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A COMPARISON OF VALUES OF PROGRESS CONVEYED IN MATHEMATICS TEXTBOOK IN MALAYSIA AND AUSTRALIA

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ABSTRACT

This research aims to compare the value of progress conveyed in the form four mathematics textbooks from Australia and Malaysia. One mathematics textbook was analysed from each of the countries. Two chapters were chosen for analysis from both of the textbooks, namely Linear Equations and Trigonometry. Content analysis was used to analyse the data. Four characteristics of the value of progress were identified, namely questioning, growth, alternative and generalisation. For the characteristics of questioning, both of the textbooks gave more emphasize to the use of "directive words or phrases compared to use of questions. The value of progress with characteristics of growth and alternative was more clearly conveyed in the TVA Math textbooks, compared to the TMA Math textbook. The value of progress with the characteristics of growth, for both textbooks, was conveyed through use of histories. The value of progress with characteristics of alternative was identified through the use of multiple strategies and methods in discussing the mathematical concepts. The value of progress with characteristics of generalisation was conveyed more clearly in the TMA Math textbook, compare to the TVA Math textbook. There were two characteristics of generalisation which could be identified from the both textbooks, namely deducing and make conclusion. It is suggested that in order to make mathematics textbooks a more comprehensive learning resource, the mathematics textbook should not only focus on developing the cognitive level of the students, but also consider their affective aspects, especially the value of progress.

Contribution/ Originality: This study is one of very few studies which have investigated the comparison of the mathematical value, specifically the value of progress as conveyed in mathematics textbooks in Malaysia and Australia. The findings of this study can be used as a guide to the educator and researcher in mathematics education about the need to focus on the inculcation of the value of progress in mathematics textbooks.

1. INTRODUCTION

Textbooks are one of the main learning resources, apart from teachers. Through textbooks, the contents of the curriculum can be conveyed to teachers and students and thus guide the student towards achieving goals (Hatam *et al.*, 2015). In the context of education today, developing students' affective domain is a goal that is clearly outlined

by many countries in the world, especially in Malaysia (Ministry of Education Malaysia, 2012) and Australia (Australian Government, 2011). The mathematics textbooks provide an interpretation of mathematics curricula to teachers and students (Johansson, 2003).

One of the important affective domains is values, besides norm and attitude (Dollah, 2007). However, more research is needed to investigate if the mathematical textbooks used in the teaching and learning process have appropriate qualities to effectively develop the affective domain of the students.

2. LITERATURE REVIEW

Theoretically, in any teaching and learning processes, value is one of the important component of domain, besides cognitive and effective. Cao *et al.* (2005) highlighted that *"Values are standard for making judgments on what is important…, and they occupy a more central place in our belief system compared with other affective qualities such as attitudes and beliefs…"* (p.483). Therefore, through the teaching and learning processes, the value will be inculcated to students, either explicitly or implicitly, and simultaneously that values will influence the students in making judgment and learning.

Generally, Bishop (2008) categorized the value in mathematics teaching and learning processes into three, namely general educational values, mathematical values and mathematics educational values. General education values are values related to norms of the particular society, and of the particular educational institution. Mathematics educational values are values embedded in the particular curriculum, textbook, classroom practices and teaching and learning process. However, for this article, the focus of the discussion is on one component of the mathematical values, namely the value of progress.

Mathematical values are qualities associated with the mathematical knowledge itself, which are about how the mathematical discipline are constructed by mathematicians in various cultures (Bishop, 1988; Dollah, 2012). Mathematical values are related to the epistemological aspect of mathematics as a discipline. There are six categories of mathematical values, namely rationalism, objectism, control, progress, openness and mystery (Bishop, 1988; Dollah, 2012).

The value of progress refers to the feeling of growth and development in mathematics (Cao *et al.*, 2005). Bishop (2008) explains further that the value of progress emphasizes the ways mathematical ideas grow and develop, that could be achieved through questioning of existing ideas and theories or developing new problem-solving methods and strategies. Hence, mathematics is not static or just application of a specific procedure but growing from basic concepts to more complex concepts through logical thinking. For example, the value of progress could be identified when the students are able to make generalisation on the concepts or algorithm to solve new mathematics problems.

The value of progress can be categorized into four, i.e., growth, questioning, alternative and generalisation (Bishop, 2001). Growth refers to a contribution to the development of mathematics or added value to any mathematical knowledge. Cao *et al.* (2005) asserted that a mathematical contribution can happen in two ways: mathematics is contributing to societal progress and historical development in mathematics. Another characteristic is questioning which refers to question posing or getting answers from readers or students (Seah and Bishop, 2000).

Alternative is a situation that is not bounded to a single way, procedure or strategy (Taber, 2016). One perspective is a constructive alternative that refers to way people making sense of their experiences or worlds (Kelly, 1963; Taber, 2016). Generalisation is about looking for broader patterns of relationship and making connection in different levels of mathematical ideas (Hashemia *et al.*, 2013). Polit and Beck (2010) added that *"generalisation is an act of reasoning that involves drawing broad conclusions from particular instances—that is, making an inference about the unobserved based on the observed."* (p. 1451).

3. PROBLEM STATEMENT

Textbooks affect the learning process of learners. According to Hatam *et al.* (2015) a textbook is the focus of attention as a principal tool to modify and improve educational curricula, besides guiding learners in the learning process. Seah and Bishop (2000) argue that the contents of the textbook are not only embedded elements that can develop students' cognitive domains, but also contain elements to develop students' affective domains. Therefore, through textbooks, students have the opportunity not only to develop their knowledge and skills but also their values (Seah and Bishop, 2000; Cao *et al.*, 2005)

There are still limited studies focusing on mathematical values in mathematical textbooks (Seah and Bishop, 2000; Cao *et al.*, 2005; Hassan and Nik, 2008). Based on literature reviews, there were a few researches conducted regarding to the mathematical values. Hassan and Nik (2008) conducted a study about the mathematical values conveyed through a Malaysian mathematics textbook. They concluded that the Malaysian mathematical textbook places less emphasis on the value of progress. Lee (2006) conducted an analysis about teachers' perspective to mathematics textbooks from Korea. Two textbooks and teachers' handbooks of 8^{th} grade of mathematics were involved in this study. In general, most of the teachers highlighted that, the knowledge which related to history of mathematics offered was superficial in all mathematics textbooks. This indicates that Korean mathematics textbooks have less emphasis on the inculcation of the value of progress.

Cao *et al.* (2005) compared the inculcation of the value of progress between a textbook in Australia and China. They found that the textbooks from both countries conveyed more frequently on the value of progress with a characteristic of growth through mathematics contributing to societal progress.

Seah and Bishop (2000) compared the appearance of the mathematical values, especially the value of progress from the textbooks from Singapore and in Victoria, Australia. The value of progress is identified in two ways, namely through progress in the mathematical concept and progress in the use of mathematics to solve problems in society. The progress in mathematical concepts was clearly apparent in Singapore textbooks through making certain formulas as the basis for getting more sophisticated formulas; for example, using the formula of area for a square to produce more sophisticated formulas such as the formula for area of a triangle, a parallelogram and a trapezium. However, in the Victoria textbooks the value of progress was directed towards the use of mathematics in solving community problems. Examples of the value of progress were shown through discussions on issues such as an anthropologist who needs to estimate the height of humans or animals based on the skeleton found; use a scale to describe the size of a map or plan of a building; and use pantographs in the era before photocopying was used.

Although there are some comparative studies on the content of mathematical values, especially those involving value of progress which have been conducted by researchers worldwide, in the context of comparisons involving Malaysian mathematics textbooks, this is yet to be implemented. Therefore, this research is keen to compare the value of progress conveyed in the Australian and Malaysia Mathematics textbooks.

4. METHOD

This study aims to compare the value of progress conveyed through mathematics textbooks, from two different countries, namely from Australia and Malaysia. The research analysis involves one "Year 10" secondary school mathematics textbook from each country. The mathematics textbook from Australia is TVA Math textbook (pseudonym) and the mathematics textbook from Malaysia is TMA Math textbook (pseudonym).

Both textbooks contain 11 chapters. However, only 6 out of 11 chapters from both textbooks contain similar contents. Two chapters containing almost identical contents from each textbook were analyzed in this study. The selection of the chapters were carried out through purposive sampling. The two chapters are as in the Table 1.

The content analysis approach was carried out to analyze these chapters from these textbooks focusing on the value of progress conveyed in B006Fth textbooks. The value of progress conveyed in the mathematics textbook are

identified through four characteristics, namely: growth, questioning, alternative and generalisation (Bishop *et al.*, 2006; Bishop, 2008).

Table-1. Equivalent chapters from TVA Math textbook and TMA Math textbook

	TVA Math textbook (Australia)	TMA Math textbook (Malaysia)
1	Chapter 2: Linear equation (LE)	Chapter 5: Linear equation (LE)
2	Chapter 9: Trigonometry (TR)	Chapter 9: Trigonometry II (TR)

Source: Unpublished monograph of the research grant for sabbatical leave UPSI/PEND/SM4/730/Jld.7(16).

The validity and reliability of this research was achieved through experts' opinion and peer checking. The data analysis was based on the value of progress developed by the researchers based on sources from (Bishop, 2001). The validation of the characteristics and the data analysis of the value of progress were achieved through experts' opinion. The reliability of the data and analysis were achieved through experts' opinion and peer checking and rechecking. There were 2 experts involved in this research and both of them ware lecturers in the area of education.

5. FINDINGS

In general, the inculcation the value of progress is clearly identified throughout development of the chapter of the *Linear equation* and *Trigonometry* from both textbooks. There are four characteristics of the value of progress which could be identified from both textbooks, namely growth, questioning, alternative and generalisation.

a. Growth

The value of progress with the characteristics of growth from the mathematics textbooks appeared in two ways, namely through the *historical development* and *mathematics contributing to societal progress*. Generally, the value of progress with characteristics of growth was clearly identified through the TVA Mathematics textbook, but rarely identified in the TMA Mathematics textbook (Table 2).

Table-2. Comparing the value of progress with the characteristics of growth from the TVA Math textbook and the TMA Math textbook

No.	Characteristic	TVA Math Textbook (number of cases)	TMA Math Textbook (number of cases)
1	Growth through contribution to history development	6	3
2	Growth through contributing to societal progress	11	0

Source: Unpublished monograph of the research grant for sabbatical leave UPSI/PEND/SM4/730/Jld.7(16).

The characteristic of growth through the contribution to the history development is identified when the texts conveyed the history of mathematics, such as the development of mathematical terms or concepts. We found that the texts involving the history of mathematical terms or concepts were conveyed more significantly in the TVA Math textbook than from TMA Math textbook. One example of the characteristics of growth through the history development could be seen in the history of mathematical term or concept about the *"Cartesian or coordinate plane"* as discovered by Rene Descartes (1596 – 1650):

"René Descartes (1596–1650), a French philosopher, made a significant contribution …. use this idea across the world to …" (TVA/LE/1).

One example of the history of mathematical terms or concepts identified from TMA Math textbook is as the following: *"The word "Trigonometry" comes from two Greek words, namely ..."* (TMA/TR/1).

Similarly, the TVA Math textbook gave more emphasis on the inculcation of the characteristics of growth through *"mathematics contributing to societal progress"* by highlighting 11 cases, but this was never highlighted in the TMA Math textbook. One example of history related to the contribution to societal progress from the TVA Math

textbook was the history about GPS (Global Position System) that allows any person with a GPS device to find his or her precise position on earth.

"The Global Position System (GPS) consist of 24 … allow any person… to find his or her precise longitude…" (TVA/TR/2).

In conclusion, the appearance of the value of progress with the characteristic of growth was conveyed more significantly in TVA Math textbook compared to the TMA Math textbook.

b. Questioning

Another way of inculcating the value of progress was evident through questioning. Through questioning, the students will be encouraged to think or find solutions to mathematics problems. The characteristic of questioning can be identified from both textbooks in two ways, namely via the use of question and the use of directive word/phrase (Table 3).

Table-3. Comparing the value of progress with the characteristic of questioning from the TVA Mathematics Textbook and the TMA Mathematics Textbook

No.	Characteristic	Description	TVA Math Textbook (number of cases)	TMA Math Textbook (number of cases)
1	Question	*Do you think…; Does the…; Have you ever…; How… (eg. How far…/How…; Is… (eg. Is it…/Is the….); What… /…what…; When… ; Which… ; Why…*	90	14
2	Directive word/phrase	*Arrange… ; Calculate…; Comment…; Compare…; Complete…; Convert…; Create….; Decide…; Describe…; Determine…; Discuss…; Divide…; Draw…; Estimate…; Evaluate…; Fill…; Find….; Identify….; Label….; List….; Make….; Mark…; Match…; Measure….; Name.; Practice….; Predict.; Put.; Record.; Rearrange…; Reason.; Show...; Sketch….; Solve.; State.; Transform.; Verify...; Write…*	212	211

Source: Unpublished monograph of the research grant for sabbatical leave UPSI/PEND/SM4/730/Jld.7(16).

Generally, both textbooks placed more emphasis on the use of words or phrases related to questioning (namely question and directive word/phrase) through the textbooks. However, both textbooks put more emphasis on the use of *directive words or phrases* compare to *questions.*

Specifically, the TVA Math textbook put more emphasis on the use of question words of phrases, compared to the TMA Maths textbook. Some examples of the question words or phrases are as the following: *Do you think…; Does the…; Have you ever…; How… (eg. How far…/How many…/How can…); Is… (eg. Is it…/Is the….); What … /… what…; When….; Which…;* and *Why.*

The two examples of phrases involving questions in the TVA Math textbook are as follows:

"What is the rate of flow of the grains ….?" (TVA/LE/3).

"How far has Q sailed?" (TVA/TR/4).

The two examples of phrases involving question in the TMA Math textbook are as follows:

"… how old is Haslina and …." (TMA/LE/2).

"Which graph is symmetric …. " (TMA/TR/3).

Generally, both textbooks emphasized on the directive words or phrases equally. Some examples of the directive words or phrases from both textbooks are as the following: *Arrange… ; Calculate…; Comment …; Compare…; Complete…; Convert …; Create….; Decide…; Describe…; Determine …; Discuss…; Divide…; Draw…; Estimate…; Evaluate…; Fill…; Find….; Identify…; Label….; List….; Make….; Mark…; Match….; Measure….; Name …;*

Practice…; Predict…; Put…; Record…; Rearrange…; Reason…; Show…; Sketch…; Solve…; State…; Transform…; Verify…; and *Write….*

The two examples of phrases involving directive word in the TVA Math textbook are as follows:

"Find the gradient of each line" (TVA/LE/5).

"Draw a triangle to represent your …." (TVA/TR/6).

The two examples of phrases involving directive word in the TMA Math textbook are as follows:

"Find the linear equation that pass through …" (TMA/LE/4).

"…state the trigonometric function that ….." (TMA/TR/5).

Therefore, both textbooks put more emphasis on the use of words or phrases related to directive words or phrases compared to questions. This indicates that both textbooks preferred to instruct the readers to find answers rather than ask questions.

c. Alternative

The value of progress with the alternative characteristic was identified via the use of different strategy or method in solving the mathematical problem. The alternative characteristic was clearly identified from the TVA Math textbook compared to the TMA Mathematics textbook (Table 4). There were more cases of the alternative characteristic identified from the TVA Math textbook, compared to cases from the TMA Math textbook.

Table-4. The value of progress with the alternative characteristic

No.	Characteristic	Description	TVA Math Textbook (number of cases)	TMA Math Textbook (number of cases)
1	Alternative – Strategy involving technology	Use two or more strategies to deliver knowledge (eg. Find x-intercept and y-intercept using drawing and excel).	10	3
2	Alternative – Method	Use two or more methods to solve the problems (eg. 1st method: Find the point of intersection using the method of substitution; and 2nd method: Find the point of intersection using the method of eliminating).	3	1

Source: Unpublished monograph of the research grant for sabbatical leave UPSI/PEND/SM4/730/Jld.7(16).

Generally, the use of two or more strategies to deliver the mathematics content could be identified more clearly through the TVA Math textbook compared to the TMA Math textbook. However, the alternative strategy in delivering the mathematics contents from the TVA Math textbook was consistent for all cases, namely from using paper and pencil methods to using technology. The purpose of using more than one strategy to deliver the mathematics content is to help the reader or students to understand mathematical concepts more easily.

One example of alternative strategy in solving mathematics problem from TVA Math textbook could be seen through the solving of mathematics problem using graph drawing and excel. The example can be seen as the following: "Take turns to draw a straight line …and state the x-intercept and y-intercept …*You can do this activity using Excel. To check your answers…"*(TVA/LE/7).

However, one example of alternative strategy in delivering content of mathematics in TMA Math textbook could be as seen as the following*: "Draw a graph: (a) $y = 2x + 1$; (b) $y = -2x + 4$"* (TMA/LE/6) and *"Use the GSP to draw …: (a) $y = 2x + 1$; (b) $y = -2x + 4$"* (TMA/LE/7).

Another way in conveying the value of progress with the alternative characteristic was by the application of more than one method to solve mathematical problems. There were three cases which could be found through the TVA Math textbook, compared to only one case in the TMA Math textbook. Here is one example whereby the TVA Math textbook highlighted the use of multiple methods to find intersection point of the straight lines: (i) using the method of substitution as *"Use the method of substitution to find the point of intersection …"*(TVA/LE/8); and (ii) using the method of eliminating as *"Use the method of eliminating to find the point of intersection …"*(TVA/LE/9).

On the other hand, there was one case involving application of alternative method which could be found from TMA Math as the following: *"Find equation for … using y = mx + c."* (TMA/LE/8) and *"Find equation for … using gradient* $m = \frac{y2-y1}{x2-x1}$ *"*(TMA/LE/9). This involves an application of alternative methods to find equation for the straight line that could be solved either using general form of linear equation, namely y = mx + c, or using formula of gradient.

In general, the application of multiple strategies and methods in discussing the mathematical concepts or solving mathematical problem was conveyed more clearly in the TVA Math textbook, compare to TMA Math textbook. Therefore, this indicates that the TVA Math textbooks were more concerned about application of multiple strategies and methods in discussing the mathematical concepts or solving mathematical problem, compared to the TMA Math textbook.

d. Generalisation

In general, the value of progress with the characteristics of generalisation was not so much highlighted by both textbooks. However, the inculcation of the value of progress with the characteristics of generalisation was identified slightly fair through both textbooks.

There were 2 categories of cases involving the characteristic of generalisation which could be identified from both textbooks, namely pattern and making conclusion (table 5). Here, pattern refers to the pattern of relationship, making connections between concepts of ideas and deducing formula. Making conclusion refers to making conclusion or statement of finding to any mathematical tasks.

Table-5. Generalisation

No.	Characteristic	Description	TVA Math Textbook (number of cases)	TMA Math Textbook (number of cases)
1	Pattern	(broader patterns of relationship, making connection and deduce formula)	4	3
2	Make conclusion	Making conclusion or statement of Finding to any mathematical tasks.	3	6

Source: Unpublished monograph of the research grant for sabbatical leave UPSI/PEND/SM4/730/Jld.7(16).

The generalisation through pattern was rather equal in both textbook, with 4 cases from the TVA Math textbook and 3 cases from the TMA Math textbook. Here are two examples involving pattern from the TMA Math textbook:

> *"Deduction the formula for gradient of a straight line that passing through the point A… and B…"* (TMA/LE/10).
>
> *"Compare the equation… Write a formula of gradient in form of intercept."* (TMA/LE/11).

Two cases involving pattern could be found from the TVA Math textbook as the following:

> *"Create some new expressions and substitute different values into them using the steps outline above. Try creating…"* (TVA/LE/10).

"Write a short report …. Including a statement about relationship between …." (TVA/LE/11).

The generalisation through conclusion was more frequent with 5 cases in the TMA Math textbook, compared to the TVA Math textbook with only 3 cases. Here are two examples involving the "make conclusion" from the TMA Math textbook:

"Make a conclusion about relationship between value of …." (TMA/LE/12).

"Compare the value of ∠POQ… with the value of Θ. State your conclusion." (TMA/TR/13).

Two examples involving making conclusion from the TVA Math textbook is as the following:

"What conclusion can you make about …" (TVA/LE/12).

"… write a brief conclusion about your patterns." (TVA/TR/13)

Therefore, the finding indicates that the inculcation of the value progress with the characteristic of generalization was fair through both textbooks.

6. DISCUSSION AND CONCLUSION

Generally, the value of progress was conveyed in the both textbooks through four different characteristics, namely *questioning*, *growth*, *alternative* and *generalisation*. Most characteristics of the value of progress could be found from both textbooks.

Both textbooks put more emphasis on the use of *directive words or phrases* compared to use of *questions*. The use of *directive words or phrases* for both textbooks was found quite often. However, the use of *questions* to ask mathematical questions was very low in the TMA Math textbook. This characteristic could be clearly seen in the TMA Math textbook, when the number of mathematics questions that asked the students through questioning was very low compared to TVA Math textbook. This indicates that the textbooks were more interested to instruct the students in getting answers compared to developing students' thinking through questioning or inquiry-based approach.

The value of progress with characteristics of *growth* and *alternative* was more clearly conveyed in the TVA Math textbook compared to the TMA Math textbook. Both textbooks conveyed the value of progress with characteristics of *growth* via the use of histories. There were two situations where the use of history can be found, namely *growth through contribution to history development* and *growth through contributing to societal progress*. The TVA Math textbook placed more emphasis on highlighting connections between current mathematics to the previous or the *"root"* of mathematics. Making connections between mathematics and the history of mathematics helps to make mathematics more relevant to human being or student contexts.

The inculcation of the value of progress with the characteristic of *alternative* was identified via the use of multiple strategies and methods in discussing mathematical concepts or solving mathematical problems. The TVA Math textbooks emphasized more on the applications of various strategies and methods in discussing mathematical concepts or solving mathematical problems compared to the TMA Math textbook.

In general, the value of progress with characteristics of *generalisation* was fair for both textbook. Two characteristics of the generalisation could be identified from the both textbooks, namely *pattern* and *making conclusion*. The characteristic of *pattern* could be identified through broader patterns of relationship, making connection and deduce formula. However, the characteristics of *making conclusion* could be identified through action to make conclusion or statement of finding to any mathematical tasks.

In conclusion, the value pf progress conveyed through both textbooks, namely the TVA Math textbook and the TMA Math textbooks, was appropriate. Most of the characteristics of the value of progress was conveyed through both textbooks. However, there were a few characteristics of the value of progress which needed to be added in both textbooks. For the TMA Math textbook, the characteristics of the value of progress which needed be more emphasized were *growth* (more contents that related to history of mathematics), use of *"questioning"* and alternative. For both textbooks, the contents that related to the characteristics of generalisation needed to be emphasized more,

by hoping that the student would be exposed to the process of *making conclusion* and *pattern* while using the textbook.

The extent of which the value of progress embedded in any mathematics textbook is very important for the students, because they will explore the contents of the textbooks while learning. Therefore, in order to make mathematics textbooks a more comprehensive learning resource, emphasis should not be only placed on developing the cognitive level of the students, but more attention is needed to develop student development of the affective aspects, especially the value of progress.

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