



Analysis of Question Papers of Physics on Bloom's Taxonomy at Secondary Level

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Javed Iqbal*

Obaid Ullah†

Muhammad Nisar‡

Abstract

This research reviewed the question-based papers on secondary-school physics on cognitive taxonomy in the Bloom area between 2014 and 2018 and considered that the papers of the BISE Rawalpindi were merely memorized fact tests or all the cognitive domain categories. In this report, the experts have provided different targets in the papers for evaluation purposes. The research population was the question papers of Physics of class10 since the last five years. The papers were analyzed by a group of five experts. The research tool was the questionnaire which was critically analyzed by the experts and identified the marks allotted to various categories of cognitive domain. Simple percentage method was used to calculate the allotted marks. The major objectives were to analyze the question papers of Physics with reference to knowledge, comprehension, application, analysis, synthesis and evaluation.

Key Words: Cognitive Domain, Physics Papers, Secondary Level, Bloom's Taxonomy

Introduction

Testing is an important part of the study of schooling. It decides the future of the students. It is the main scale for rising the number of students. The BISE tests are administered for the evaluation of high school and middle school students. The high education is in the elementary and middle schools and ranges from 6 to 10 grades (VI to X). Students are expected to take the exam administered by BISE at the end of the first section, i.e. grade IX. At the end of the second part (grade X), a similar test is carried out. On completion of both tests, good students are accredited as high school students (SSC) or shortly metric. While the government makes significant efforts to expand access to colleges, increase enrollment and boost attendance for universal primary schools, the Government still has considerably delayed the efforts to improve the standard of education. The low students' achievement levels and the lack of standard of school information illustrate this fact. This is one of the strong evident.

As education is a key to success, the assessment process for educational institutions is a vital step in evaluating learners' results. The content of the examination papers is the key criterion for ensuring the standard of education of the institutions created by the students. The exam serves as a reference for students on their progressive journey towards knowledge. Therefore, it is important to follow the correct procedure for compiling examination papers.

The assessment process is an essential practice to assess the performance of the students in education institutions. The nature of test papers is directly related to the assessment of graduates' quality. However, it is a laborious job for the academics to design question papers. Assessment is an integral part of any successful teaching effort and 'if we want to discover the truth about the educational system, we need to look into its assessment procedures' (Rowntree 1977).

Bloom's taxonomy

The primary purpose of any evaluation method is to measure the cognitive level of students. However, the study paper design will have to be revised and measures taken to ensure that the pupil is tested for various levels of

*Assistant Professor, Department of Educational Development, Karakoram International University (KIU), Gilgit-Baltistan, Pakistan.
Email: javed.iqbal@kiu.edu.pk

†Lecturer, Department of Education, NUML, Islamabad, Pakistan.

‡Principal, Model High School, Shakardarra, Kohat, KP, Pakistan.

cognitive performance. Blooms Taxonomy named after Benjamin Bloom classifies the various stages of learning procedures that a student undergoes when the learning goals of a program are set.

According to Bumen (2007) Bloom's taxonomy might be classified into knowledge, comprehension, application, analysis, synthesis and evaluation categories and this taxonomy presented the classification of educational objectives in such a way which help the teachers, professional specialists, research workers and administrators in evaluation and curricular problems. If applied properly the depth of knowledge of the students with respect to definite learning objectives may be evaluated by the educators with more accuracy. He further added that learning is facilitated by assessment and student learning would be the most effective if certain objectives or standards are set before the instructions, and the use of Bloom's taxonomy was suggested to facilitate assessment.

Parker and Eber (2007) stated Bloom's taxonomy as it was an instrument for educators that might help in widening learning of the students but unfortunately there was lack of judging higher order skills in schools for the purpose of assessment. He elaborated that higher levels of thinking should be included in classroom teaching practices. According to him if students were not trained to learn higher levels of thinking they may not be assessed in that area. He further added that the measurement of a student's achievement might be ensured by each of the six levels of the cognitive domain. If there is a demand of higher order thinking, assessment might be such that measure critical thinking of the students.

According to Rashid (1998) Cognitive domain is described by Bloom in 1956. Bloom mentioned that cognitive domain is categorized from simple to complex. It relates with mind of an individual. Basically, cognitive is perception and require information/ knowledge. It relates with mental process or mental abilities.

Examination is a vital part of educational analysis. The fate of student is determined by it. It is the main scale to promote the students to higher grades. Examinations are conducted by the BISE for the judgment of high and higher secondary class students. In examinations assessment to a great extent stressed only on straight and simple questions and they overlooked the assessment of such items which involved higher skills like comprehension, application, analysis, synthesis and evaluation. That is why the students kept concentration on memorization as a strategy for passing the examination. So many researches in the last three decades have outlined this situation. According to these researches the major limitation of the examinations is that they have tested memorized information in cognitive domain and neglected other objectives like comprehension application analysis, critical thinking and logic etc. Dave (1969) Srivastava (1979).

Srivastava (1979) clarified that the purpose of secondary examinations is to know whether or not students meet the pre-determined education goals specified in the curriculum and, if so, at which stage.

In Pakistan, however, only a small number of teachers have appropriate training in designing test items and in using modern methods of evaluation (Mirza et al; 1999).

Dave (1969) awareness does not contribute to the overall growth of children's personality, as a result of a bad evaluation, according to Y. Agarwal (2000). It is a fact that cognitive, affective and psychomotor areas are the key features of education. The purpose of the school curriculum is to allow students to acquire knowledge, develop a sense of understanding and enhance values, positive attitude and actions essential to the growth of the child's overall personality. Only the development of intellectual abilities (i.e. the achievement of expertise in the cognitive field) is given secondary attention. Our appraisal framework has also emphasized the cognitive component and neglected other facets of children's personality. The secondary school process is clearly crucial for students' careers. In this process the Boards only concentrate on the achievement of competence within cognitive fields is a summative form of evaluation and examinations.

The study of physics articles on the cognitive domain in taxonomy in Bloom concluded with Jafari and Arain (2002). "The paper setter did not take into account the weighting of various cognitive targets such as information, implementation and awareness in the development of articles. According to them, after research on questions of physics at the secondary stage, there was no correlation between the weights of the various categories of cognitive field such as information, understanding and usage. The intellectual deficit among students from level to level emerged as the students advanced, they deteriorated in all aspects of the cognitive domain, in physics, which was dangerous for physics education's aims.

Christie and Afzaal (2005) suggested that the frequency of questions being asked increased. According to them, the questions and selected material have been replicated again and again during our public examinations,

which have enabled the students to achieve selective study and little preparation. Nobody had taken this point seriously.

Khan (2006: 6) revealed the flaws in the assessment system in his work under the title research in evaluations. He noticed that assessments were not able to determine the abilities and to recognize students' weaknesses due to lack of trustworthiness and performance. He emphasized once again that exam papers were designed to direct students not to have a beneficial impact on teaching methods and curricula but to concentrate only on the memories. It means that test items were not accurate and correct. At the end of any lesson in the textbook, he also noticed that the questions were based on empirical information and only on low level skills.

According to the national curriculum framework, our evaluation focuses more on memorizing in the cognitive field and less on knowledge, imagination and problem-solving skills.

Bloom Taxonomy of Learning Domains

Bloom and his colleagues created what they called the Educational Objectives Taxonomy. First of all, they identified three broad areas of assessment (Bloom , 1956):

1. Cognitive: mental abilities (what we know)
2. Affective: growth in emotions or in emotional areas (how we feel)
3. Psychomotor: manual or physical skills (what can we do)

Table 1. Cognitive Domain of Bloom's Taxonomy is Summarized as Under;

Category	Description
Knowledge	<ul style="list-style-type: none"> • Information observation and retrieval • Dates, events, locations information. • Understanding important ideas • Expertise in topics • Knowledge comprehension • Good grasp
Comprehension	<ul style="list-style-type: none"> • To translate knowledge into new contexts • Identifying reality, comparing, contrasting • Order, group, causes of inference • Forecast impacts • using information
Application	<ul style="list-style-type: none"> • use new approaches, principles and theories • To solve problems with the skills or expertise necessary: • patterns are shown
Analysis	<ul style="list-style-type: none"> • Parts control • • Hidden meanings identification • • Part recognition • To produce new ones, use old ideas.
Synthesis	<ul style="list-style-type: none"> • generalize the facts • Apply to many fields of information • Foresee, draw findings
Evaluation	<ul style="list-style-type: none"> • Comparison and inequality of ideas • Make decisions on the basis of rational reasoning • Check the proof value • Analysis of subjectivity

Adapted from: Bloom, B.S. (1956) *Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain*. New York ; Toronto: Longmans, Green.

Table 2. Bloom’s Revised Taxonomy is Summarized as Under

Category	Description
Remember	To recall facts and definitions by using memories
Understand	Constructing meaning from information.
Apply	Using procedures to bring out a task.
Analyze	The breakdown and the determination of a relation an idea or a collection of ideas
Evaluate	Making judgements based on checking against given criteria.
Create	Setting materials together to form a unique product.

Adopted from book "A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives." By Anderson and Krathwohl

In his latest book, Hargreaves (2004) argues for generic skills like:

- Managing one’s own learning
- Problem solving
- Thinking
- Research, inquiry and investigation
- Leadership

Hargreaves suggests, is the role that assessment plays in supporting the development of learning to earn’.

Statement of the Problem

The researcher finds that, at secondary levels, paper makers are typically highly skilled and have a broad understanding of the topics, but ignore or weigh less on certain levels of the cognitive domain and add a greater weight to information in secondary review papers. In view of the above, the researcher has decided to make a proper study of this issue and called it as "Study of Cognitive Domain of Bloom 's Secondary Taxonomy Question Papers"

Objectives of the Study

1. To analyse the question papers of Physics with reference to knowledge category of cognitive domain in Bloom’s taxonomy at secondary level.
2. To analyse the question papers of Physics with reference to comprehension category of cognitive domain in Bloom’s taxonomy at secondary level.
3. To analyse the question papers of Physics with reference to application category of cognitive domain in Bloom’s taxonomy at secondary level.
4. To analyse the question papers of Physics with reference to analysis category of cognitive domain in Bloom’s taxonomy at secondary level.
5. To analyse the question papers of Physics with reference to synthesis category of cognitive domain in Bloom’s taxonomy at secondary level.
6. To analyse the question papers of Physics with reference to evaluation category of cognitive domain in Bloom’s taxonomy at secondary level.

Research Methods and Procedure

In this study, a group of five experts, specialists in their field, examined the question papers. Experts carried

out the study of five-year question paper from BISE Rawalpindi 10th grade Physics which filled out the questionnaire. Data from the questionnaire were collected.

Population

The study population contained the last 5 years of the 10th BISE Rawalpindi class Physics Question Papers for the researchers. This includes the question paper for the 2018 analysis and the question papers, i.e. 2017, 2016, 2015 and 2014 for the previous four-year evaluations. Analyzing five years will allow us to evaluate the appraisal rating over a five-year period.

In this investigation, the researcher concentrated on reviewing question papers of physics; the analysis has been restricted to the lack of evaluation of the growth of competences in other topics.

Sampling Procedure

The researcher took the study population as a sample of the investigation as a small population. The results of the study are the physics subject of the 10th grade question papers since last 5 years.

Experts

For the researcher who examined the question papers, selection of experts was the principal step. A group of 5 specialists in their field evaluated the question papers. In BISE Rawalpindi class 10 experts have examined the question papers of physics. The study of the different experts offered insights into the evaluation status of the secondary exams. In addition, the research was intended to be more detailed and accurate for experts from all three groups, i.e. the researchers, the paper editor and the instructor.

Research Instrument

The researcher selected the questionnaire as a research tool. The reasons for the selection of the questionnaire were the following.

- (a) There are fewer errors in the data collected through the questionnaire.
- (b) The coding and capture of data shall be assisted by a questionnaire.
- (c) Data shall be collected in a minimum period of time.
- (d) In comparison with other instruments, this instrument was more appropriate due to limited resources.

Data Analysis

The researchers obtained reasonably detailed information from their expert review which was tabled before the conclusions could be extracted. The data contained expert answers to about 30 five-year questions. Data were coded several days after the coded data were re-checked by 2 to 3 people, to avoid any mistakes.

The collected data were evaluated via a questionnaire and labelled for different cognitive domain categories. The calculation was done using a simple percentage process. In analysing the results, their total marks and their average marks were tabulated and the level of satisfaction tested for different categories of cognitive domain.

The researchers also concentrated on reviewing question papers on the subject of physics during this study. It is the constraint of the analysis that competency advances in other topics are not found and this is omitted.

Data Analysis

Table 3. Cumulative Results of all the Five Experts

Year	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
2014	58%	18%	8%	7%	5%	4%
2015	59%	16%	6%	7%	8%	4%
2016	57%	17%	15%	7%	1%	3%

2017	54%	18%	12%	9%	5%	2%
2018	59%	19%	8%	8%	2%	5%
Average	57%	18%	10%	8%	4%	4%

Discussion

The cumulative results of the five experts are shown in the table above. This shows the average of all five experts. It shows that over a five-year period, 57 per cent marks are allocated to the knowledge category, 18 per cent marks to the comprehension category, 10 per cent marks to the application category, 8 per cent marks to the analysis category, 4 per cent marks to the synthesis category and 4 per cent marks to the cognitive domain category assessment in Bloom's taxonomy. It shows that over a period of five years, more weighting is given to the knowledge category, while much less weighting is given to the synthesis and evaluation categories.

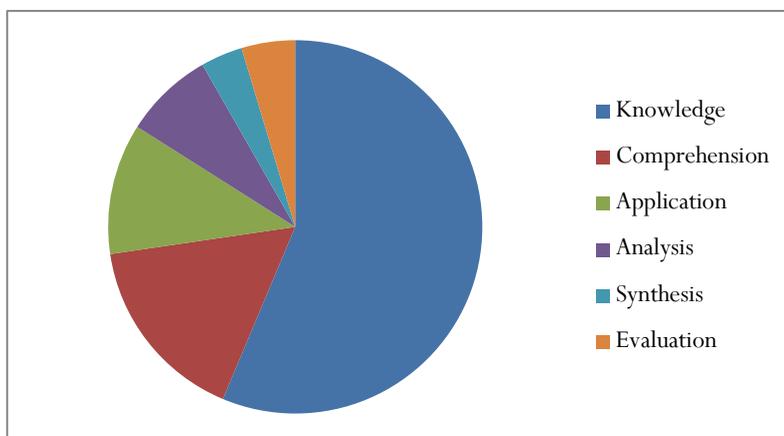


Figure and Graph 1: Cumulative Results of all the Five Experts

Findings

The Cumulative findings from all 5 experts showed that the Physics question papers measured students' scientific capabilities by 57 percent over a five-year period. 18 per cent of the measured comprehension capability, 10 per cent of the measured application capability, 8 per cent of the measured analytical capability, 4 per cent of the measured synthesis capability and 4 per cent of the measured student evaluation capability at secondary level.

Conclusion

1. In Bloom's taxonomy, BISE Rawalpindi 's Physics papers examined only the reminder of memorized facts and utterly disregarded the others cognitive domain.
2. The assessment of student creativity and the assessment of judgment was completely neglected.
3. BISE Rawalpindi's Physics Papers measured only those items that could be easily reproduced by recalling and failed to measure higher skills such as analysis, synthesis and evaluation.
4. Physics papers were unable to assess the student's ability to analyse things, the ability to synthesize new things, and the ability of the students to judge.
5. At the secondary level, our Physics papers have not been able to evaluate higher capabilities, such as analysis, synthesis and evaluation.

Recommendations

1. In order to achieve the future objectives of the learner papers, Bloom's taxonomy should be Properly established.

2. There may be a balance between all the categories of cognitive domain of Bloom's Taxonomy.
3. The Items included in the Physics Question Papers must measure all the aspects of learning, i.e. the application, analysis, synthesis and evaluation of students at secondary level.
4. The teachers selected by BISE Rawalpindi for paper setting must expert in the subject of Physics and also have thorough knowledge of the assessment techniques in the subject of Physics.
5. Training must be provided to the paper setters in such a way that lead them to include such items which can measure different abilities of the students to achieve the required objectives. Teacher training programme must be provided, by the help of which they became able to teach in such a way which can help in the development of various abilities of the students.

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