Research Report

Modules and Active Learning: Module of General Biology I (Bio111) of the Abbiyi Addi College of Teacher Education

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Abstract: Since the beginning of the new teacher education system, Teacher Education Institutions (TEIs) have been prepared modules for courses offered in different streams. Abbiyi Addi College of Teacher Education a TEI has prepared different modules since the beginning of the new program. One of the modules prepared is a teaching material for the course General Biology I (Bio111). The objective of this study was to assess the appropriateness of the prepared module for the new system of education in general and for active learning in particular. Its appropriateness was assessed from the way the contents are presented and the thinking level the contents promote. To do this, content analysis study was conducted. In the analysis students' involvement index in terms of text, figure, diagram, questions and activities was considered. In addition, the objectives were classified based on major categories of taxonomy of educational objectives. The findings of the study indicated that the module was weak in involving learners through the texts, figures and diagrams; in enabling learners to critically think and solve problems. Hence, the need for immediate revision of the module by the concerned department council was recommended.

Introduction

Following the 2003 government's call for complete Teacher Education System Overhaul (TESO), colleges have been preparing teaching materials for the courses to be offered. This is an encouraging beginning, but assessing the standard of the modules   is very crucial for the over all goal the colleges aspire to achieve. In this regard, the purpose of this study was to see the appropriateness of the target module to the new teacher education program in general and to active learning in particular.

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Review of related literature

Helping students learn might be the desire of every teacher. But the question is how a teacher helps her/ his students learn? To help students learn, a teacher needs to be an effective teacher. To be an effective teacher, s/he should know what an effective teaching is. According to Newman (1999), "Teaching is effective only when students are learning; learning is effective only when it is meaningful to students and finally learning is meaningful to students when they can connect it to their lives and actively participate in it," p.6.

Effective teaching is the responsibility of a teacher. To do so, a teacher has to be creative and innovative enough in many aspects, like in material preparation and in teaching methodology. If a teacher is creative and innovative, students become active learners and critical thinkers. If the students become active learners and critical thinkers, they are in a position to make their learning meaningful. They can also connect it with their real lives.

Cognizant of these facts, the country's education system seems in a paradigm shift- *a shift from teaching to learning.* The summary of the difference between the old (a teaching approach that promotes teacher-centered teaching) and the new (a teaching approach that promotes student-centered teaching) is given in Table 1 below.

Table 1: *Summary of the old and the new approach to education*

Old	New
Passive learners	Active learners
Exam. driven	Learners are assessed on an on-going basis
Rote-learning	Critical thinking, reasoning, reflection and action
Syllabus is content-based and broken down into subjects	An integration of knowledge, learning relevant and connected to real-life situations
Textbook/worksheet bound and teacher-centered	Learner-centered; teacher is facilitator; teacher constantly uses group work and teamwork to consolidate the new approach
Syllabus is rigid and non-negotiable	Learning programs seen as guides that allow teachers to be innovative and creative in designing programs
Teachers are responsible for learning; motivation dependent on the personality of teacher	Learners take responsibility for their learning; pupils motivated by constant feedback and affirmation of their worth
Emphasis on what the teacher hopes to achieve	Emphasis on outcomes – what the learner becomes and understands
Content placed into rigid time-frames	Flexible time frames to allow learners to work at their own pace
Curriculum development process not open to public comment	Comment and input from the wider community is encouraged.

Source: Newman 1999

The objective of the paradigm shift introduced in the new teacher education program is to have "teacher education system that develops higher order thinking skills in graduates" (TESO Document 2003:2). According to the document, this can be developed by making learners explore things. The actual words of the document run as follows:

> It is well understood now that children learn by exploring and interacting with the world. Their brains try to make sense of all the different things they discover and it is this process, which creates learning. The more they explore, the more they learn. So, if we want them to learn about something specific, we must give them something to explore. (TESO, 2003; p., 14*)*

In other words,   as many scholars like Harmin (1994) believe, in order to make students learn, they have to be encouraged to be active and critical thinkers through active learning. Active learning is:

> Learning in which students are required to use higher thinking skills, discover meaning for them. They are involved in activities, which are meaningful, with the teacher acting as a guide and facilitator. The students are not just learning unrelated, unanalyzed facts but are making meaning, making connection with the knowledge that they have…-(Newman, 1999 p, 3)

At this juncture, the role of modules in promoting active learning becomes indispensable.   In this regard, Guthrie (2001:2) states: "Schools depend on books. Teachers depend on students' reading these books. If students should be critical thinkers and problem solvers, modules should be written in the way they meet the demand of this type of learning. They should be designed in the way they ensure ample opportunities for learners to question apply and consolidate new knowledge.

Modules need to be involving, enabling learners to observe, investigate and draw inferences from data. Modules can encompass this type of learning-offering problems to be solved and cases to be studied.   They should encourage reflective discussion and concept formulation. Furthermore, modules should encourage the formulation of questions, analytical thinking, and etc. Modules should help students to develop & test hypothesis and draw inferences. This type of learning is named inquiry learning.

There are four levels of inquiry. These levels are given in Table 2 below.

Table 2: Levels of Inquiry

Level of inquiry	What is given to the learner		
	Problem	Procedure	Solution
0	Yes	Yes	Yes
1	Yes	Yes	No
2	Yes	No	No
3	No	No	No

Source: Herron. (1971) and Sleshi (2005)

The meanings of the levels are also summarized in Table 3.

Table 3: Meanings of Levels of Inquiry

Level of inquiry	Meaning	Remark
0	Confirmation	Results are known in advance
1	Structured inquiry	Learners investigate a teacher presented question through a prescribed procedure
2	Guided inquiry	Learners investigate a teacher presented question using student designed procedure
3	Open inquiry	Learners investigate student formulated question through student designed procedure

Source: Instructional strategy (online)

A module can meet the demand of inquiry learning by incorporating tasks and activities which promote guided and open inquiries to enhance higher level thinking.

To sum up, if modules have to encourage learners not only to learn facts, but also to think critically, they should not be full of notes that discuss certain facts. Similarly, figures should not be put only for illustrative purposes. They should also be used for doing activities and exploring something. Furthermore, questions should not be only simple recall ones. They have to enable learners to critically think and reach conclusion by themselves. In other words, a teaching material's, inputs need to be involving and challenging. If the materials, are engaging students become active learners and critical thinkers. To make this happen, there should be a balance in setting different taxonomy of educational objectives and taxonomy of thinking in setting questions and activities.

Methodology

A Few General things about the Module

Module: General Biology I (Bio.111)
Author: Prasad, P.N
Year: 2003
Number of Chapters: Five
Contents covered:
- The Science of Biology;
- Cell Biology;
- The Chemistry of life;
- Diversity of life and classification and
- Plant Biology;

The module also has a variety of figures and diagrams with a fair level of clarity. It also has different types of exercises and activities in each chapter.

The assessment was made to see whether or not the module was appropriate for active learning. In order to check this, students' involvement index in terms of text, figure, diagrams as well as the inquiry level of activities were computed. Moreover, questions and activities were analyzed in terms of Bloom's taxonomy of thinking levels.

Involvement index in texts

To calculate students' involvement index (a task's level in engaging learners) from the texts of a module, three pages (one from the beginning, one from the middle and one from the end) of each unit were selected and their contents were analyzed based on the method of Romey's Involvement Index as shown in Fletcher and Richard (1974).

a= Statements of fact
b= Stated conclusions
.
c= Definitions
d= Questions asked but answered immediately by the text.

e= Questions requiring data analysis
f= Statements requiring formulating conclusions
g= Directions telling to perform and analyze some activity
h= Questions that are asked to arouse student interest and not answered
   immediately
i= Sentences directing the reader to look at a figure; procedural instructions in
   activities; sentences not fitting any of the above categories

$$I_t \quad = \frac{Involvement}{Noninvolvement}$$

Index of student involvement of the text $= \dfrac{e+f+g+h}{a+b+c+d}$

Involvement index in figure & diagrams

The next point considered in the analysis is the appropriateness of figures and diagrams for active learning. This was assessed by grouping all figures and diagrams into two figures and diagrams that are used only for illustrative purpose; (a) and (b) figures and diagrams that require learners to perform certain activity.

Inquiry level index

The other method considered in the analysis is the inquiry level index of Herron (a method that shows thinking level that a task or activity demands of learners). This instrument of analysis, as mentioned in the literature, has four levels based on the tasks learners are expected to perform. All the activities in the module were classified into the four categories discussed in the reviewed literature.

Rating objectives and Questions

The objectives and questions were also rated as objectives and questions that promote higher and lower order thinking based on the categories of Bloom's Taxonomy of thinking. The findings of the study are presented in the next part of this paper.

Findings and Discussion

Findings of Involvement Index in texts

The results from the analysis of students' involvement index are given in Table 4.

Table 4: Findings of Involvement Index in Texts

Index	No.	%
a	188	73.72
b	10	3.92
c	7	2.74
d	10	3.92
e	3	1.17
f	4	1.56
g	4	1.56
h	11	4.31
i	18	7.05

Students' involvement in

$$\text{Texts (SIT}_S) = \frac{e + f + g + h}{a + b + c + d}$$

$$\text{SIT}_S = \frac{3 + 4 + 4 + 11}{188 + 10 + 7 + 10}$$

$$\text{SIT}_S = \frac{22}{215}$$
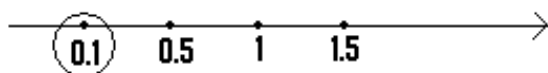
$$\textbf{SIT}_S \ \textbf{= 0.1}$$

Figure 1: Involvement Index of texts

This implies that the contents of the module are more of facts and definitions which are not involving and which do not promote critical thinking. They encourage rote memorization.
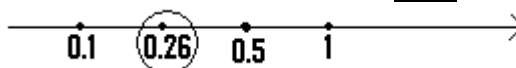
Findings of Involvement index in figures and diagrams

Students' involvement index in figures and diagrams in the modules is summarized in Table 5.

Table 5: Students' of Involvement Index in Figures and Diagrams

Figures and diagrams for illustration only (a)		More Involving figures & diagrams (b)		Figures and diagrams fit none	
No	%	No	%	No	%
19	76	5	20	1	4

Students' involvement in figures and diagrams (SIFDs) $= \dfrac{b}{a}$

$$\text{SIFDS} = \dfrac{5}{19}$$

$$= \mathbf{0.26}$$

Figure 2: Involvement Index of Figures and Diagrams

The figures and diagrams used in the module do not make learners active and involved. They don't invite students to do some activities on their own. Learners don't have the chance to think about the figures and diagrams in depth. Most of the figures and diagrams gave illustrations. A good example is the diagram about 'all living things' presented on page 63 of the module.

Findings of Inquiry level index

Table 6: Findings of Inquiry level Index

Level zero		Level one		Level two		Level three	
No	%	No	%	No	%	No	%
27	65.85	12	29.26	2	4.87	0	0

As could be seen from Table 6, the module's inquiry level index is mostly at level zero and at level one. This means that many of the activities given have problem, method and answer. This approach does not encourage students to think critically and to, analyze and synthesize things.

Findings of Rating objectives and Questions

The way objectives have been stated and questions designed in the module were rated based on the Taxonomy of learning domain (Clark, 1999). Summary of the categories is presented in Table 7.

Table 7: Findings of Rating Objectives

| Item | Lower Order | | | | | | Higher Order | | | | | | Lower-higher order ratio |
| | Knowledge | | Comprehension | | Application | | Analysis | | Synthesis | | Evaluation | | |
	N<u>o</u>	%	N<u>o</u>	%	N<u>o</u>	%	N<u>o</u>	%	N<u>o</u>	%	N<u>o</u>	%	
Objective	26	47.27	13	23.63	1	1.81	14	25.45	0	0	1	1.81	3:1
Questions	40	32.52	49	39.83	10	8.13	9	7.3	1	0.81	13	10.56	4:1

Lower order to higher order ratio for objectives was 3:1; lower order to higher order ratio for questions was 4:1.These indicate that both at objective and at question setting levels, the focus of the module was on lower order thinking.

Conclusion and Recommendation

Conclusion

A number of measurements were considered to assess whether or not the Biology module was appropriate for active learning. The findings showed that the module was not good enough in making students get involved in the teaching learning process. Students' involvement index for the text, figures and diagrams were found to be 0.1 and 0.26 respectively. The inquiry level of the

module was also at level zero and level one. Moreover, lower-order- to higher order ratio for the objectives and questions in the module were found to be 3:1 and 4:1 respectively.

Recommendations

Based on the findings, the following recommendations are given. The module should be revised by the Department council and made to have:

- texts that are appropriate to increase students' involvement;
- figures and diagrams that develop students' thinking and interpreting power;
- objectives and questions that ask higher order thinking;
- activities that make students think critically and that have direct connection with students lives; and
- activities that are challenging but manageable this teachers. To do this, teachers who are expected to revise the modules should be given a short term training on "how to write modules appropriate for active learning". This can be done both at the College and the education bureau levels.

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