Analysing “Science and Technology Course Exam Questions” According to Revised Bloom Taxonomy

Hakan Şevki AYVACI¹, Ali TÜRKDOĞAN²

¹ Assist.Prof.Dr., Karadeniz Technical University, Fatih Faculty of Education, Trabzon -TURKEY
² Research Assist. Karadeniz Technical University, Fatih Faculty of Education, Trabzon -TURKEY

Received: 21.06.2009 Revised: 03.10.2009 Accepted: 20.10.2009

The original language of article is Turkish (v.7, n.1, March 2010, pp.13-25)

Keywords: Revised Bloom Taxonomy; Science and Technology Teaching; Classification of Questions; High Order Level Question.

SYNOPSIS

INTRODUCTION

Newly released primary science curricula in Turkey have focused on theory of constructivism in which students actively engage in their own learning tasks by doing and experiencing. Thus, this procedure requires students to gain higher order cognitive process skills (Demir & Dindar, 2006). In order to improve students’ higher order skills, teachers should both employ suitable teaching and assessment methods and techniques. Because techniques or tools used in assessment process may affect students’ learning and development in both negative and positive ways. Therefore, assessment tools those are appropriate to the aims of the curriculum or used to improve students’ higher order skills should be designed and implemented in practice. While designing and preparing such assessment tolls, various criteria need to be considered. Bloom’s Taxonomy (Bloom, 1956) of cognitive domain is one of them. Bloom’s taxonomy as revised by Anderson and Krathwohl (2001) defines knowledge as factual knowledge, conceptual knowledge, procedural knowledge and Meta-Cognitive knowledge, and there are remembering, understanding, analyzing, evaluating and reorganizing in the cognitive process dimension (Anderson & Krathwohl, 2001; Çepni et. al., 2007).

There is a need at this point to investigate teachers’ abilities to prepare different levels of questions.

PURPOSE OF THE STUDY

The aim of this study is to evaluate science and technology examination questions based on Bloom’s taxonomy defined above and to determine the extent to which these questions comply with the learning theory of constructivism.

Corresponding Author email: aliturkdogan@hotmail.com
METHODOLOGY

The study employed the document analysis research method. 100 examination papers in total prepared by grade 6 science and technology teachers in the fall term of 2008-2009 educational years in the city of Trabzon were examined in accordance with revised Bloom taxonomy.

The data obtained were tabulated according to revised Bloom taxonomy and its subdivisions by using pie charts of knowledge dimension. Finally, graphs demonstrating percentages of levels of Bloom’s cognitive process dimensions (i.e. remembering, understanding, applying, analyzing, evaluating and reorganizing) in the examination papers were formed.

FINDINGS

The findings of the study, obtained analyzing questions by comparing the new version of the Bloom taxonomy are given in the following table.

According to the table 38.4% of 1592 questions asked by the teachers were remembering, 16.3% were in understanding, 13.5% were in applying, 8.5% in analyzing, 23.1% in evaluating and 0.5% were in reorganizing levels.

Additionally, the table shows that 38.8% of the questions asked factual knowledge, 38.7% of them asked conceptual knowledge, 18.9% asked procedural knowledge and 3.5% asked scientific meta-cognitive knowledge.

Table 1. Distribution of the questions according to Bloom’s Taxonomy (n=1592)

<table>
<thead>
<tr>
<th></th>
<th>Remembering</th>
<th>Understanding</th>
<th>Applying</th>
<th>Analyzing</th>
<th>Evaluating</th>
<th>Creating</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factual</td>
<td>267</td>
<td>41</td>
<td>41</td>
<td>49</td>
<td>214</td>
<td>7</td>
<td>619</td>
<td>38.8</td>
</tr>
<tr>
<td>Conceptual</td>
<td>212</td>
<td>118</td>
<td>115</td>
<td>56</td>
<td>114</td>
<td>0</td>
<td>615</td>
<td>38.7</td>
</tr>
<tr>
<td>Procedural</td>
<td>97</td>
<td>83</td>
<td>57</td>
<td>27</td>
<td>38</td>
<td>0</td>
<td>302</td>
<td>18.9</td>
</tr>
<tr>
<td>Meta-Cognitive</td>
<td>34</td>
<td>17</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>56</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>610</strong></td>
<td><strong>259</strong></td>
<td><strong>214</strong></td>
<td><strong>135</strong></td>
<td><strong>367</strong></td>
<td><strong>7</strong></td>
<td><strong>1592</strong></td>
<td></td>
</tr>
<tr>
<td><strong>%</strong></td>
<td><strong>38.4</strong></td>
<td><strong>16.3</strong></td>
<td><strong>13.5</strong></td>
<td><strong>8.5</strong></td>
<td><strong>23.1</strong></td>
<td><strong>0.5</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION and RESULTS

From the analysis results of the data it can be said that there were little reflections of constructivist approach on the exam papers, which were prepared by the teachers who reported that they were using constructivist approach. Majority of the questions asked in the examination papers required recall or memorizing ability. Comparing to the study by Çepni, Ayvacı and Keleş (2001), it can be said that there has been a decline in memorizing based questions. However, the proportion of these questions is still high. Clearly, teachers avoid asking analysis and reorganizing level questions. Especially, the extremely low number of reorganizing level questions brings this question to mind: “How much improvement can be achieved in higher order skills of students with such a low number of higher order questions?”

The distribution of the questions shows that the teachers are not concerned with knowledge and scientific process dimensions of Bloom’s taxonomy. A study by Baykul (1989) revealed that the science and mathematics course examination questions in public
schools were generally at the low levels of Bloom’s taxonomy. The study by Çepni and Azar (1998) also reported similar results. This means that the results of this study support what earlier researchers reported. Thus, clearly, teachers mostly ask lower order examination questions that target memorizing.

Going through the findings from the perspective of knowledge dimension of Bloom’s taxonomy, it was observed that 39% of 1592 questions were in factual and 38% were in conceptual dimensions. In other words, although teachers say they apply the new system, they still focus on lower order cognitive process skills while assessing their students.

Özdemir and Baran attributed this result to teacher training programs at universities (Baran & Özdemir, 1999). Teachers should consider Bloom’s taxonomy while preparing questions because higher order examination questions direct students to think creatively. By this way students comprehend the science and they can interpret and explain situations they face in daily life.

The questions in procedural knowledge level contain different process knowledge. Procedural knowledge makes students have the skill of handling phenomena holistically with their own unique methods and helps them to have higher order skills like establishing empathy. Additionally it teaches not to look from only a single point of view, which is a significant element of scientific awareness. Yet, the number of these questions was too low in the study.

The low number of the questions targeting scientific awareness was another point worth mentioning and needs serious consideration. Teachers should ask questions inquiring about how to direct and organize knowledge instead of simple recall questions. By this way, the more students direct knowledge and discover new ways of doing something, the more interested and aware they will be and they can use science to find permanent solutions for circumstancing problems.

SUGGESTIONS

Teachers should ask questions targeting higher order thinking more.

In addition, there should be alignment between how teachers teach and how they assess or the level of questions they ask.

Thus, it seems that it is necessary to provide effective pre-service and INSET programs to improve teachers’ knowledge and skills in asking higher order questions.
REFERENCES


