

# Impact of Training of Teachers in Bloom's Taxonomy on Question - Paper Setting

Lalchhuanmawii, R. P Vadhera

Department of Education, Pachhunga University College, Mizoram University, Aizawl, Mizoram, NE India  
*machhuaniralte[at]gmail.com*

**Abstract:** *Teachers ask hundreds of questions every day and it is important that they use questioning techniques that challenge the thinking of all of their students. Improving students' conceptual understanding depends on the question types asked by the teachers, whether in the classroom or in examinations. The art of skilful questioning is a key to stimulate student's mental activities, thereby engaging students in higher - order thinking. Bloom's Taxonomy has been found effective in improving students' cognitive skills. A mixture of questions from various levels of the taxonomy may result in most effective learning at higher levels.*

**Keywords:** Assessment, Bloom's Taxonomy, cognitive levels, question setting

## 1. Introduction

Planning, teaching, and assessment stages are used to achieve educational aims, where assessment is the final stage in determining whether students have developed higher order cognitive skills. Since assessment has such an important and significant part in the future of students, there is little doubt that any assessment system will determine what and how students learn, and what and how we teach.

Teaching is a very important activity, but evaluation of the effectiveness or results of teaching is an equally important task. Everyone knows that when something is done, it is to be judged or evaluated as to whether it has been done properly and how far it has achieved set objectives. Questions are an essential component of effective instruction. It is important that the examination questions posed encompass the student's learning experience and level and style of learning. Examination questions should include a wide range of cognitive levels and be consistent with the learning outcomes of the course. Effective questions include informational or problem solving questions, and significantly more complex thinking questions that stimulate a student's mental activities.

Examination is one of the common methods to assess knowledge acceptance of the students, and questioning is the most important component of the education system. Teachers use questioning strategies to review, check on learning, probe thought processes, pose problems, seek out alternative solutions and challenge students to think critically and reflect on issues or values. Teachers ask hundreds of questions every day and it is important that they use questioning techniques that challenge the thinking of all of their students. Improving students' conceptual understanding depends on the question types asked by the teachers, whether in the classroom or in examinations. The art of skilful questioning is a key to stimulate student's mental activities, thereby engaging students in higher - order thinking.

## 2. Literature Survey

Although Bloom's Taxonomy has been around for many years, the number of researches done in this area are not many. Few literature related to setting question papers using the cognitive levels of Bloom's Taxonomy has been found. *Sultana, Q (1997)* evaluated the lesson plans submitted by 67 student teachers in Kentucky, USA by using Bloom's Taxonomy. The result was that 77% of the lesson objectives were aimed at the three lowest cognitive processes. 41% of the lesson objectives were of knowledge domain and only 3.2% were considered to be of evaluation domain. This study clearly highlights that colleges are sending out new teachers with limited higher order thinking skills. *Jackson, L (2000)* tried to integrate critical thinking into the Grade VI mathematics curriculum to improve students' critical thinking skills by allowing students to approach problems in many different ways such as drawing a graph, using a formula, counting, journal writing, co - operative learning, etc. They were given pre - test and post - test in order to measure the efficacy of the intervention. The study revealed that out of the 17 students, 9 showed a statistically significant improvement in higher order thinking skills in mathematics. *Stabile, C (2001)* conducted a study in a Grade VI world history classroom in Florida where the class had been dealing with low - level assessment and very few opportunities for taking the content to critical level. The students were taught Bloom's Taxonomy, thus creating a vernacular for exploring higher order thinking skills within the subject matter being covered. The idea of incorporating Bloom's Taxonomy in order to develop higher order thinking was a success for both the teachers and students. *Noble, T (2004)* created a tool to help teachers better deliver a differentiated curriculum to learners at all levels within the same classroom by combining Bloom's Taxonomy with Gardner's Multiple Intelligence. 16 teachers ranging from kindergarten to grade VI were observed using this tool for 18 months. The outcomes indicate that using the tool helped teachers to target higher order thinking skills of students at every level. *Hawks, K (2010)* conducted a study to determine if teachers who developed lessons based on Bloom's Taxonomy saw increased scores on the Mathematics benchmark assessment for grade IV. Two classes taught by different teachers participated in the test.

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The mean of the posttest scores for the experimental group in which the teachers developed lessons using Bloom's Taxonomy was significantly higher than the mean of the group which used textbook bound instruction.

### 3. Problem Definition

Accurately measuring students' abilities require a classification of levels of intellectual behaviour important in learning. This classification of cognitive levels was given by Benjamin Bloom in his famous work called "Bloom's Taxonomy". Bloom's Taxonomy has been found effective in improving students' cognitive skills. A mixture of questions from various levels of the taxonomy may result in most effective learning at higher levels. Researchers suggest that professional development on the effective use of questioning strategies and the development of high - level questions is helpful to teachers. For these reasons, this study was conducted to find out the prevailing standard of question paper setting among teachers in the higher educational institutions of Mizoram, India; and to study the impact of training of teachers in Bloom's Taxonomy on their question paper setting. Thus, the problem under study reads as "Impact of training of teachers in Bloom's Taxonomy on question paper setting".

### 4. Methodology

The methodology section outline the plan and method of how the study is conducted. The details are as follows:

#### Objectives

The objectives of the study are given as follows:

- 1) To study the impact of training of teachers in Bloom's Taxonomy on their question paper setting.
- 2) To give suggestions for improvement in question setting.

**Method of study:** Experiment method was employed to study the impact of training of teachers in Bloom's Taxonomy on their question - paper setting. The investigator conducted a Pre - test Post test experiment on 30 teachers who participated in the Orientation Course programme organized by the UGC - Human Resource Development Centre, Mizoram University between 19<sup>th</sup> October and 15<sup>th</sup> November 2018.

**Sample:** 30 College and University teachers were used as a sample for the study. The demographic profile of the participants of the experiment are given in the table below:

**Table 1:** Demographic Profile of Samples for Pre - test & Post - test experiment

Gender	Nos.	Institution Level	Nos.	Stream	Nos.	Degree	Nos.
M	14	PG	3	Arts	25	Master Degree	13
						M. Phil	12
F	16	UG	27	Science	5	Ph. D	5

**Tools of Data Collection:** Pre - Test/Post - Test Experiment was conducted to find out the impact of training of teachers on question setting. Questionnaire was constructed for the Pre - Test and Post - Test Experiment and both the Pre - test and Post - test Schedules consisted of 12 items – a combination of questions and test exercises. Intervention in the form of a detailed lecture with power point presentation on Bloom's Taxonomy was conducted after the Pre - test. Post - Test was conducted after an interval of one week to find out the impact of the intervention.

### 5. Results and Discussion

The outcomes of the Pre - Test Post - Test Experiment are presented in detail under three sections as follows: -

#### A) Background Experience of Participants in the Experiment:

##### i) Appointment as University Examination paper setter:

Majority of the respondents (63.33%) revealed that they have not been appointed as paper setters at college or university end semester examination levels and a small number (36.67%) replied that they had been appointed as paper setters. At the same time, all of them (100%) revealed that they had set questions for various class/unit/term tests in their own institutions.

##### ii) Training on Question Paper Setting:

96.67% of the participants reported that they have no formal training in question - paper setting. Only one participant (3.33%) replied that he/she received such training after joining the job in college, which was organised by Tripura University for 1 day.

96.67% of the respondents declared that they believe training on question - setting is a necessity for teachers, and only one (3.33%) replied that there is no particular need for such a training.

76.67% of the respondents revealed that they had no idea/knowledge about Bloom's Taxonomy of Educational Objectives and only 23.33% replied that they had come across Bloom's Taxonomy, probably during their student days as these respondents had background in Education subject.

##### B) Impact of Intervention on teachers' opinions on various issues related to evaluation and question paper setting as per Bloom's Taxonomy:

In order to determine the impact of Intervention on the performance of the participants, a test of significance was conducted on 7 items which are common in both the pre - test and post-test. T - test for Large Correlated Sample (Single Group Method) was applied by the researcher to find out whether there was significant difference between the pre - test and post - test scores of the participants. Null hypothesis was formulated stating that there is no significant

difference between pre - test and post - test performance/scores. These 7 items selected for testing significance of difference include: -

- 1) Purpose of Formative Testing
- 2) Purpose of Summative Testing
- 3) Awareness on Classification of Questions
- 4) Assessment of difficulty level of questions
- 5) Verbs Used in Writing of Questions

- 6) Level of Students' Learning
- 7) Question Paper Setting

The findings regarding the impact of intervention on the teachers are presented in Table 2 and a more detailed explanation of the findings for each of the 7 items is also provided.

**Table 2:** Significance of Difference between Pre - Test and Post - Test Scores on Various Issues Related to Question Paper Setting

S. No	Question	Score				Correlation	Df	t - value	Decision about Ho
		Pretest		Posttest					
		Mean	SD	Mean	SD				
1	Conduct of class/unit/term tests.	3.5	1.41	4	1.2	0.47	29	2.00 n. s	Accepted
2	Conduct of annual/semester exams.	3.2	1.37	3.7	1.29	0.51	29	2.08 *	Rejected
3	Classification of questions	0.8	0.96	1.87	0.97	0.63	29	7.13**	Rejected
4	Arranging questions in terms of difficulty order from 1 to 6.	2.7	1.92	3.87	1.91	0.51	29	3.34**	Rejected
5	Writing verbs used for framing questions.	16.33	3.55	19	1.98	0.19	29	3.93**	Rejected
6	Arranging six situations depicting level of students' learning from lowest to highest level of 1 to 6.	1.83	1.64	3.07	1.74	0.69	29	4.96**	Rejected
7	Setting of 6 questions of different difficulty order of 1 to 6 for end semester exam	2.9	0.92	4.23	0.86	0.38	29	7.39**	Rejected

n. s= not significant, \* Significant at.05 Level, \*\* Significant at.01 Level

**i) Purpose of Formative Testing:** The respondents were asked to give five responses for the purpose of conducting class tests / unit tests / term tests, i. e., formative testing. The total score for the pre - test was 105 and 120 for the post - test. On the basis of the pre - test and post - test scores shown in the above Table 5.2.6, it can be seen that there is improvement in the post - test. T - test was applied to determine whether there was significant difference between the two results. It was found that the calculated t - value (2.00) was smaller than the table value of t at.05 level (2.04) and.01 level (2.76). Therefore, null hypothesis is accepted and we can conclude that there was no significant difference between the performances in the pre - test and post - test regarding the purpose of formative testing.

**ii) Purpose of Summative Testing:** The respondents were asked to write five points on the reasons for conducting annual/semester examinations. The total score for the pre - test came to 96 and the total score for the post - test was 111. Based on the scores shown in the above table 5.2.6, it can be declared that there is an improvement in the post - test. In order to find out if the differences in the results were significant or not, t - test was applied and it was found that the calculated t - value (2.08) was higher than the table value of t at.05 level (2.04). Therefore, null hypothesis is rejected and we may conclude that the performance in the post - test was significantly better than the pre - test.

**iii) Awareness on Classification of Questions:** In the pre - test, the respondents were asked whether they had ever come across any classification of questions and it was found that 46.67% had no idea about classification of questions. Therefore, these respondents did not answer the corresponding question asking them to give different classification of questions that they knew of. In the post - test, they were able to give a number of classification of questions. In the pre - test, only about half of the respondents (53.33%) answered the question while all of them answered it in the post - test.

The total score for the pre - test was 24 and 56 for the post - test. Based on these total scores and the fact that all the respondents were able to answer the question in the post - test compared to 14 of them not being aware of any classification of questions in the pre - test, we can state firmly that there has been improvement in the post - test performance. T - test was applied to find out if there was significant difference between the pre - test and post - test scores and it was found that the calculated t - value (7.13) was much higher than the table value of t at.05 level (2.04) and.01 level (2.76). Thus, null hypothesis is rejected and we can conclude that there is significant improvement in the performance of the respondents in the post - test.

The above Table 5.2.6 shows that in the pre - test, the mean score (0.8) is lower than the standard deviation (0.96). This is because only 14 respondents answered in the pre - test while all the 30 respondents answered the question in the post - test.

**iv) Assessment of difficulty level of questions:** Six questions belonging to the different Cognitive levels of Bloom's Taxonomy were given and the respondents were asked to give ratings for each question in terms of their difficulty order by giving 1 to the most easiest and 6 to the most difficult question. These questions related to testing of analytical capabilities of students; testing of understanding of acquired knowledge of students; testing of evaluation of a scheme/ policy/ theory/ programme; testing of the knowledge of students; testing of ability to apply acquired knowledge in a new situation; and testing of ability to synthesize the existing knowledge to create something new and different.

For this test, the total pre - test score was 81 and the total score for the post - test came to 116. This result indicates that there has been improvement in the post - test as compared to the pre - test. T - test was applied to determine whether there was a significant difference between the pre -

test and post - test performances. It was found that the calculated t - value (3.34) was higher than the table value of t at.05 level (2.04) and.01 level (2.76). Thus, null hypothesis is rejected and we can conclude that there is significant difference between the pre - test and post - test and the intervention worked successfully.

v) **Verbs Used in Writing of Questions:** This section is further divided into 2 sub - sections:

a) Number of Verbs suggested by the participants for framing questions.

b) Classification of Verbs suggested by the participants for framing question.

a) **Number of Verbs suggested by the participants for framing questions:**

The respondents were asked to write 20 verbs used for framing questions and some examples were provided to them. In the pre - test, the respondents gave 490 verbs and in the post - test, they were able to give 570 verbs. This result indicates that there is improvement in the performance of the respondents in the post - test with regard to writing of 20 verbs for framing of questions. T - test was applied to determine whether the difference between the two tests were significant or not. It was found that the calculated t - value (3.93) was higher than the table value of t at.05 level (2.04) and.01 level (2.76). Hence, null hypothesis is rejected and we can conclude that the performance of the respondents in writing 20 verbs was significantly better in the post - test.

b) **Classification of verbs suggested by the participants:**

In the earlier question, the respondents were asked to write 20 verbs for framing questions. These verbs were then analysed on the basis of Bloom's Taxonomy Coding Scheme and placed in their proper categories. The findings regarding the classification of verbs suggested by the respondents are given below in Table 3.

In the pre - test, 47.55% of the verbs suggested belonged to Knowledge domain and 25.51% belonged to Comprehension domain. Only a small number of verbs were suggested in Application (7.14%), Analysis (9.18%), Synthesis (2.86%) and Evaluation (7.76%) domains respectively. This finding indicates that majority of the verbs suggested in the pre - test belonged to the two lower cognitive domains and a small number belonged to the other four higher cognitive domains.

In the post - test, 33.33% of verbs suggested belonged to Knowledge domain and 22.98% belonged to Comprehension domain. The verbs suggested for the other cognitive domains such as Application (11.23%), Analysis (10.70%), Synthesis (10.53%) and Evaluation (11.23%) were not significantly large. However, in the post - test, we see that there has been a slight decrease in Knowledge and Comprehension verbs and a slight increase in the other four higher cognitive domains. Hence, we can conclude that there has been improvement in the post - test with regard to number of verbs as well as classification of verb levels for the higher cognitive domains.

**Table 3:** Number of Verbs Suggested by Teachers for framing questions

Cognitive Domain	Pre - Test	Post - Test
	No. of verbs given by respondents (with %)	No. of verbs given by respondents (with %)
Knowledge level	233 (47.55%)	190 (33.33%)
Comprehension level	125 (25.51%)	131 (22.98%)
Application level	35 (7.14%)	64 (11.23%)
Analysis level	45 (9.18%)	61 (10.70%)
Synthesis level	14 (2.86%)	60 (10.53%)
Evaluation level	38 (7.76%)	64 (11.23%)
Total	490	570

vi) **Level of Students' Learning:** The respondents were asked to rate situations depicting six levels of students' learning based on the Cognitive domain of Bloom's Taxonomy. They were asked to give a rating from 1 to 6 depending on the situation indicative of the lowest level to the highest level of students' learning. These six levels depicted situations where students can generate new products, ideas, or ways of viewing things; students can justify a decision or a course of action; students can explain ideas or concepts; students can recall information; students can use the information in another familiar situation; and students can break information into parts to explore understandings.

In this test, the total score for the pre - test was 55 and 92 for the post - test. This indicates that there is improvement in the performance of the respondents in the post - test. T - test was applied to determine whether there is significant difference between the pre - test and post - test and it was found that the calculated t - value (4.96) was greater than the table value of t at.05 level (2.04) and.01 level (2.76). Hence, null hypothesis is rejected and we can conclude that there is significant difference between the pre - test and post - test performances regarding understanding of the level of students' learning.

vii) **Question Paper Setting:** The respondents were asked to set 6 questions of different difficulty order ranging from 1 to 6 for End Semester Examination in both the pre - test and post - test experiments. The questions were then analysed and categorised in terms of Bloom's Taxonomy Coding Scheme. The findings in this regard are provided in Table 5.2.6 and it clearly reveals the performance of the respondents in question - setting in the pre - test and post - test experiments.

The total score calculated for the pre - test (87) is much lower than the total score for the post - test (127). Therefore, it can be seen that there is improvement in question setting according to the six Cognitive levels of Bloom's Taxonomy in the post - test. T - test was applied to find out if there was significant difference between the two tests. It was found that the calculated t - value (7.39) is much greater than the table value of t at.05 level (2.04) and.01 level (2.76). Hence, null hypothesis is rejected and we can conclude that the respondents showed significant improvement in question - paper setting according to the Cognitive levels of Bloom's Taxonomy in the post - test.

C) **View of participants on various issues related to the experiment:** The views or opinions of the participants on



various issues related to experiment on question paper setting as per Bloom's Taxonomy are provided in the following paragraphs:

**i) Opinion of participants on the quality of Intervention and need of training on question paper setting:**

60% of the respondents revealed that they found the quality of training on question - setting provided during the process of the experiment to be very good, and 40% said it was good. All the respondents (100%) declared that there is a need for conducting training on question - paper setting for every teacher.

**ii) Classification of Questions set according to the Cognitive Domain of Bloom's Taxonomy:**

The respondents were given a set of six questions belonging to different Cognitive levels of Bloom's Taxonomy and they were asked to write down in which Bloom's Taxonomy level each of them belong. The result showed that 6.67% of the respondents got a low score of 1, 10% got a score of 2, 16.66% got a score of 3, 40% got a score of 4, 20% got a score of 5 and 6.67% got a perfect score of 6 where they placed all the questions correctly in their proper category of the Cognitive levels of Bloom's Taxonomy. This result indicates that since only a small group of the respondents (33.33%) were in the low score range of 1 – 3, and majority of the respondents (66.67%) were in the high score range of 4 – 6, we can conclude that the intervention was successful and the respondents now have a good understanding of classification of questions set according to the Cognitive levels of Bloom's Taxonomy.

**Suggestions for Improvement in Question Setting**

- 1) The study found that majority of the sampled teachers had no training in question paper setting. Teacher Training Programmes/Workshops/Seminars on Question Paper Setting should be periodically conducted by the concerned authorities.
- 2) Teachers need to be made aware of Bloom's Taxonomy and its relevance in the field of education, particularly in question paper setting. It may be made an integral part of the curriculum in teacher training programmes.
- 3) Teachers need to be informed of the importance of maintaining the correct balance between lower and higher order cognitive questions. Teachers cannot set an examination paper comprising of numerous Lower Order Cognitive Questions. Effective questions that include problem solving and complex thinking skills should be adequately included to stimulate students' mental activities.
- 4) Teachers selected for setting of question papers should be given short training (one day) on Bloom's Taxonomy. If this is not possible, they should be provided with information regarding Bloom's Taxonomy Coding Scheme and be instructed to set questions accordingly.
- 5) Teachers need to design their instructional objectives and student learning activities to encompass questions, topics and activities that will challenge students to use higher cognitive abilities.
- 6) Question banks comprising of model questions belonging to different cognitive levels should be

provided to the teachers to be used as guidelines while setting question papers.

**6. Conclusion**

In order to produce useful graduates who can make useful contributions to the economy, we must provide quality higher education. An important objective of education is to develop and promote the higher cognitive abilities of students such as abstract and logical thinking abilities, critical and analytical skills, evaluative and problem solving skills and many others. Teachers need to be given more awareness regarding the cognitive levels and how to develop these higher cognitive abilities. Teachers need to design their instructional objectives, teaching - learning activities and evaluation methods in such a way as to promote and develop the reasoning, constructive and problem solving skills of students.

Teachers need to be made aware of the importance of developing and functioning at the higher cognitive levels, how to plan teaching objectives and learning activities to promote higher cognitive thinking, what innovative pedagogical techniques to apply in the classroom, how to frame questions to test and challenge the higher thinking skills of students, how to engage and nurture these higher cognitive abilities and so on. Rote memorization and bookish knowledge should be done away with as much as possible. Less dependence on lecture method and more emphasis on interactive methods like discussions, feedback, debates, etc will surely improve the teaching – learning process. Bloom's Taxonomy will serve as an effective tool guiding the faculty to arouse the curiosity of learners in their subjects. If we can gradually adjust our way of teaching and questioning towards higher order cognitive skills according to Bloom's Taxonomy and use it to help design examinations and analyze the results, it will greatly improve the quality of assessment in education.

**7. Future Scope**

Research work may be undertaken in the following related fields or areas:

- 1) Use of Bloom's Taxonomy for designing instructional objectives and learning activities.
- 2) Implications of Bloom's Taxonomy for developing and designing curriculum.
- 3) How to use Bloom's Taxonomy in the classroom for effective teaching and learning.
- 4) Analytical study of teaching - learning and evaluation methods at elementary and secondary stages of education in terms of the Cognitive Domain of Bloom's Taxonomy.
- 5) Innovative techniques and methods to promote higher cognitive abilities of students at various stages of education.
- 6) Cognitive abilities/levels of students of elementary and secondary schools in terms of the Cognitive Domain of Bloom's Taxonomy.

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## Author Profile



**Lalchhuanmawii**, Assistant Professor, Department of Education, Pachhunga University College, Mizoram University, NE India