

An Analysis on the understanding of Revised Bloom's Taxonomy and its implications on the Academics.

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Abstract: The aim of the study is to evaluate the understanding level of the Revised Bloom's Taxonomy (RBT) among the Teaching fraternity. For this purpose, an online quiz was conducted to assess comprehension on RBT. The RBT which was proposed by Lorin Anderson and David Krathwohl (2001) is a revision to Bloom's taxonomy expostulated by Dr. Benjamin Bloom in 1956. The RBT has a tremendous impact on the Teaching-Learning Process, so, it's very important for the Teaching fraternity to have a clear idea on the RBT and its implementation, to the betterment of the learners. A thorough analysis has been done on the strength of RBT and the data collected through the online quiz has been interpreted accordingly to find a perfect response in the implementation of RBT.

Keywords: Revised Bloom's Taxonomy, assessment, RBT, Bloom, taxonomy, cognitive domain, meta-cognition, Teaching-Learning process.

1. Introduction:

The purpose of the education is to produce all-round individuals, with the requisite skills set that enhances the learners understanding, help them be competitive and with a special emphasis on values and their ability to integrate and contribute positively to the society (Tanik and Saracoglu, 2011) for the development of human and to protect the environment for the future generations to come. The existence of clear and specific objectives is of great help to both teachers and students (Skilbeck, 2007) to achieve the desired target of human development.

The curriculum in general is prepared with the principle that human development does not end in a certain period and continues throughout life (Yukel, 2007), that is why all the development of all the ages is considered (Crowe *et al*, 2008). The curriculum in an educational system is developed to make use of the meta-cognitive skills, which provide a meaningful learning to the

learners and integrate with their previous learning to bring a Robust Holistic Learning and thus makes curricula a visionary document that takes care of all the requirements of the learners.

1.1 Significance of the study:

Evaluative Case Study has been used as a method to analyze the outcome of the online quiz on Revised Blooms Taxonomy. Evaluator case study is predominately used in the interpretation of a phenomenon in the education sector (Merriam, 1998). To analyze on the understanding of Revised Bloom's Taxonomy and its implications on the academics, the following steps have been devised, and the details are as follows:

1. Analyzed the impact of the Revised Blooms Taxonomy in the Teaching-Learning process.
2. The online question paper on RBT has been analyzed according to the cognitive domain.
3. Thorough analysis on the outcome of the online quiz conducted for the Teaching fraternity on RBT.

2. Literature Review:

Taxonomy in general means the scheme of classification (Oxford Dictionary). In curricula, Taxonomy refers to the progression of outcomes from simple to complex, easy to difficult, and abstract to complex in the building of curricula (Bloom, 1956). So, the taxonomy helps us in integrating the objectives with the outcomes by Cognitive, Affective and Psychomotor (Burnett, 1999). Dr. Benjamin Bloom created Bloom's Taxonomy in 1956, dividing learning into three categories:

- Cognitive: Ability to think (attributes to Knowledge)
- Affective: Emotional connection or Inner-self (attributes to Attitude)
- Psychomotor: The Body's Movements (attributes to Muscular activity)

KSA (Knowledge (Cognitive), Skills (Psychomotor), and Attitude (Affective)) is a popular acronym. The taxonomy of learning behaviors is in fact the goal of learning process. In a learning environment, with each session the learner is learning a new skill, knowledge, or developing a novel perspective to look at things. What is the learner learning and what the outcome of each learning session is and how do we link Topic Learning Outcome (TLO) with the Course Outcomes (CO) to the Program Outcomes (PO) of a course decides how effectively a course is delivered, and the stakes of the learner obviously relies on the faculties understanding and interpretation of RBT.

The Bloom's Taxonomy was more concerned with the objectives making it 'one dimension' (Tutkun & Okay, 2012), it was not designed to measure 'Higher Thinking Skills'. To fill these gaps Revised Bloom's Taxonomy was developed as a two dimension structure that facilitates Learning and Evaluation (Zorluoglu et al, 2017). Lorin Anderson and David Krathwohl revised the Cognitive domain by changing the nouns forms to verb forms and thus created a knowledge matrix, which takes the Teaching-Learning process from simple to complex (Anderson, Krathwohl & Blooms, 2001).

Bloom's Taxonomy	Revised Bloom's Taxonomy
Evaluation	Creating
Synthesis	Evaluating
Analysis	→ Analyzing
Application	→ Applying
Comprehension	→ Understanding
Knowledge	→ Remembering

Table1 Revised Blooms Taxonomy, Anderson, Krathwohl, & Blooms (2001)

In RBT the instruction and assessment are aligned with the specific objectives making it a comprehensive model in Teaching-Learning Process. The two dimensions guided the objectives and facilitated the planning by providing clear instructions, defining assessments, and thereby bringing a stronger connection between objectives and instructions. RBT moved away from simple bits of knowledge accomplishments to achieving the complex learning aspects. It also provided a wide range of assessment models and applications to the faculty to choose on assessments for different types of objectives, thereby validating the Higher Order Thinking Skills.

3. Evaluation and Assessment:

Assessment of quiz questions classified by Revised Bloom's Taxonomy

The use of Revised Bloom's Taxonomy to produce a range of question kinds allows for more effective curricular teaching and learning. Changing the types of questions asked in the classroom from lower-order to higher-order questions aids in comprehensive absorption and analysis of knowledge, allowing students to have a better understanding of the subject matter. While it may be important to ask lower-order questions at the outset of a unit study, teachers must progress to higher-order inquiry in order for their students' full potential to be realized (Jones, Harland, Reid, & Bartlett 2009). Within the integrated classroom environment, this steady development to higher-order inquiry allows the instructor to gain a better understanding.

Furthermore, higher-order questions assist pupils in achieving a higher level of cognitive development (Marshall, Horton 2011). As a result, students with a greater level of cognitive development are more capable of adapting behaviours and addressing complicated problems

(Brendel, Kolbert, Foster, 2002). The higher cognitive level promotes the use of evaluative and creative works, which results in greater cognitive development in the students' brain. Thus, the efficient usage of Blooms Taxonomy in respect to question generation has substantial consequences on both the learning and cognitive development of learners. Another benefit of designing questions around Bloom's Taxonomy is that it allows teachers to measure their students' academic level and conduct formative evaluations throughout the journey of learning the content (Jones, Harland, Reid, & Bartlett 2009). Teachers can better identify their students' intellectual capabilities by employing different levels of questioning and thereby can identify the gaps or susceptible weakness in the learning process of the students. This allows them to focus on specific areas that require immediate attention, rather than take a generalized approach towards all the students. This formative assessment approach can assist both teacher and learner in building a stronger knowledge of the course content, and with this type assessment being at the focus of learning, student performance should substantially improve (Tomlinson, Moon 2013). The ability to use Taxonomy questions for formative assessment is linked to the previous two benefits described, as it allows for a differentiated classroom and higher cognitive growth among students. This focused and one-to-one approach between the teacher and student will add great value to the student's outcome.

This Revised Bloom's Taxonomy can help teachers structurally construct performance parameters of learners, can craft questions to elicit the best response from their students, and provide feedback on students work quickly and efficiently by giving a hierarchy of levels. This method shall add value to the questions that are posed giving a clear understanding to the student about the content and what is expected from the content.

The online quiz questions with the options provided and the way they are graded in various RBT's level has been provided for the purpose.

1. Revised Bloom's Taxonomy deals with _____
 1. Assessment
 2. Teaching
 3. Learning & Assessment
 4. None of the Above

2. How many levels are there in Bloom's Taxonomy?
 1. 5
 2. 7
 3. 6
 4. 8

3. At the **Knowledge** level, students will _____
 1. Argue the point
 2. Justify the statement
 3. Recall information
 4. Categorize topics

4. Which type of question is a sample of **Evaluation**?
 1. Why was it better than...
 2. What sources can you use to support your opinion?
 3. Do you agree with the actions of Ram?
 4. All the above

5. List the order of Revised Bloom's Taxonomy?
 1. Remembering, Applying, Understanding, Analyzing, Evaluating, Creating
 2. Remembering, Understanding, Applying, Evaluating, Analyzing, Creating
 3. Remembering, Understanding, Analyzing, Applying, Evaluating, Creating
 4. Remembering, Understanding, Applying, Analyzing, Evaluating, Creating

6. What does HOTS stand for _____

7. What is the change from Bloom's Taxonomy (1956) to Revised Bloom's Taxonomy (2001)?
 1. Evaluating to Creating
 2. Synthesis to Creating
 3. Creating to Synthesis
 4. Creating to Evaluation

8. Who among the following advocated revised Bloom's Taxonomy?
 1. Anderson and Kalvarthy 2001
 2. Anderson and Krathwohl 2001
 3. Richardson and Kalvarthy 2001
 4. Richardson and Krathwohl 2001

9. "Students to demonstrate that they can judge, critique, or interpret processes, materials, methods etc. using standards and criteria", what is the level of Bloom's taxonomy we are referring to?
 1. Creating
 2. Analyzing
 3. Applying
 4. Evaluating

10. If the questioning prompt is –"What would happen if...", what is the Bloom's Level we are referred to?
 1. Creating
 2. Analyzing
 3. Applying
 4. Evaluating

11. What does LOTS stand for _____

12 Blooms Taxonomy relates to the cognitive skills of the students.

1. TRUE
2. FALSE

13. Identify the odd one out verb form: Discuss, Elaborate, Explain, Emphasize.

1. Discuss
2. Elaborate
3. Explain
4. Emphasize

14. Match the Verb with the Revised Bloom's Level

1. Analyze-----A. Explain
2. Create-----B. Compare
3. Understand----C. Define
4. Remember-----D. Design

15. Does Higher order thinking skills refers to deeper understanding of the content?

1. True
2. False

16. When a faculty is conducting a test based on the classroom instruction, what Revised Bloom's Level is the faculty addressing?

1. Understanding
2. Analyzing
3. Applying
4. Evaluating

17. If students construct a model to show how something works they are following _____ Revised Bloom's Level.

1. Creating
2. Applying
3. Analyzing
4. Remembering

18. Identify which of the following are NOT part of HOTS: Applying, Creating, Evaluating, Analyzing.

1. Creating
2. Analyzing
3. Applying
4. Evaluating

19. After watching the video, if students are asked to defend the actions of the main character. What level of Revised Bloom’s Taxonomy is being referred?

1. Analyzing
2. Creating
3. Evaluating
4. Remembering

20. When Bloom’s Level –**Understanding** is referred, what does that mean?

1. Student can justify a stand or decision.
2. Student distinguishes between different parts.
3. Student can explain ideas or concepts.
4. Student can use the information in a new way

The Analysis of the e-quiz question paper on the basis of Revised Bloom’s Taxonomy:

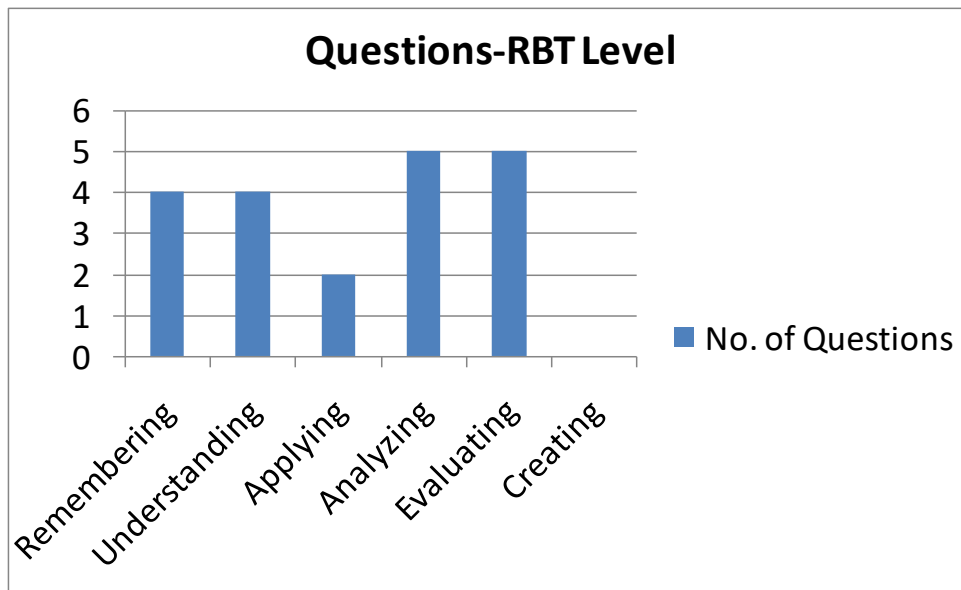


Figure1 Distribution of e-quiz questions on the basis of Cognitive Level

Q. No.	RBT Level	Details	Levels Higher Order Thinking Skills (HOTS) Lower Order Thinking Skills (LOTS)
1	Level IV	Analyzing	HOTS
2	Level I	Remembering	LOTS
3	Level II	Understanding	LOTS
4	Level IV	Analyzing	HOTS
5	Level II	Understanding	LOTS
6	Level I	Remembering	LOTS
7	Level III	Applying	LOTS
8	Level I	Remembering	LOTS

9	Level V	Evaluating	HOTS
10	Level V	Evaluating	HOTS
11	Level I	Remembering	LOTS
12	Level II	Understanding	LOTS
13	Level V	Evaluating	HOTS
14	Level IV	Analyzing	HOTS
15	Level II	Understanding	LOTS
16	Level IV	Analyzing	HOTS
17	Level IV	Analyzing	HOTS
18	Level III	Applying	LOTS
19	Level V	Evaluating	HOTS
20	Level V	Evaluating	HOTS

Table2 Details of categories of e-quiz questions under RBT level

Pie chart distribution of e-quiz questions:

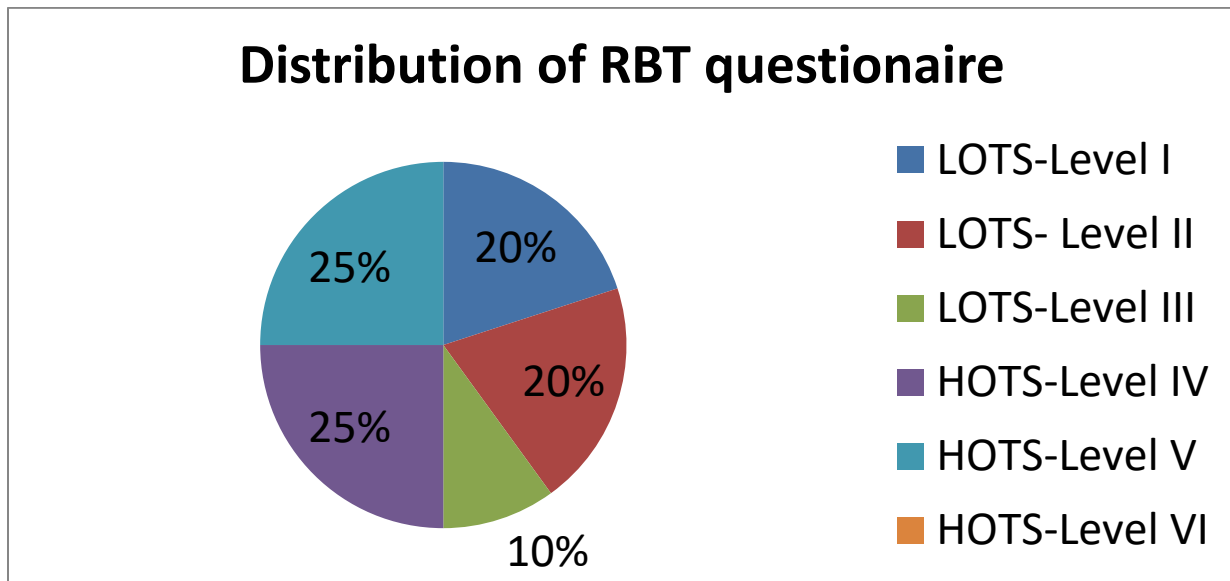


Figure2 Distribution of e-quiz questions under LOTS and HOTS

S.No.	Level	RBT Level	Questions Numbers	Total Questions
1	LOTS	Level I	2, 6, 8, 11	4
2	LOTS	Level II	3, 5, 12, 15	4
3	LOTS	Level III	7, 18	2
4	HOTS	Level IV	1, 4, 14, 16, 17	5
5	HOTS	Level V	9, 10, 13 19, 20	5
6	HOTS	Level VI	---	---

Table 3 Details of categories of e-quiz questions under LOTS and HOTS

The multiple choice questionnaire had 20 questions, out of this 10 questions are from Lower Order Thinking Skills which represent Level-I *Remembering*, Level-II *Understanding* and Level-III *Applying* and the questions assigned on the basis of their levels are 4 questions from Level-I, 4 questions from Level-II and 2 questions from Level-III. The 10 questions are from Higher Order Thinking Skills which represent Level-IV *Analyzing*, Level-V *Evaluating* and Level-VI *Creating* and the questions representing their levels are 5 questions from Level-IV, 5 questions from Level-V. No questions could be accommodated from the Level VI as it promotes a descriptive question.

S. No.	Order of Thinking	Numbers of Questions	Percentage
1	LOTS	10	50%
2	HOTS	10	50%
	Total Questions	20	

Table 4 Number and percentage of e-quiz questions

The questions are equitable distributed on the order of thinking Lower Order Thinking Skills 10 questions and Higher Order Thinking Skills 10 questions. To achieve proficiency or mastery on a particular subject we need two types of knowledge, i.e., factual knowledge and conceptual knowledge. The factual knowledge emphasis on getting the facts right, which means setting the basics right and conceptual knowledge emphasis on using the basics to set something bigger and better and taking them to the fringe of the subject. To build the subject or to help the subject evolve and add value to the domain knowledge the emphasis should be on to generate questions on enhancing the conceptual knowledge which in turn is to promote HOTS. So, the goal of all the subjects should be to promote HOTS among students. There should be a clear demarcation between LOTS and HOTS, questions on LOTS shall constitute fewer marks when compared to questions on HOTS. The question papers shall emphasize significantly on HOTS.

S.No.	Level	RBT Level	Questions Numbers	Total No. Questions	Total No. Marks
1	LOTS	Level I	2, 6, 8, 11	4 X 1	4
2	LOTS	Level II	3, 5, 12, 15	4 X 1	4
3	LOTS	Level III	7, 18	2 X 1	2
4	HOTS	Level IV	1, 4, 14, 16, 17	5 X 2	10
5	HOTS	Level V	9, 10, 13 19, 20	5 X 2	10
6	HOTS	Level VI	---	---	
Total Questions/ Total Marks				20	30

Table 5 Details of marks assigned for each question

The benchmark set as 50% and those who scored 50% and above, that means scored 5 marks and above out of the total 10 marks in LOTS level and 50% and above, that means scored 10 marks and above out of the total 20 marks in HOTS level. The assessment is done for the total 30 marks all those who have scored 15 and above are considered as participants with clear understanding on the RBT.

4. Findings:

The Online National e-quiz on Revised Bloom's Taxonomy was conducted from 19th to 23rd June 2020. A good number of 2421 participants from all over India took the quiz, the faculty members, research scholars and teaching staff from Central, State, Private, Deemed Universities and Technical universities like IIT, NIT, State Technical universities, affiliated Engineering colleges, Autonomous Engineering colleges, faculty from Junior colleges, Degree colleges, Polytechnic colleges, staff from affiliated CBSE board, and School teachers participated in the online e-quiz. It's a honor that we could luckily gather the feedback from almost all the various stages of the student's learning process, right from School, Junior college, Degree college and professional colleges like polytechnic, top engineering colleges like IIT, NIT, and state universities. The faculty attending the quiz itself says a lot that the teaching fraternity exclusively depends on Revised Bloom's Taxonomy while referring to the Teaching-Learning process.

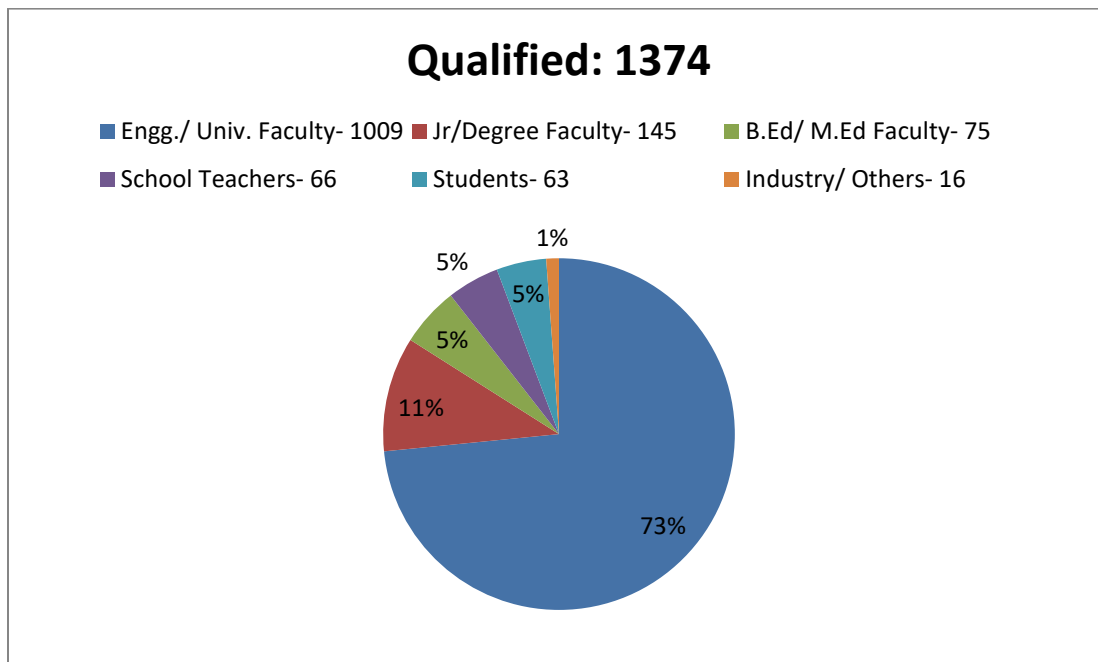


Figure3 Total qualified participants on the basis of their affiliations.

Out of the total 2421 participants only 1374 qualified that means they have scored 15 marks and above out of the total 30 marks, a total of 1047 participants did not achieve the set benchmark. When we consider it in terms of percentage then it is $1374/2421$ is 56% cleared the quiz and nearly 44% faculty could not clear the quiz. Here is the detailed analysis of the entire faculty who cleared the quiz with the emphasis on their affiliations for our understanding on how much of Revised Bloom's Taxonomy has penetrated into their Teaching-Learning process. The majority of the Engineering and University faculty participated in the quiz and 1009 faculties cleared the quiz, making it clear that the Revised Bloom's Taxonomy is extensively used in the Technical Institutions and University probably a part of the credit should go to National Board of Accreditation (NBA) for the importance given to RBT in Teaching-Learning process.

Total 145 faculties (11%) from Junior and Degree Colleges cleared the quiz and the majority of the faculty were from Degree colleges, and very few faculty from the junior colleges participated making it clear that the emphasis of a Junior college faculty is the competitive exams like Indian Institute of Technology- Joint Entrance Exam (IIT-JEE), and State Engineering exams like Engineering and Medical Common Entrance Test (EAMCET), the autonomous degree college faculty were the majority who participated and cleared the quiz among the degree colleges.

75 faculty (5%) from the Education department i.e. the institutes that offer Bachelor of Education (B.Ed) and Master of Education (M.Ed) cleared the quiz, 66 school teachers (5%) cleared the quiz, and the majority faculty in Government schools are well qualified with either B.Ed or M.Ed and probably in the private schools the low retention (ever floating) of school teachers, and poor salary package may be the reason for the poor participation. A great revelation is from students of technical education and university, 63 students (5%) cleared the quiz, which means that they knew what RBT is and understood its importance, and this is a great achievement that RBT is making an impact in the lives of its most important stake holder, i.e. students. 16 participants (1%) from the industry have cleared the quiz probably they may be associated with the internal training program in their organization or might be people interested in the field of Education. We can clearly see the impact of RBT in Teaching-Learning process and it aids the teaching fraternity to give their best and help the students enjoy the journey and make it a happy learning.

5. Conclusion:

The Revised Bloom's Taxonomy has been an indispensable tool for the teaching fraternity and it had made an impact in facilitating a smooth transition of the otherwise challenging journey of learning and relearning. The emphasis for all the subject teachers shall be to promote Higher Order Thinking Skills and encourage the students to develop their cognitive aspects by increasing the level of understanding by taking them from simple to complex and concrete to abstract (Jideani and Jideani (2012)). The Revised Bloom's Taxonomy not only promotes Higher Order Thinking Skills, but also helps the teachers measure the students' intellectual capabilities by the way of questioning and thereby identify the gaps or susceptible weakness in the learning process of the students.

The Evaluative case study has been done by conducting a National e-quiz on Revised Bloom's Taxonomy for a period of one week and almost 2500 faculty participated. It is found that faculty from engineering colleges/ universities i.e. Technical educational institutions are having a clear idea on the process of RBT. It's not only the faculty of technical education, but even the students of technical education have shown a keen interest and understanding on RBT. A considerable amount of work has to be done as far as the school education, junior college and degree colleges are considered to promote the importance of RBT.

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