QUANTITATIVE METHOD OF TEXTBOOK EVALUATION FOR CHEMISTRY (KBSM)
FORM 4 TEXTBOOK

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ABSTRACT

Textbook plays very important roles for both teachers and students. For many teachers, a textbook is used to guide them in delivering their contents in classroom. As for learners, the textbook serves as a framework to help them in organizing their learning both inside and outside the classroom. However, as teaching in science and mathematics has moved from teacher-centred to student-centred approach, the role of a textbook has also changed. A textbook is considered as good if it is more student-centred, promoting self-directed learning, allowing students to learn by themselves at their own pace and have activities for students to enhance the mastery of the topic. One way of gaining all the information is by conducting a textbook evaluation. This study has been done to evaluate a textbook of Chemistry (KBSM) Form 4 by using a quantitative approach. Six aspects which include texts, diagrams, exercises, summaries, activities and learning objectives have been analysed. An index (I) for students’ involvement from those criteria is used as an indicator. The total evaluation index obtained is 0.78 out of 1.00. This value suggests that the textbook partly meets the criteria of a good textbook. However, some improvements are still needed to enhance the quality of the textbook in terms of making the textbook more students-centred and can promote discovery learning.

Field of Research: Textbook, science and mathematics, student-centered, self-directed learning.

1. Introduction

Textbooks play a very important role in education. It serves as medium of instruction for teachers and students to improve the effectiveness of discussions, activities and exercises conducted during class. In choosing an appropriate textbook to be used in class, textbook evaluation is very important. There are two methods of evaluating a textbook, reference book or curriculum material. The two methods are:

i. Quantitative (Shaharom Noordin, 1994)

ii. Qualitative (American Association for the Advancement of Science, Project 2061, since 1985)

This report will discuss about the findings of a textbook evaluation that follows the quantitative method proposed by Shaharom Noordin (1994). As suggested by Shaharom Noordin (1994), a good textbook is more student-centered, can promote self-directed learning, allow students to learn by themselves at their own pace, have activities for students to enhance their mastery of a topic and outline the objectives of a topic before the learning process takes place.

Therefore, the evaluation will focus on several aspects of the textbooks as listed below:

• Texts
• Diagrams
• Exercises at the end of the chapters
• Summaries of the chapters
• Activities
• Learning objectives

All these six aspects will be evaluated by using an index (I). A higher index of evaluation shows that the textbook has high students' involvement which means that it is more students-centered. Therefore, it is better in helping the students to learn.

2. Data Analysis

The data analysis for all the six categories is done according to the steps outlined by Shaharom Noordin (1994).

2.1 Index for Students’ Involvement from Texts

According to Shaharom Noordin (1994), a text in a textbook can be divided into eight categories which are:

a= Facts- simple statements given by the author
b= Conclusion/ Generalization – author’s opinions
c= Definitions of a concept or principle
d= Questions with immediate answers from the texts
e= Questions that ask the students to analyze some data
f= Statements that require the students to make their own conclusion
g= Statements that require the students to solve a problem or conduct an activity
h=Questions that attract students’ interest and there are no immediate answers to the questions

To determine the index for students’ involvement from texts, at least 10 pages or around 10% - 15% pages of the book are selected. The first 25 sentences for each page are read and classified according to the categories listed above. The sentences on the next page can be used if there are less than 25 sentences on the current page. The 25 sentences read should not include the headings, diagram captions, titles and introduction of the chapter. After that, the following formula is used to calculate the index value:

\[ I_t = \frac{e + f + g + h}{a + b + c + d} \]

In this formula, the categories a, b, c and d are related to passive learning whereas categories e, f, g and h are considered as active learning.
2.2 Index for Students’ Involvement from Diagrams

The index for students’ involvement from diagrams can be determined by selecting at least 10 diagrams or more in the textbook. The diagrams are then analyzed and categorized into one of the followings:

a= For illustrative purposes  
b= For activities or data analysis

After that, the following formula is used to compute the index value for diagram evaluation.

\[ I_d = \frac{b}{a} \]

2.3 Index for Students’ Involvement from Exercises

As for the exercises at the end of a chapter, the evaluation can be done by selecting 10 chapters of the textbook randomly. However, all chapters should be used if there are less than 10 chapters in the book. After that, 10 questions are randomly selected from each of the chapters and categorized into:

a= Questions which answer can be obtained straight from the text  
b= Questions asking for definitions  
c= Questions about applications  
d= Questions about problem solving

The following formula is then used to calculate the index for students’ involvement from the exercises.

\[ I_e = \frac{[c + d]}{[a + b]} \]

2.4 Index for Students’ Involvement from Summaries

For summaries index evaluation, the summaries of at least three chapters are selected. From the summaries, any two of the paragraphs are read and categorized into the followings:

a= Summary that only summarizes the same ideas from the texts  
b= Summary that contain questions where the answers are not found in the texts.

The formula used to calculate the index for students’ involvement from summaries is:

\[ I_s = \frac{b}{a} \]

2.5 Index for Students’ Involvement from Activities

The methods of evaluating the index for students’ involvement from activities are almost the same as the methods for evaluating the index for texts. At least 10 or around 10%- 15% pages of a book are selected. These pages will be denoted as B. After that, the number of pages that have suggested
activities for students are counted and denoted as A. The following formula is used to calculate the value of index:

\[ I_a = \frac{A}{B} \]

From this formula:

A= Number of pages that have activities  
B= Total number of pages

2.6 Index for Students’ Involvement from Learning Objectives

Defining the learning objectives before the learning process takes place is one of the characteristics that a book should have (Shaharom Noordin, 1994). To determine the index of learning objectives of a book, the total number of chapters with objectives should be counted and divided by the total number of chapters of the book. The mathematical formula for the evaluation is as follows:

\[ I_o = \frac{A}{B} \]

From this formula:

A= Total number of chapters with objectives  
B= Total number of chapters

2.7 Total Evaluation Index

A total evaluation index for students’ involvement from the textbook is calculated after obtaining all the values of the six categories involved. The Table 1 below shows the summary of the data analysis results for texts, diagrams, exercises, summaries, activities and learning objectives.

<table>
<thead>
<tr>
<th>Evaluation Aspects</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texts, ( I_t )</td>
<td>0.53</td>
</tr>
<tr>
<td>Diagrams, ( I_d )</td>
<td>0.94</td>
</tr>
<tr>
<td>Exercises, ( I_e )</td>
<td>1.43</td>
</tr>
<tr>
<td>Summary, ( I_s )</td>
<td>0.00</td>
</tr>
<tr>
<td>Activities, ( I_a )</td>
<td>0.78</td>
</tr>
<tr>
<td>Learning Objectives, ( I_o )</td>
<td>1.00</td>
</tr>
</tbody>
</table>

The total evaluation index for the students’ involvement from the textbook can be obtained by summing up all the values and then divided by six.

\[ I = \frac{[I_t + I_d + I_e + I_s + I_a + I_o]}{6} \]
\[ = \frac{[0.53 + 0.94 + 1.43 + 0.00 + 0.78 + 1.00]}{6} \]
\[ I = 0.78 \]
Finally, an index interpretation table is used to interpret the results obtained (Shaharom Noordin, 1994). The index value will indicate how good the textbook is in promoting the students’ learning. The index interpretation table is as shown in Table 2 below.

Table 2: Index interpretation

<table>
<thead>
<tr>
<th>Index</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No involvement of students.</td>
</tr>
<tr>
<td>&lt; 0.4</td>
<td>Authoritarian, not challenging, more to memorizing and definitions.</td>
</tr>
<tr>
<td>1.0</td>
<td>Ideal and balance.</td>
</tr>
<tr>
<td>&gt; 1.5</td>
<td>Not much contents, only questions or activities. Not enough information for students to work with.</td>
</tr>
<tr>
<td>Infinity</td>
<td>No contents only require students to do analysis.</td>
</tr>
</tbody>
</table>

3. Discussion

The data analysis performed for all the six criteria in the textbook evaluation gives different values for those aspects. Firstly, the index value for text evaluation shows a value of 0.53. Based on the index interpretation table by Shaharom Noordin (1994), the ideal and balance index value for students’ involvement is 1.00. Therefore, the result obtained shows that the students’ involvements from texts are not fully acquired. There are lots of facts and explanations which considered as passive learning. However, the textbook partly meets the criteria of promoting students-centered learning by having texts that suggesting activities, problem-solving and questions that can attract students’ interest to learn.

As for diagrams, the index for students’ involvement is 0.94. This shows that this textbook is good and balance in terms of providing diagrams for illustration and data analysis purposes. This is very important as diagrams are one of the methods to convey information to students in a simple and easier way (Norliana and Shaharom, 2004). A balance between these two types of diagrams will help students in gaining information as well as promoting scientific skills. With good diagrams, students are able to understand the new information better.

Another important aspect in textbook evaluation is the exercises at the end of the chapters. The analysis performed shows that the index for students’ involvement from the exercises is 1.43 which exceeds the ideal and balance index value, 1.00. This value indicates that this textbook consists of more questions on applications and problem solving compared to questions with immediate answers from texts and questions that ask for definitions. In general, the exercises at the end of the chapters are able to get the students’ effectively involved by providing them with all four categories of questions.

The index for students’ involvement from summaries records a very poor value which is 0.00. According to the index interpretation table by Shaharom Noordin (1994), the index value of 0.00 shows no involvement of students at all. This indicates that the summaries provided at the end of the chapters are only focusing on the repetition of the same idea from the texts. There are no questions provided to develop the students’ thinking skills.

The next important aspect is the students’ involvement from activities. The index value recorded is 0.78 which means that the activities presented in the textbook manage to involve students actively during the learning process. There are many sections of the textbook that suggest interesting activities for students. For example, “Work This Out” section provides many activities for students such as group
discussions, presentations, collecting data and role-plays. There are also “Weblink” and “Computer Simulation” sections which provide students with interesting websites for them to explore more about the topics. All these activities can help in strengthening the students’ understandings about the concepts learned (Nor Rahimah, 2002).

The final aspect to be considered is the index for students’ involvement from the learning objectives. The value obtained is 1.00 which is considered as ideal and balance. This shows that the textbook has the learning objectives stated for all the nine chapters. The learning objectives are very important to improve the students’ understandings about a topic. It can also prepare them to achieve the objectives (Normalah, 2001).

Based on the result obtained for all the six aspects, the total evaluation index for students’ involvement is calculated. The value obtained is 0.78. By referring to the index interpretation table by Shaharom Noordin (1994), the index value of 0.78 shows that the Chemistry (KBSM) Form 4 textbook is closer to meet the criteria of ideal and balance textbook which is 1.00. However, there might be some unbalanced emphasis in the contents of the textbook which reduced the value to be less than 1.00. By looking into the index value for each of the criteria, we can determine in which aspect that the textbook needs to be improved. Therefore, some changes must be done in order to achieve the ideal and balance level and also to get the students involved actively in all the six criteria evaluated.

4. Recommendations

Based on the analysis performed for all the six criteria, the results obtained shows that there are some aspects that need to be improved. The improvements are very important to ensure that the textbooks will have good quality to help teachers and students in teaching and learning. As mentioned by Nogova and Huttova (2005), textbooks of high qualities not only serve as the main source of knowledge, they can also help in developing the student’s personality, the individual skills, stimulating interest in learning and in supporting interactivity. Therefore, several recommendations on how to improve the quality of Chemistry (KBSM) Form 4 textbook will be elaborated further in the next section of this report.

4.1 Improvements for Texts

Based on the result of the analysis performed, the index value for students’ involvement from text is only 0.53. It means that it is closer to 0.4, a value considered by Shaharom Noordin (1994), as authoritarian, not challenging, more to memorizing and definitions. Therefore, the result of 0.53 indicates that this textbook lacks in promoting the student-centered learning but more emphasis on providing facts, definitions, statements and conclusions. It also lacks in providing challenging activities mainly because the problems presented in the textbook is easy and students can find immediate answers from the texts. Even though it is important to have this kind of criteria in a textbook, but there must be a balance between texts that require students’ involvement with the texts that do not require the students’ involvements. This is supported by Romey (1968) who claimed that a good text should be balanced between these two aspects. In other words, the texts must have a balance in terms of facts, definitions, conclusions, statements and explanations so that it can promote thinking skills among students during the reading activities. Romey (1968) also stated that a good text should have questions to attract the students’ interest and enable them to explore new knowledge.

4.2 Improvements for Diagrams

The index for students’ involvement from diagrams is 0.93 which can be considered as good since it is closer to the ideal and balance index, 1.00. However, improvements are still needed in terms of
providing more diagrams for activities and data analysis purposes. The diagrams with only illustrative purpose will hinder students from developing the discovery learning and thinking skills (Ch’ng, 2000).

4.3 Improvements for Exercises at the End of the Chapters

The index for students’ involvement indicates a high value which is 1.43. This value is near to 1.5, a value defined by Shaharom Noordin (1994) as lacks in contents, consists of only questions or activities and does not provide enough information for students to work with. Therefore, improvements should be made to ensure that the exercises consist of a balance distribution among the four categories of questions mentioned before. These four types of questions are very important to get the students actively involved in thinking skills as well as developing new ideas (Lilia et al., 2002). A balance in all four categories of questions is also one of the characteristic of good exercises (Romey, 1968). It is recommended that all the questions constructed should cover all the six levels of Bloom Taxonomy which are knowledge, comprehension, application, analysis, synthesis and evaluation. This is to ensure that all students’ cognitive skills are assessed and the questions are balance in terms of the difficulty levels (Kaur, 2008).

4.4 Improvements for Summaries

The result obtained for the summaries aspect of the Chemistry textbook shows no involvement of students. Therefore, major improvements should be made. To develop the students’ involvement from the summary, some questions should be included for every chapter. According to Romey (1968), a good summary should have summarized the important points from the chapters and should also provide questions where the answers cannot be found in the texts. This is to encourage the students to explore new sources for information and knowledge. Therefore, a summary is not just a repetition of conclusions (Nor Zalina, 2001). One of the interesting and useful ways of summarizing the contents for each chapter is by using mind maps (Nor Hayati, 1993). By using the mind maps, more questions can be constructed.

4.5 Improvements for Activities

The students’ involvement from activities gives the index value 0.78. For improvements, more activities should be included. As discussed by Norliana and Shaharom (2004), the activities provided in the textbook are important as they can stimulate the students’ thinking and scientific skills and encourage them to think by investigating. The activities should also be presented in interesting ways and related to the students’ experiences. According to Dreckmeyr et al., (1994), these types of activities can foster better engagements of students. Besides that, challenging activities are also useful as they can contribute to the learning of the contents, scientific skills and processes (Lemmer et al., 2008).

4.6 Improvements for Learning Objectives

As for learning objectives, the result obtained indicates an ideal and balance value which is 1.00. This means that all chapters have stated the learning objectives at the beginning of every chapter. Therefore, it is recommended that these criteria are maintained. However, improvements can still be done in terms of providing clear and detailed learning objectives to enable the students to have better understanding about the topics and also to prepare them in achieving all the objectives (Normalah, 2001).
5. Conclusions

A textbook plays a very important role in teaching and learning. It is part of the education system and becomes the medium for the proper implementation of the school curriculums (Mahmood, 2010). It gives many advantages for teachers and students. Parrish (2004) summarized the benefits of using a textbook as a tool that helps the teachers to obtain a well-structured, consistent and logical progress in class, minimize the teachers’ preparation time and provide guidance for novice teachers. As for learners, textbooks are important to serve as the basis for the content of the lessons as well as to supplement the teacher’s instruction (Riazi, 2003). Due to the central roles of the textbooks in the teaching and learning, it is important for teachers to perform the textbooks evaluation to ensure that the textbooks are very good in qualities. A quantitative method by Shaharom Noordin (1994) has been used to evaluate the Chemistry (KBSM) Form 4 textbook. Six aspects are analyzed and the result shows that there are two aspects that require major improvements which are texts and summaries. Some recommendations have been given for the improvements. As discussed by Kulm at al., (1999) good textbooks are books that can foster better understanding in students, engage them with the lesson, develop ideas, promote student thinking, assess student progress and also enhance the learning environment and the only way to achieve all these criteria is through the textbook evaluation.

References


