

**Analysis of Assessment Levels of Students' Learning according to
Cognitive Domain of Bloom's Taxonomy**

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Abstract

In Bloom's Taxonomy, cognitive domain is one of the three domains that were established by Benjamin Bloom in 1956. This domain was intended to verify a student's cognitive excellence during written assessment. The purpose of the study was to analyze the assessment levels of students' learning according to cognitive domain of Blooms' Taxonomy. The study measured the cognitive levels of questions that teachers asked in examinations to evaluate students' learning. Question papers of all teachers were collected to analyze the cognitive levels. The results showed that there are several teaching methodologies used to teach the students but the examinations were limited to the lower level of learning. Most of the teachers had no information about Bloom's Taxonomy. Results of the question paper analysis revealed that most of the questions were on lower level (knowledge, comprehension and application); only few questions were on higher level (analysis, synthesis, and evaluation). The results revealed that there were more focused on lower levels of learning while asking questions. There was less implementation of higher level of questions. In crux, the best ranked university should provide the good questions' criteria, and there should be focused to improve the student-teacher interaction which is the main cause of lack of higher level of learning in students.

Key words:

Bloom's Taxonomy, Students' learning, Question papers, University education, Assessment levels.
Cognitive domain

1. Introduction

1.1 Bloom's Cognitive Domain

Bloom's Taxonomy's Cognitive domain (Bloom, 1956) is one of the three domains that have presented by Benjamin Bloom in 1956s. This domain is intended to confirm a student's cognitive excellence during examinations. The renowned Bloom's taxonomy comprises of six levels i.e. knowledge, comprehension, application, analysis, synthesis and evaluation (Bloom, 1956).

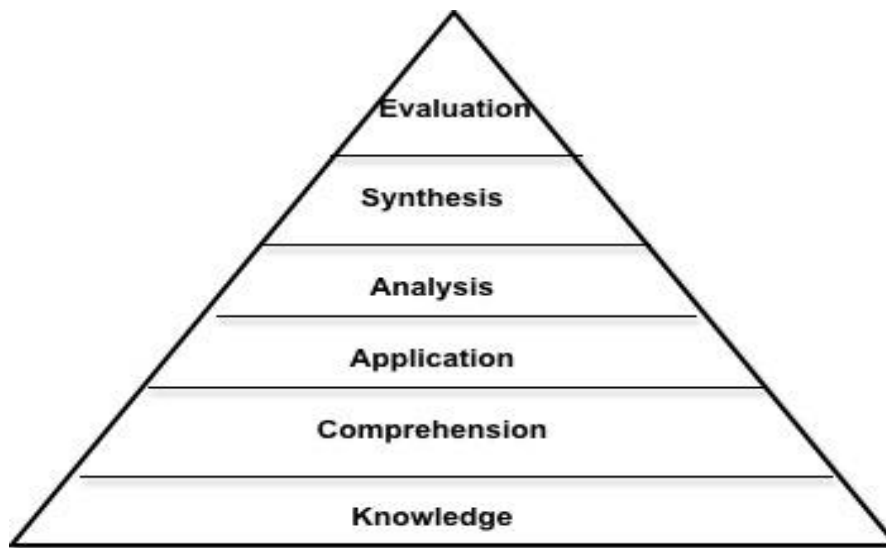


Figure 1: Bloom's Taxonomy cognitive levels of learning

The following some explanation of each levels of Bloom's Taxonomy:

- 1.1.1 Knowledge:** At this level, the pupil is requisite to show memory of earlier learned substance by remembering facts, conditions, fundamental thoughts and answers.
- 1.1.2 Comprehension:** The learner is requisite to illustrate understanding of facts and thoughts by categorizing, comparing, translating, understanding, giving descriptions, and conditioning main ideas.
- 1.1.3 Application:** This level requisite via new knowledge; resolve problems in new circumstances by applying acquired information, facts, strategies and policies in a different way.
- 1.1.4 Analysis:** Here the pupil is likely to observe and break knowledge into parts by recognizing purposes, reasons or inferences and find confirmation to support generalization.
- 1.1.5 Synthesis:** Here the individual pupil gathers information mutually in a different way by joining fundamentals in a new model or suggesting alternative solutions.
- 1.1.6 Evaluation:** The pupil is needed to present and protect opinions by manufacturing judgments about knowledge, strength of thoughts or excellence of work based on a set of principles.

Keywords of cognitive domain of Bloom's Taxonomy according to levels of learning

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
List	Summarize	Solve	Analyze	Design/Plan	Evaluate
Name	Explain	Illustrate	Organize	Hypothesize	Choose
Identify	Interpret	Calculate	Deduce	Support	Estimate
Show	Describe	Use	Contrast	Schematize	Judge
Define	Compare	Interpret	Compare	Write	Defend
Recognize	Paraphrase	Relate	Distinguish	Report	Criticize
Recall	Differentiate	Manipulate	Discuss	Justify	Recommend
State	Demonstrate	Apply	Plan	Formulate	Appraise
Visualize	Classify	Modify	Devise	Generate	Argue

Questions on the knowledge level need the students to memorize actualities they have officially learned and review these as they have been learned. At this stage, students are required to recall facts identifying with the subject that has been taught. The instructor would ask for students to explain, or name the information they've learned in class. In our taste-receptor plan the question could be, List the five taste sensations in the mouth. The team of Bloom believed that this level of thinking would be the easiest for the instructor to create and score; as such, he found that questions of this sort incorporate the greater part of questions of exam (Huitt, 2004).

On comprehension level students must have the capacity to reword information using their own statements and make an interpretation of knowledge into new context and interpret diagrams, tables, graphs and cartoons. Bloom (1956) depicted this level as grasping the meaning of information. The capacity to interpreting, extrapolating, grouping, explaining are the ideas of these levels. The questions for program (Thompson *et al.*, 2008) in this classification could be interpreting algorithm (e.g.; write output of a program), clarifying the procedures and flows of a program and giving examples to an idea.

Application is defined by applying the idea to a specific situation (Starr *et al.*, 2008). The questions for programming in this class have the accompanying criteria: comprehend the idea and utilize it to other algorithms and modifying controls.

The analysis level requires that students divide a thought into its parts or components and show a comprehension of the relationship of the parts to the whole. Here, students are required to break ideas into parts and uncover the unique qualities of what they have been told. Terms like assume, explore, and survey are frequently experienced in questions in this grouping. In our taste-receptor representation, students may be requested to choose the location from the different taste-receptor sites on the tongue for each of the unlabeled solution provided. This is tougher task than those given in the preceding classes because students must recognize a sensation they aren't told the name of. This requires a neural analysis of a gustatory experience as students encounter interpretation. Thinking, like this requires distinct screening of the perspective, and because of its difficulty, is used infrequently in test improvement (Huitt, 2004).

Questions on synthesis level allow students to devise approaches to design experimentations and test hypotheses. Students might be required to compose a paper and a report in which thoughts are synthesized or issues are solved. Students who work at this level can design knowledge in new, unique ways and exploit their imagination. Terms like formulate, produce, and rebuild are regularly found at this level of the scientific classification. In our taste-receptor design, a question at this level could be, depict a gustatory sensation experienced from the combination of two distinctive taste receptions. Here students must combine what they experience into what is measured as a novel sensation. Such unique idea lives high on a learning chain and is seldom seen time to time on course exams (Huitt, 2004).

At evaluation level, course instructors expect that students will make judgments about what they have acknowledged based on either external or internal criteria. Students must prioritize their understandings as they form their conclusions. An Evaluation-level question in our taste receptor plan would be, According to investigate by the American Obesity Association, approximately 127 million people in this country are truly overweight and the issue continues grow greater every year . Discuss how gustatory reception and obesity are associated. Here students are constrained to assess their experience as they relate their understandings to a real issue. Such analysis is extremely tough for students (Huitt, 2004).

1.2 Objectives

The objectives of the present study were to analyze the assessment levels of students' learning according to cognitive domain of Bloom's Taxonomy, and to identify the cognitive level of questions asked by the teachers in examination.

2. Materials and Methods

2.1 Introduction

It gave the study plan, selection criteria for respondents, sampling processes, sample size and variety of statistical methods used for data analysis, for example frequency and percentage. Therefore, the major objective of this section is to clarify a variety of tools and methods employed for the data collection, analysis and explanation of the data. Those are explained in detail in this section.

2.2 Research Design

In present study descriptive cross-sectional research design were used. It is most commonly used design in social sciences particularly when the data depends on survey research. In this design collected data were used for creating causal relationship among the variables.

2.3 Study Area

The present study entitled "Analysis of assessment levels of students' learning according to cognitive domain of Bloom's Taxonomy" was conducted in Pakistan.

2.4 Population

The University of Agriculture, Faisalabad Pakistan is the largest University of Asia, it has been declared as the 86th best university worldwide in the area of Agriculture Sciences by QS ranking.

The population of the study was comprised of all teachers of undergraduate and postgraduate level of the main campus of University of Agriculture, Faisalabad Pakistan. The total population on 19-01-2017 was 675 while the present teachers were 529 according to the list which was taken from personal section University of Agriculture,

Faisalabad Pakistan and the study was conducted on present teachers and the other teachers were on study leave while some teachers were in sub campuses, and the population of the study was all undergraduate and postgraduate level teachers of the main campus of University of Agriculture, Faisalabad Pakistan.

2.5 Sampling

The sample size of the study was determined from population by using online available software www.surveysystem.com. To choose the respondents from population www.randomizer.com online software were used to randomize the sample. The sample size of the study was 115 teachers from University of Agriculture Faisalabad, the list of all teachers were collected from personal section and 115 question papers were collected from selected teachers to analyze the questions' level.

2.6 Data Collection Tool

The question papers from University teachers were collected to analyze the levels of questions according to cognitive domain of Bloom's Taxonomy for this study. The study was also aimed to measure the levels of questions asked by the teachers.

2.7 Data Collection

The researcher had gone to every respondent to collect question papers. 115 question papers were collected from the teachers to measure the cognitive levels of questions.

2.8 Difficulty during data collection

- 2.8.1 The researcher spent a lot of time in explaining the purpose of study to every respondent.
- 2.8.2 The respondents did not give time properly.
- 2.8.3 The researcher went to every respondent 3, 4 times, some of them gave time but some of them refused to give time, so after 2, 3 times they decided to give a little amount of time for providing me question papers.

2.9 Data Analysis

The questions of question papers were analyzed manually by using keywords of cognitive domain of Bloom's Taxonomy, a committee of experts were gathered to categorized the question. Further after analysis, the frequency and percentage on each level according to cognitive domain of Bloom's Taxonomy was found to measure the results.

3. Results

The rationale of this section is to represent analysis and explanation of the data about to the documented problem. Explanation of the data is very important part of all social research. Without the explanation of the data researcher cannot simplify the results on the whole population. Explanation of the data also facilitates the researcher to formulate prediction and to recommend for the betterment in any dilemma.

Table 1: Summary of questions according to Bloom's Taxonomy

Data in Table 1 revealed that the most of the questions in papers were of comprehension level (40.90%) followed By knowledge level (33.05%) and analysis level (17.37%). There were only some questions that were of application synthesis (1.96%) and evaluation (1.96%) level. Results indicated that most of the papers' questions were at lower level of learning. Results of the study have some similarities with the results of (Gezerm *et al.*, 2014) it might be proposed that the social studies teachers generally utilized the things measuring learning at basic level in their classroom estimation and evaluation practices and higher levels ignored by the teachers. It was explained that no exam questions were prepared with respect to meta-cognitive learning sub-dimension. In the cognitive procedure sub-dimension, the questions were set up in understand, analyze, evaluate and apply sub-dimensions respectively. It was discovered that cognitive procedure sub-dimension was not utilized as a part of the procedure of preparation of the questions of exam.

Table No. 2: Designation wise analysis of question papers according to Bloom's Taxonomy

Table 2 revealed that simple majority of professors (40.0%) made question papers on comprehension level while (25.0%) made on knowledge level, (15.0%) made on application level, only (10.0%) made on analysis level, (10.0%) made on evaluation level respectively, while there were no focus on synthesis level question. Synthesis

level totally ignored by the professors. In this way students' synthetic ability will be finished because it was totally unseen. The results are contrasted with the results of (Hand *et al.*, 2002) who showed that teachers rarely tend to use higher level questions, for example, higher level of learning which motivated students to progressive their scientific thinking. After all, despite the fact that questions requiring students' higher intellectual abilities were asked in Anatolian High School and Ordinary High Schools physics exams, they were not asked in Vocational and Commercial High School exams.

Table 2 also depicted that simple majority of associate professors (39.4%) made question papers on knowledge level while (33.3%) made on comprehension level, (3.0%) made on application level, (12.1%) made on analysis level, (9.1%) made on synthesis level while (3.0%) made on evaluation level. It was showed that there were also less concentration on higher level of questions and as well as learning. Teachers preferred to evaluate students' lower order thinking skills. Application and evaluation level approximately ignored by the associate professors. The results are matched with the findings of (Halis, 2002) in his study, although, no questions for the levels of application, synthesis or evaluation were seen in the prep questions of the sixth grade textbooks.

Table 2 also showed that simple majority of assistant professors (32.5%) made question papers on knowledge level while (42.1%) made on comprehension level, (1.0%) made on application level, (17.2%) made on analysis level, (5.3%) made on synthesis level while (1.9%) made on evaluation level. It was indicated that knowledge and comprehension levels were evaluated by assistant professors while they were have some concentration on analysis level. But over all there were also less concentration on higher level of questions and learning. Application and evaluation level approximately ignored by the assistant professors.

Table 2 also demonstrated that simple majority of lecturers (33.7%) made question papers on knowledge level while (41.1%) made on comprehension level, (1.1%) made on application level, (21.1%) made on analysis level, (3.2%) made on synthesis level while evaluation level was highly ignored by teachers in evaluating students. It showed that lecturers have more focused on knowledge and comprehension levels while they were have also some concentration on analysis level. But over all there were also less concentration on higher level of questions and learning as well. Application level approximately ignored by the lecturers and evaluation level was unseen.

3.1 Discussion and implications

Results showed the designation wise questions' details which indicated that knowledge and comprehension level were highly implemented by the great majority of lecturers and assistant professors. A simple majority of associate professors used knowledge and comprehension level in question papers. Application level was mostly used by thy professors and analysis level was highly used by the assistant professors, while synthesis level was ignored by the professors and evaluation level was mostly used by the assistant professors. The above summary of questions showed that application, synthesis, and evaluation level was ignored by the respondents. They adopted lower levels of cognitive domain while making question papers. Examination questions were prepared on lower level of learning to measure the students' cognitive skills. Higher level of learning was ignored by the mostly teachers. Keeping in view the results of this study, it revealed that students promotion to the next class or in next semester were based on lower level. Consequently some of the questions were accepted on synthesis and evaluation level while knowledge, comprehension, application and analysis level were found mostly. During the analysis of questions it was found that question was prepared without considering the cognitive levels of Bloom's Taxonomy which directly affect students' performance. For this reason teachers should use different software to find out their levels of questions after making question papers, to make a balanced question paper which evaluate the whole performance of students and contain on all cognitive levels of Bloom's Taxonomy. Most of the teachers had no information about Bloom's Taxonomy. Therefore, this study indicated that teachers were aiming their teaching and testing primarily at the lowest cognitive levels. There is dire need to improve the paper making criteria that should be according to the levels of learning. The best ranked university should provide the good questions' criteria, and there should be focused to improve the student-teacher interaction which is the main cause of lack of higher level of learning in students. Student-teacher interaction is the main key to improve the learning levels.

3.3 Conclusions and perspectives

The study was designed to measure the cognitive levels of questions that teachers asked in examinations to evaluate students' learning according to cognitive domain of Bloom's Taxonomy.

According to findings from this research, it can be understood that teachers asked most dominant questions and the type was knowledge, comprehension, and analysis. There are several teaching methodologies used to teach

the students but the examinations were limited to the lower level of learning. Analysis, synthesis, and evaluation level are the higher levels of learning while knowledge, comprehension and application level are the lower levels of learning. The results revealed that there were more focused on lower levels of learning while asking questions. The results also showed that teachers asked questions on lower level and they assessed students by using lower level of asking questions. There was less implementation of higher level of questions. It can deprive students from concrete thinking and their logical abilities might be waste in this way.

The criteria for preparing question papers by the respondents were identified as most of the respondents made question papers to evaluate students' overall understanding, whereas some of them made to test students' memory. The question papers made to evaluate the lower level of learning. Most of the questions asked in the question papers were of lower cognitive order i.e. knowledge and comprehension

However, due to short time and resources, it was difficult to conduct research on huge population, and faculty members were randomly selected from different department in order to analyze the assessment levels of students' learning according to cognitive domain of Bloom's Taxonomy. The research was only carried out in the University of Agriculture, Faisalabad based www.surveysystem.com, the sample size was limited according to resources, and data was collected from the teachers only. However, future studies should be conducted in different public and private sector institutes using large sample size. The aspect of teacher-student interaction was not studied in the present research, thus more detailed studies are needed in order to analyze the teacher-student interaction at higher level of education and its impact on learning level of students. . It is also suggested that the young teachers should be trained in preparing high order questions.

References

- Bloom, B. S., (1956). *The cognitive domain: Taxonomy of educational objectives handbook I*. New York: David McKay Co Inc.
- Gezerm, M. O., Sunkur, I. F., & Sahin, (2014). An evaluation of the exam questions of social studies course according to revised Bloom's taxonomy. *GESJ: Education Science & Psychology*. 2(28), 3-17
- Halis, I., (2002). *Ogretimiplanlamavedegerlendirme*. Ankara: Nobel Yayın Dağıtım.

- Hand, B., Prain, V., & Wallace, C., 2002. Influence of writing task on students' answersto recall & higherlevel test questions. *Research in Science Education*. 32(1), 19-34.
- Huitt, W., (2004). Bloom et al.'s Taxonomy of the cognitive domain. *Educational psychology interactive*. Valdosta, GA: Valdosta State University Press.
- Starr, C. W., Manaris, B., & Stalvey, R. H., (2008). Bloom's Taxonomy Revisited: Specifying Assessable Learning Objectives in Computer Science. *SIGCSE 08*. Portland, Oregon, USA. March 12-15, 261-265.
- Thompson, E., Reilly, A. L., Whalley, J. L., Hu, M., & Robbins, P., (2008). Bloom's Taxonomy for CS assessment. *Proceeding Tenth Australasian Computing Education Conference (ACE 2008)*. Wollongong, Australia. 155-162.

Table No. 1: Summary of questions according to cognitive domain of Bloom's Taxonomy

Questions' Levels	Frequency	Percentage
Knowledge	118	33.1
Comprehension	146	40.9
Application	7	2.0
Analysis	62	17.4
Synthesis	17	4.8
Evaluation	7	2.0
Total	357	100.0

Table No. 2: Designation wise analysis of question papers according to cognitive domain of Bloom's Taxonomy

Questions' Levels	Professors		Associate Professors		Assistant Professors		Lecturers	
	F	%age	F	%age	F	%age	F	%age
Knowledge	5	25.0	13	39.4	68	32.5	32	33.7
Comprehension	8	40.0	11	33.3	88	42.1	39	41.1
Application	3	15.0	1	3.0	2	1.0	1	1.1
Analysis	2	10.0	4	12.1	36	17.2	20	21.1
Synthesis	-	0.0	3	9.1	11	5.3	3	3.2
Evaluation	2	10.0	1	3.0	4	1.9	-	0.0
Total	20	100	33	100.0	209	100.0	95	100.0

Table No. 3: Keywords of cognitive domain of Bloom's Taxonomy according to levels of learning

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
List	Summarize	Solve	Analyze	Design/Plan	Evaluate
Name	Explain	Illustrate	Organize	Hypothesize	Choose
Identify	Interpret	Calculate	Deduce	Support	Estimate
Show	Describe	Use	Contrast	Schematize	Judge
Define	Compare	Interpret	Compare	Write	Defend
Recognize	Paraphrase	Relate	Distinguish	Report	Criticize
Recall	Differentiate	Manipulate	Discuss	Justify	Recommend
State	Demonstrate	Apply	Plan	Formulate	Appraise
Visualize	Classify	Modify	Devise	Generate	Argue