachers need to use supporting materials according to teaching process in the classroom. Planning needs to be started by ensuring that supporting materials work well by evaluating and testing beforehand (Romiszowski, 1968).

By referring to elements across the curriculum detected in the topic of fractions, the element of language focussing on mastering mathematical terminology such as part-whole fractions, denominator, numerator, comparing fractions and decimals. The factual knowledge important to enhance pupils' intellectual intelligence. In order to embedded values, all four intelligences suggested in teaching and learning. It involves cooperative and collaborative activity and encourage pupils to be confident. Whereas, to support emotional intelligence, the values of caring, respecting others, smile and responsible on doing the task also embedded. The element of values such as respect others' religious believe, embedded through representation of Muslim people wearing the scarf and Singh pupil with the turban. This represent the important of spiritual balance for individual pupils. Besides, pupils cooperatively working for the task

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together with peers through picture representation shows the important of intellectual intelligence to support the element of value.

The element of patriotism supports physical abilities when different races together practices cooperate and collaborate. Patriotism supported by spiritual balance when traditional delicacies of other races presented, which represent the concern and acceptation of different culture in Malaysia. The element of creativity and innovation also emphasized through suggested teaching and learning. Activities presented involve paper folding and representation of examples related to traditional games such as 'tip tap toe', which support physical intelligence.

The element of information and communications technology emphasized in teachers' note in the form of suggested educational website to encourage the teacher bringing technology resources into the classroom. By representation of sharing cake or pizza with siblings and friends, elements of global sustainability can be nurtured from the basic. It supports pupils' emotional intelligence. Finally, intellectual intelligence represented through equality of different races opportunity to learn.

In summary, what can we learn from textbooks? Based on the review, there are several important functions of the textbook. First, textbooks provide all children with elements across curriculum which enable pupils to have divergent thinking, encourage links and connection at a level of consciousness coming with more creative solutions and ideas for future problems may arise.

Second, the quality of textbooks depends on the presentation of examples and exercises, and it is tailored to the ability of pupils; whereby, these have attracted pupils' motivation and improve pupils' ability from low to medium and consequently to higher levels. The shift in pupils' ability does not depend on the sophistication of learning materials presented in the textbooks, but through practical activities that are engaging and brought by teachers in the classroom. These learning activities involve pupils, promote interaction with friends and determine how they can relate to pupils' daily life. Examples that related to pupils also influences their understanding.

Third, the role of language is essential for communication in the classroom. Easy-to-understand or repetitive language used by teachers can stimulate pupils' thinking. In addition to language, less emphasis is given to textbooks in terms of the application of values and social interactions. Engaging awareness does not only involve humans but also with flora, nature, animals and the environment that closely related to pupils' life.

Realistic context which pupils interpret and experience mostly different for various country whether it's social, cultural and historical context. Representation of mathematical concepts or problems embedded in the textbooks because of their different effect. Provide contextual information through the elements across the curriculum help pupils see what context related to the problems concern. Therefore, curriculum reform that leads to the changes of textbooks is not just about subject matter. However, it is more latent. It is related to the need of engaging pupils through problem solving activities in order to build pupils' mental strength to face any challenges in solving future problems wisely and become physical, emotional, spiritual and intellectual balance.

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