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Development of Teaching Materials on Climate Change *R.B. Bunnett* Model For High Schools In Fiji

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Abstract
This study aims at the development of teaching materials for fifth form Geography students of high schools in Fiji. Teaching materials were developed due to the lack of appropriate teaching materials especially on Climate change. The materials available were not suitable enough to be used for teaching.
The design of this study is Research and Development (R & D) with the adaptation of the development proposed by Borg and Gall which covers needs analysis, material development, expert and teacher validation, revision, try out, final revision and the final product. The subjects of the study were ten students of the fifth form of Nukuloa College in Ba, Fiji. This study applied the following tec-hniques of data collection; questionnaire, interviews, written documents, and rating scales. In carrying out the needs assessment, the teacher was interviewed and questionnaires were distributed to the students, while expert judgement was done by giving out questionnaire to the expert. Questionnaires were also given out to the students after the materials were tried out.
The result of the needs analysis showed that the students needed teaching materials which were more specific and had colourful pictures and photos to make them understand the concepts easily. The data gathered from the expert also sugg-ested that revision was to be done for the materials developed. The developed material was given a score rating of 90% by the content validator. This meant that the material developed was good enough to be tried out in high schools in Fiji.
Keywords: development, teaching materials, climate change, learning process, geography text book model

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I. INTRODUCTION

In the teaching learning process, teachers mostly use instructional materials that are obtained from text books sold in the market. These books often do not pay attention to the scope and content of the material required in the learning process, thus affecting the students' understanding of the concept being studied. Degeng (1985) states that the text books published by educational institutions do not consider the essence of the structure of the content and its relevance to learning. This is quite unfortunate, considering the fact that teaching materials have an important role in the learning process. In addition to reducing the essence of learning, it can also result in a lower quality of learning and learning outcomes. At this moment, there is a great teacher dependence on textbooks since it eases their role in teaching.

Teachers dependence on textbooks will have a negative impact on the quality of learning since they hardly pay attention to standards and basic competencies to be achieved in learning but rather rely on textbooks alone. There are other negative impacts that arise when textbooks have errors in content. Teaching materials and geography textbooks also consist of many weaknesses and faults that affect the Geography students in understanding the subject matter. Purwanto (2001) stated that errors in Geography teaching materials among other misconceptions, encourages students to memorize facts and concepts and to generalize, and use language in the teaching materials that is ineffective.

The issue of teaching materials is also common in Fiji. For that reason, the researcher conducted a study of the existing teaching materials in Fiji and the study findings revealed some errors and weaknesses among others being, punctuation, data, facts, sentences, images, and content which is imprecise.Based on the study of the teaching materials on climate change developed by the Ministry of Education in Fiji, it can be concluded that the material on climate change still contains some weaknesses. For instance, the material contains outdated facts and data, uncler presentation of pictures which is not easily absorbed by students. The presentation of materials should be well done with more recent data and many colourful pictures. This would attract students attention towards the material on climate change. The study of climate change is a vital one because all countries in the Pacific Ocean are faced with the early symptoms of this phenomena.

One of the alternatives to overcome the problem of inappropriate teaching material is to develop teaching materials that are more appropriate and relevant. Therefore, the development of the textbook would follow the steps of the research model proposed by Borg and Gall. The development of teaching materials in Fiji follows the model consisting of the four pillars of Education.

II. LITERATURE REVIEW

The Fiji government's decision to incorporate climate change issues in the curriculum of elementary schools, high schools and colleges is intended to create greater awareness and participation inorder to be able to mitigate and adapt to this global phenomenon. As such the government has approved a thorough review of the Fiji school curriculum and suggested for the inclusion of the issue of climate change (The Fiji Times, 2013).

The government has also signed a memorandum of understanding with the German Society for International Cooperation (GIZ) which will fund the incorporation of a climate change syllabus into the curriculum. According to Mrs Mataikabara (spokesperson for the ministry of education), the education ministry has endorsed the work plan to support the implementation of the Education and Training as Fiji along with the Pacific is at the forefront of climate change and global warming. This program will include a review and update of the current curriculum of primary, secondary and tertiary education as well as vocational courses to ensure the inclusion of local, accurate and up to date climate change information, and to encourage and involve student research on the issue of climate change".

III. RESEARCH AND DEVELOPMENT

The research and development design proposed by Borg and Gall (1983: 775) was used in this study. It consists of ten major steps, usually known as the R&D cycle, which are 1) research and information collecting; 2) planning, (3) development of the preliminary form of the product; 4) preliminary field testing, (5) main product revision, (6) main field testing, (7) operational product revision, (8) operational field testing, (9) final product revision, and dissemination and implementation. However, this development design was further modified and the following five steps were adopted: 1) research and information collecting; 2) development of the preliminary form of the product; 3) validation; 4) field testing; and 5) the main product revision. This modification was based on the problems found, the research objectives and consideration of the time limit to carry out the research. The five steps that are omitted include the following: main field testing, operational product revision, operational field testing and deployment and implementation. This research design begins with the product expert validation. Moreover, the subjects for product field testing are fifth form high school geography students of Nukuloa College, Ba. Fiji. Data collection instruments consisted of a questionnaire and observation sheet to measure the students' understanding of the developed material. The data analysis technique used in this study is descriptive analysis.

IV. 4.RESULTS OF THE DEVELOPMENT RESEARCH DATA ANALISIS

1. Data Analysis- Field Testing

Field testing was conducted inorder to determine the effectiveness of the instructional materials developed. Data was collected from observations and questionnaires. Product trials were conducted over a three week period starting from mid November until early December 2013. The trials were performed by the fifth form geography teacher whereby ten students from form five were selected as subjects for testing. The highest achievable score for each item was 5 and the lowest being 1. Results obtained during the try out can be seen in the following table:

Table 1. Test scores for the appropriateness of the material with the objectives

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	3	30
5.	(5) strongly agree	7	70
	Total	10	100

The students' answers for the apropriateness of the materials to the learning objectives can be described as follows: (a) three students agreed that the materials developed were in accordance with the learning objectives, (b) seven students strongly agreed that the material was in accordance with the purpose of learning. So this signifies that the materials developed were generally in accordance with the objectives as stated by 94% of the students.

Table 2. Test scores for the attractiveness of the material

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	4	40
5.	(5) strongly agree	6	60
	Total	10	100

Students' answers regarding the attractiveness of the layout of the material are as follows: (a) four students agreed that the layout of the materials are attractive/interesting, (b) six students strongly agreed that the layout of the material is very interesting. This means that the layout of the material developed is attractive/interesting as expressed by 92% of the students.

Table 3 Test Scores for the relevancy of the materials to the needs and interests of the students

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	5	50
5.	(5) strongly agree	5	50
	Total	10	100

The students' responses regarding the relevance of the materials to their needs and interests are as follows: (a) five students agreed that the materials developed are relevant to their needs and interests, (b) five students strongly agreed that the materials developed are relevant to their needs and interests. This means that the materials are relevant to the needs of students as expressed by 90% of the students.

Table 4 Test scores for the role of the materials in developing writing skills

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	5	50
5.	(5) strongly agree	5	50
	Total	10	100

The students' answers on the effectiveness of the material in helping develop writing skills are as follows: (a) five students agreed that the material helps them to develop writing skills, (b) five students strongly agreed that the material helps them to develop writing skills. This means that the material developed is very helpful to the students in developing their writing skills as stated by 90% of the students.

Table 5 Test Scores for the provision of concepts in the material related to the topic

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	3	30
5.	(5) strongly agree	7	70
	Total	10	100

Students' answers on the provision of concepts in the material related to the topic are as follows: (a) three students agreed that the materials provide sufficient concepts related to the topic, (b) seven students strongly agreed that the material provides sufficient concepts related to the topic. This means that the materials developed indeed provides sufficient concepts related to the topic as stated by 94% of the students.

Table 6 Test scores stating the clarity of the instructions

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	3	30
5.	(5) strongly agree	7	70
	Total	10	100

Students' answers regarding the clarity of the instructions are as follows: three students agreed that the instructions are clear, (b) seven students strongly agreed that the instructions are clear. This means that the instructions used in the materials developed are clear as stated by 96% of the students.

Table 7 Test scores for the provision of student activities, explanations, and examples

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	4	40
5.	(5) strongly agree	6	60
	Total	10	100

The students responses in regards to the provision of student activities, explanations, and examples are as follows: (a) three students agreed that the materials provide enough student activities, explanations, and examples, (b) seven students strongly agreed that the materials provide enough student activities, explanations, and examples. This means that the materials developed provide enough student activities, explanations, and examples as stated by 92% of the students.

Table 8 Test scores for the provision of interesting and meaningful activities in the material

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	2	20
5.	(5) strongly agree	8	80
	Total	10	100

Students' responses concerning the provision of interesting and meaningful activities are as follows: (a) two students agreed that the material provides interesting and meaningful activities, (b) eight students strongly agreed that the material provides interesting and meaningful activities. This means that the materials developed provides interesting and meaningful activities as stated by 96% of the students.

Table 9 Test scores for the clarity and attractiveness of the material composition

No.	Score	Total	Percentage (%)
1.	(1) strongly disagree	–	–
2.	(2) disagree	–	–
3.	(3) uncertain	–	–
4.	(4) agree	6	60
5.	(5) strongly agree	4	40
	Total	10	100

Students' responses concerning the clarity and attractiveness of the material composition are as follows: (a) six students agreed that the material composition is clear and attractive, (b) four students strongly agreed that the material composition is clear and attractive. This means that the composition of the materials developed are clear and attractive as stated by 88% of the students.

Based on the data collected above, the value can be calculated using the following formula:

Percentage = $\frac{total\ score\ of\ items}{total\ number\ of\ items}$

= $\frac{832}{9} \times 100$

= 92%

After the score was converted to gauge the validity of the material, it was concluded that the material developed can be suitably classified as "*very apropriate*". Therefore, very little revision was required. However, some comments and suggestions were recommended by the students during field testing. Firsly, the students commented that the material developed was complete, attractive and full of colourful images. Moreover, the content of the teaching material was good since it consisted of objectives, concepts, exercises, and summaries. Thirdly, the teaching materials offered a variety of writing activities that allows students to improve their essay writing skills. Finally, the content of the material is also easy to understand and helps students to develop skills and knowledge.

2. Data Analysis- feedback from the Subject Teacher

The number of question items for geography teachers to respond to in regards to the material on the causes of climate change, impacts and solutions are 10. The number of respondents (subject teachers) are 3 with the highest possible score (criterion) being 150 (10 × 3 × 5) whereas the lowest possible score (criterion) being 30 (10 × 1 × 3). The following table analyzes the responses of the geography subject teachers concerning the material that was developed.

Table 10 Test Scores of Subject Teacher Responses by Category (questionnaire)

Category of responses	Question items based on teachers responses										Total
	1	2	3	4	5	6	7	8	9	10	
SA*	1	2	2	3	2	3	2	2	3	2	22
A **	2	1	1	0	0	0	1	0	0	1	6
U ***	0	0	0	0	1	0	0	1	0	0	2
D ****	0	0	0	0	0	0	0	0	0	0	0
SD *****	0	0	0	0	0	0	0	0	0	0	0
					Total						30

Explanation:
*Strongly agree
**Agree
***Uncertain
****Disagree
*****Strongly disagree

The following table shows the analysis of the field trials of each item based on each answer.

Table 11 Scores of individual question items based on the results of the questionnaire analysis from the Subject Teacher

Category of answers	Total Score of responses multiplied by the score	Total
Strongly agree	22x5	110
Agree	6x4	24
Uncertain	2x3	6
Disagree	0x0	0
Strongly disagree	0x0	0
	Total	140

Total scores obtained from the results of the questionnaire analysis for teachers responses is as high as 140, therefore the level of agreement on the use of the material by the geography teacher is (140:150 × 100%) = 93% from the highest possible value of 100%. Based on the data obtained from the subject teachers which is 140, or 93%, the materials developed can be categorized as being *very effective.*

V. CONCLUSION

The development and improvement of this material has been done as follows: Firstly, the content of the material on climate change for form five geography students in Fiji has been designed by using the Borg and Gall model. The contents of the material can be described as follows: This teaching material consists of four chapters namely (1) Chapter 1 Introduction, (2) Chapter 2 Causes of Climate change, (3) Chapter 3 Impacts of climate change and finally, (4) Chapter 4 Climate change mitigation. Secondly, the teaching material on climate change emphasizes on independent learning, which provides a learning experience that is self-direct, whereby the students interact with the learning materials and receive immediate feedback about the learning that has been done on their own. In this case the students guide themselves to study during classes.

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