Teaching/Learning Materials and the Development of Students’ Thinking Skills: The Case of Pre-service Teacher Training in Ghana

By
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Abstract

The goal of any meaningful education is to develop the cognitive skills of learners (Bruner, 1960) and make them think critically. According to Dewey (1966), schools as learning institutions should seek to develop the learners’ abilities to think. This can be achieved by placing thinking at the core of the educational process (Fisher, 1998). The school curriculum and other educational materials should aim at fostering problem solving and inquiry skills in learners. However, most materials like test items, curriculum, and textbooks used in learning institutions reflect lower level thinking (Bloom, et. al., 1956; Hummel& Huitt, 1994; Black, 1980; Holden, 1992; Risner, Nicholson & Webb, 2000). This qualitative single case study used content analysis to look at the science, mathematics and social studies curriculum, textbooks and external tests used in pre-service teacher institutions in Ghana to see how they reflect the various thinking levels.

KEY WORDS: Teaching-learning materials, thinking, pre-service teacher, Ghana

Introduction

The development of thinking in schools is very crucial as society shifts from an industrial model to a learning society (Costa, 2008). Swartz and Perkins (1994) indicate that in this age of technological challenges and multicultural world, good thinking is key to success and personal advancement. For this to be achieved, schools must prepare learners to “exercise critical judgment and creative thinking ...” (Swartz & Perkins, 1994; p. 1). This requires an educational establishment that develops individuals with knowledge, problem-solving skills, cognitive processes, intellectual disposition and the habit to engage in lifelong learning (Costa, 2008). Such skills do not come to learners accidentally. They need to be nurtured by teachers but research has shown that most teachers are inadequately prepared for such a task (Acheampong, 2001; Ministry of Education, 1994). According to Wideen, Mayer-Smith and Moon (1998), traditional teacher education programs do not engage their pre-service teachers in reflective thinking. Pre-service teacher institutions should therefore put the development of students’
thinking at the core of their proceedings but certain factors like ineffective testing and overloaded curriculum inhibit the development of thinking (Beyer, 1988). It is essential to investigate this phenomenon in a particular context and setting to determine how they hold back the development of thinking skills in pre-service teachers.

Methodology

The study was conducted at Assai Hills Teacher Training College (a pseudonym). It is a 3-year pre-service teachers’ training institution for high school graduates leading to a teachers’ certificate in Diploma in Basic Education (DBE). The selection of the site for the study was based on the fact that it is representative of teacher training institutions in Ghana. It recruits students from all the ten regions of the country, it is coed, it is both science and liberal arts bias and trains teachers for both programs A and B (Program “A” teacher training colleges specialize in training teachers to teach at the lower primary level (Primary 1-3) and upper primary (4-6), while Program “B” institutions train teachers for the upper primary (Primary 4-6) and the Junior Secondary School - JSS 1-3). The data collection strategy used was documents analysis. The documents included curriculum, textbooks, and test items from mathematics, science and social studies. These were analyzed using content analysis. The analysis was based on lower-higher level thinking dichotomy (Bloom et. al., 1956) and described using simple percentages. In this study, lower level thinking encompasses Knowledge and Comprehension while higher level thinking includes application, analysis, synthesis and evaluation. The data were presented using narrative-logic approach. The researcher combed through the literature to find the various verbs used to describe the various cognitive levels. The curriculum had only its objectives analyzed while the questions at the end of each unit/chapter of the textbooks and each test item in the 2004 and 2005 external examinations written by the Institute of Education at University of Cape Coast were analyzed.

Literature Review

The goal of education should be intellectual development (Bruner, 1960) and this begins with the curriculum. However, the traditional curriculum does not encourage learners to view themselves and the world from multiple perspectives. A curriculum that ensures intellectual development creates a climate of inquiry in the classroom. At its core is problem solving and practical work (Nisbet, 1993), planning, evaluating, decision making and teaches learners to use knowledge even after school (Nisbet, 1990). The realization of these begins with the objectives of the curriculum. However, Acheampong (2001) notes that objectives in science and mathematics curriculum in pre-service teacher institutions in Ghana emphasize lower level thinking. Lower level thinking in teaching learning materials is not peculiar to the curriculum; most test items emphasize lower level; knowledge and comprehension (Bloom et. al., 1956; Hummel & Huitt, 1994; Black, 1980; Marzano & Costa, 1988; Ole Takona, 1999). Besides, textbooks are also found to portrays lower level thinking in subject areas like mathematics (Nicely Jr., 1991), reading skills development (Hoeppep, 1980) and in science (Risner, Nicholson & Myhan, 1991). Notwithstanding, Risner, Nicholson and Webb (2000) have found that some social studies textbooks emphasize higher level thinking skills. This phenomenon does not promote students’ thinking. As Stiggins, Rubel, and Quellmaiz (1988) put it, if we want to boost the thinking skills of learners, our instruction and materials must be conducted and planned in the same manner.
Findings And Discussions

Curriculum Objectives

The curriculum discussed in this research is for the first and second years since the third year class is an out program. The curriculum for the three subject areas were divided into two sections; methods and content. The first year curriculum is devoted to content while the second year concentrates on methods with the exception of mathematics which combines content and method in year two. Semester one and two of year two is devoted to methods of primary and junior secondary school teaching respectively. Each of this curriculum had four sections; namely the unit, topic, subtopic and suggested duration. The curricula listed only the topics and subtopics with no suggested activities for achieving the objectives. The objectives analyzed below were the broad objectives. The following are the individual analysis:

Mathematics

The mathematics curriculum had a total of 25 objectives for the first and second years for both content (12) and methods (13). On the whole, 27.88% of the objectives expressed lower level thinking while 72.12% indicated higher level thinking. A breakdown of this showed that 25% and 30.77% of the objectives in content and methods were lower level thinking respectively, while 75% of the content objectives and 69.23% of the methods objectives were higher level thinking. A critical look at the higher level thinking objectives showed that application which was in the majority. About 77.65% of the content and 55.56% of the methods were higher level thinking objectives were application. 66.66% of the total number of higher level thinking objectives was application and out of the 25 objectives, there were analysis (3), synthesis (2) and evaluation (1). The higher number of application objectives is not a good sign of the mathematics curriculum emphasizing higher level thinking since most authors classify it as lower level (Bloom, et. al., 1956) or intermediate level thinking (Stronge, Tucker & Hindman, 2004).

Science

Generally, the thinking skills level reflected in the science curriculum was slightly skewed toward higher level thinking. There were 19 stated objectives for both content and methods of which nine (56.25%) were higher level thinking and seven (43.75%) lower level thinking. Further analysis indicated that 44.44% of the content objectives were lower level and about 55.56% higher level. In the methods section, 71.43% were geared toward lower level thinking while 28.57% were higher level thinking. A second look at the various higher level objectives indicated that in the content section only 20% of the objectives were application and 75% above application in the methods section. The analysis showed that higher level thinking was more in the methods section where learners were supposed to apply the teaching methods and techniques they have acquired in their training than in the content section.

Social Studies

The social studies curriculum for the first two years had a total of 19 objectives, of which 10 were in content and nine in methods. An analysis of the objectives showed that they were skewed towards higher level thinking. 10 of the stated objectives (52.63%) were higher level thinking while nine (43.7%) were lower level thinking. A second look at the data on content-methods basis showed that most of the higher level thinking objectives were in the content area. About 70% of the content objectives were higher level and 30% lower level. Contrary, six (66.67%) of the methods objectives were lower level and four (33.33%) higher level. The most commonly used words were know (4 times), acquire (4 times) and create (3 times). Looking further, it was
realized that the social studies curriculum has more objectives above application than science and mathematics curricula. It had six (60%) of the higher level objectives above application.

Test Items (Test Questions)

Examinations play an essential role in pre-service teacher preparation. It is the main evaluation tool used in certifying graduates. Students’ assessments are made up of 40% internal examinations and 60% external examinations organized by the Institute of Education of the University of Cape Coast. The test items discussed in this research was for the years 2004 and 2005 for the three subject areas. In each of the years the original (first) papers were analyzed. For easy analysis, the two years’ test items for each subject were analyzed together.

Mathematics

The 2004 and 2005 mathematics test items analyzed in this section was for both methodology and content. The content paper was made up two sections A and B. Section A items were of simple problems for students to solve without necessarily showing how they arrived at the answer while Section B involved solving complex problems by showing detailed step-by-step process of arriving at the answer. Students were to answer all questions in Section A and four questions from Section B. The methods paper also had two sections. Section A required simple answers. Students answered four questions from Section B. This involves a lengthy writing of at least two pages. An analysis of the test showed a total of 75 items. The content area had 14 (18.67%) and 61 (81.33%) higher level and lower level thinking items respectively. In the methods section, there were a total of 34 test items of which 3 (8.83%) tested higher level thinking and 31 (91.17%) tested lower level thinking skills. In the content section, find (LLT) was used about 38 times (50.66%) followed by draw (5 times) and simplify (7 times), while the methods section, describe was used 9 times (26.47%), explain (7 times) and show (4 times). Only three test items in the methods category tested higher level thinking skills (How which is level 3). In general, about 86.25% of the test items in mathematics (method and content) for the two years tested lower level thinking skills while 13.75% tested higher level thinking skills.

Social Studies

The findings from the analysis of the social studies content and methods test items for the two years were as follows. Each paper comprised two sections (A and B). Test items in section A involved completing statements, writing a sentence or two and sometimes selecting from multiple answers while test items in section B involved detailed writing. This was the same for the methods paper. An analysis of the test items showed that there were a total of 56 questions in the content and 17 in the methods. Out of the 56 content questions, 50 (82.28%) tested for lower level thinking and six questions (10.72%) tested for higher level thinking (HLT) of which only six questions were synthesis while the remaining were in the lowest category of the spectrum. The most frequently used verbs in the content area were state (11), explain (10), list (7) and what (6) while explain (5), what (4), and write (3) were in the method section. In general, test items in social studies for the two years tested for lower level thinking skills (98.78%).

Science

The science content test was made up of four sections. Candidates were expected to answer all questions in section A and one each from sections B, C, and D. Questions in section A required simple answers while those in the other three sections required students to respond with at least two or more pages of writing. The methods paper consisted of two sections and candidates were expected to answer all questions in section A and 4 questions from section B. Section A test
items required short answers while those in section B required detailed writing. The analysis showed that there were a total of 86 content questions and 43 methods questions. On the whole, the questions were skewed towards testing lower level thinking. In the content area, 83 test items (96.51%) were lower level and 3 (3.48%) tested higher level. The most commonly used question types were what (18 times), state (13 times), give (10), and describe and name (7 times each). The three higher level questions were all application. The methods section had a total of 43 test items of which 4 (9.30%) were higher level and 39 (90.69%) were lower level. The most frequently used type questions were what (14 times), write (10 times), and state (8 times). Overall, approximately 94.51% of the test items were lower level.

Textbooks

Textbooks influence the content and strategies used in teaching/learning and in most cases form the focal point in curriculum and/or course design. It plays a major role in enhancing the thinking skills or cognitive development of learners. The criteria for selecting these books included the following: the book must be recommended by the institution, liked by both teachers and students and had questions or students activities at the end of each unit/chapter. Every single question in the content and method textbook was analyzed. For double-barrel questions, they were treated as two separate questions and analyzed as such. The following were the analysis:

Social Studies

The social studies textbooks analyzed were the Environmental and social studies for teacher training institutions in Ghana published by Salt and Light + Mantdik Press, Ghana in 2006 (content) and Teaching social studies in basic schools published by the Ghana Education Service, Ghana in 2001. The content textbook was written by three renowned social studies experts and teacher educators while the methods book had two authors. There were 13 and 10 units in the content and methods textbooks respectively. The analysis showed that there were 58 questions in the content and 32 in the methods textbooks. This totaled to 90 questions which indicated that there was an average of four questions (3.91%) per unit. Further analysis showed that 96.88% of the method and 82.75% of the content questions were lower level, while 3.12% of the methods and 17.24% of the content questions reflected higher level thinking. The most commonly used higher level thinking questions in the content textbook were analysis while application was the most commonly used in the method textbook. What questions (31%) were the most frequently asked questions in the methods textbook while discuss type questions were the most common (17%) in the content textbook. In summary, the questions in the social studies textbooks for both method and content emphasized lower level thinking; 89.81% lower level and 10.18% higher level.

Mathematics

The mathematics textbooks used in the study were Mathematics for Diploma Colleges (content) published in 2006 by Ash Metro Printing Press, Kumasi, Ghana and Teaching basic mathematics for college education (2006) published by Learner’s Publishers, Kumasi, Ghana. These books were selected because they were written with the syllabus for the new teacher program as a guide. The content textbook had 29 chapters while the methods on had 18 chapters. There were a total of 288 questions in the content and 141 questions in the methods book. An analysis of the cognitive level of the questions in the textbooks indicated that in the content area, there were 194 lower level thinking questions about 67.36% and 94 higher level questions about 32.63%. The type of question with the highest frequency in the lower level thinking is find which is 102 about 52.51%. Other question types with high frequency include
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how many/long (18 times), simplify (14 times), what (12 times), and write (11 times). Further analysis revealed that calculate was the most commonly used – 23.4% (22 times) among the higher level thinking type questions. In the content area, there were a total of 141 questions of which 129 about 91.48% were lower level and 12 about 8.51% were higher level questions. The frequencies of the questions in the lower level thinking were describe (47 times) and explain (22) state (14 times) and give (12 times). Illustrate had the highest frequency in the higher level thinking category. Generally, the questioning levels in these two textbooks were skewed towards lower level thinking; 20.57% higher level thinking and 79.43% lower level thinking. This finding is collaborated by earlier study by Nicely Jr. (1991) in mathematics textbooks.

Science

The two books analyzed here were the Methods of teaching elementary school science by the Center for Continuing Education of University of Cape Coast in 2005 (methods) and Integrated Science 1 (content) written by three authors and published by the Ministry of Education, Youth and Sports in 2004. The method textbook had 225 pages while the content had 499 pages. The method book was meant for distant education teacher students for a diploma certificate but it is liked by students of initial pre-service teacher institutions. There are trial questions at the end of every lesson and sample examination questions at the end of the book. All these questions were included in the analysis. The picture portrayed in the science textbooks was not different from that in the social studies and mathematics textbooks. There were a total of 171 questions in the content textbook and 153 in the methods. In the content textbook, there were 12 (7.02%) and 159 (92.98%) higher level thinking and lower level thinking questions respectively. The higher level thinking questions were from application and analysis categories. The most frequently asked questions required students to explain (39 times), state (20 times), and describe and draw (13 times) and what (10 times). The method textbook portrayed a similar pattern. There were 14 (9.15% higher level thinking questions and 139 (90.85) lower level questions. The most commonly asked questions were in the area of what (45 times), list (18 times), state (17 times), give (15 times) and explain (13 times). In totality, there were 8.08% higher level thinking questions and 91.92% lower level thinking questions in the science textbooks which is consistent with previous studies by Risner, Nicholson, & Myhan (1991) in science textbooks.

Table 1: Summary of thinking levels portrayed in science, mathematics and social studies curriculum, tests and textbooks

<table>
<thead>
<tr>
<th>Thinking levels</th>
<th>Curriculum</th>
<th>Test</th>
<th>Textbook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower level Thinking (LLT)</td>
<td>39.67%</td>
<td>90.85%</td>
<td>87.05%</td>
</tr>
<tr>
<td>Higher Level Thinking (HLT)</td>
<td>60.33%</td>
<td>9.15%</td>
<td>12.95%</td>
</tr>
</tbody>
</table>

Fig. 1: Bar chart summary of thinking levels in curriculum, tests and textbooks in science, mathematics and social studies.
Conclusion

To develop students’ learning, there is the need to develop quality materials that help students construct knowledge of their own. VanTassel-Baska (2008) indicates that the field of material development should take a second look at existing materials to ensure that they are of high quality and positively impact students’ learning. The study has revealed that there was a gap between the curriculum objectives and what is portrayed in other learning materials in terms of developing students thinking. This gap can be bridged by embarking on rigorous staff development (teachers) on materials development that enhance students’ thinking and use of teaching strategies anchored on cognitive development. There is also the need to train independent textbook and test developers with the focus on higher level thinking. Finally, extensive research needs to be conducted in the development of materials and effective teaching methods aimed at stimulating learners’ thinking at all levels of education in the country.
References:


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