Quest Journals
Journal of Research in Humanities and Social Science
Volume 9 ~ Issue 10 (2021)pp: 01-07
ISSN(Online):2321-9467
www.questjournals.org

Research Paper

Perception of students regarding the Cognitive Levels of Bloom's Taxonomy

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***ABSTRACT**: Higher-order thinking is an instructional strategy supported by research. Often referred to as critical thinking skills, it is more than simple recall of facts or information retrieval but rather a function of the interaction between cognitive strategies, meta-cognition, and nonstrategic knowledge during problem solving. Students often have difficulty performing at these higher cognitive levels. In the past decade, considerable effort has been directed toward developing students' critical-thinking skills by increasing student engagement in the learning process.*

***KEY WORDS:** Perception, Cognitive, Bloom's Taxonomy, Educational Objectives*

Received 20 September, 2021; Revised: 03 October, 2021; Accepted 05 October, 2021

I. INTRODUCTION

Education is a process that attempts to change an individual's behaviour. An important aim of education is to provide students with lasting learning of concepts, and to improve their thinking skills. Educational institutions worldwide are recognizing that teaching core courses in the curriculum alone is not sufficient to equip students for the knowledge economy. To be prepared for the demands of the knowledge economy, students need to know how to use their knowledge and skills - by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, and making decisions.

Most faculties would agree that academic success should be measured not just in terms of what students can remember, but what students are able to do with their knowledge. It is commonly accepted that memorization and recall are lower order cognitive skills (LOCS) that require only a minimum level of understanding, whereas the application of knowledge and critical thinking are higher-order cognitive skills (HOCS) that require deep conceptual understanding . Higher-order thinking skills are "goal directed, multi-step, strategic processes such as designing, decision-making and problem solving" that require analysis, evaluating, connecting, imagining, elaborating and synthesizing (Iowa Department of Education 1989).

Higher-order thinking is based on the concepts in the cognitive domain of Bloom's Taxonomy and suggests that some types of learning require more cognitive processing than others. Bloom's Taxonomy suggests that skills involving analysis, synthesis and evaluation are of a higher order, requiring different instructional practices. It also suggests that higher-order thinking involves "the learning of complex judgmental skills such as critical thinking and problem solving." 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.

II. METHODOLOGY

Objectives: The study has the following objectives –

1. To study the perceptions of students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy of Educational Objectives.
2. To find out at what cognitive level of Bloom's Taxonomy the students of Higher Secondary, Collegiate and University are functioning.

Method of study: Descriptive survey method, which comes under Quantitative Research, was employed to achieve the objectives of the study.

Population: All Higher Secondary, College and University students studying Education subject in different Higher Secondary Schools, Colleges and Universities in Mizoram constituted the population of students for this study.

Sample: The sample for the study consisted of 776 students- 380 samples consisted of Class XII students reading Education in various Higher Secondary Schools in Aizawl; 310 students of 5th Semester BA (Education Core) studying in various degree Colleges of Aizawl; and 86 students studying MA (Education) in Mizoram University and ICFAI University. 258 of the sampled students were male and 518 were female.

Data Collection: Primary data consisting of higher secondary, college and university students were personally collected by visiting Higher Secondary Schools, Colleges and Universities in Aizawl city, Mizoram.

Tools Used

1. Rating Scale: Rating Scale consisted of 2 sets, Set I and Set II, with 6 questions from Educational Psychology course in each set, which the students have to rate according to difficulty level on a scale of 1 to 6. Rating Scale was administered to 776 students in total - 380 students of Class XII, 310 students of B.A Education; and 86 students of M.A Education.

2. Bloom's Taxonomy Coding Scheme : The Coding Scheme basically comprises of the six cognitive levels given by Bloom, viz., Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. Key words or verbs for each level was compiled to be used as a guide for structuring or framing questions and tasks. This tool was used in setting questions for the Rating Scale.

III. ANALYSIS OF RESULT AND MAJOR FINDINGS

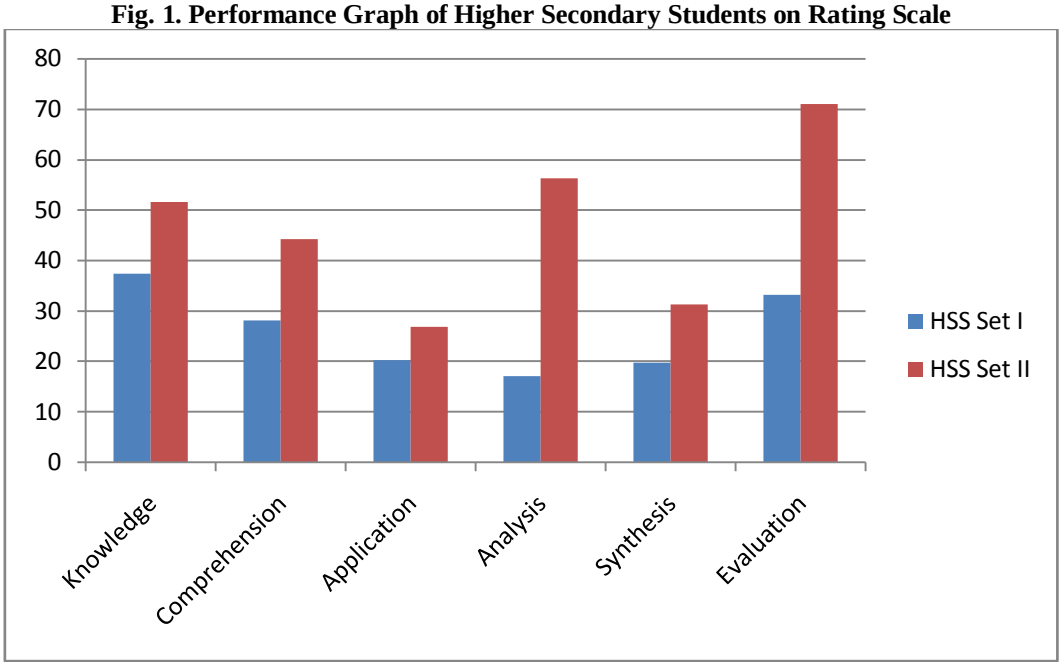
A Rating Scale was constructed by the investigator to study the perception of students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy and to find out the cognitive level at which the students are functioning. The Rating Scale consisted of two sets (Set I and Set II) with 6 questions in each set which the students have to rate on a scale of 1 to 6 based on difficulty order. The questions provided in the Scale had been set beforehand by the investigator from Educational Psychology paper, which is a common paper in Class XII, B.A and M.A Education courses. These questions had been set based on the six Cognitive levels of Bloom's Taxonomy. Clear instructions were given to the sampled students and they were told to give a rating of 1 to the question they think is easiest, 2 to the second easiest and so on. A rating of 6 was to be given to the most difficult question. After Set I was completed, the investigator gave a short lecture on the Cognitive Domain of Bloom's Taxonomy, what type of questions should be asked in each level and what key verbs should be used for framing questions, what learning outcomes are expected in each level and model questions for each level of the Cognitive domain. The investigator prepared a chart on these topics to help make the presentation clearer for the students. After an interval of a few days, the test was conducted again with Set II to determine whether there is improvement in the perception of students regarding the difficulty level of questions. The sample for this test consisted of 380 Higher Secondary students, 310 College students and 86 University students reading Education subject in Class XII, V Semester B.A (Education) and M.A (Education) Ist and IIIrd Semesters. The findings in this regard are presented in the following paragraphs.

1) Perception of Higher Secondary Students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy: The findings on the perception of Higher Secondary students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy are presented below:

Table 1. Performance of Higher Secondary Students on Rating Scale

HIGHER SECONDARY (N=380)		
Taxonomy Level	**Set I (Correct Response %)**	**Set II (Correct Response %)**
Knowledge	37.37%	51.58%
Comprehension	28.16%	44.21%
Application	20.16%	26.84%
Analysis	17.11%	56.32%
Synthesis	19.74%	31.32%
Evaluation	33.16%	71.05%

Fig. 1. Performance Graph of Higher Secondary Students on Rating Scale



The above table shows the performance of Higher Secondary Students on Set I and Set II of the Rating Scale to test their perception regarding the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy. The scores are given in terms of percentage of correct answers. In Set I, the students got the highest number of correct answers in Knowledge level (37.37%) followed by Evaluation (33.16%), Comprehension (28.16%), Application (20.26%), Synthesis (19.74%) and Analysis (17.11%) respectively. In Set II, the highest number of correct answers belonged to Evaluation level (71.05%), followed by Analysis (56.32%), Knowledge (51.58%), Comprehension (51.58%), Synthesis (31.25%) and Application (26.84%) respectively. Thus, it can be seen that the scores in Set II are higher than Set I in all the Cognitive levels.

The percentage of correct answers in each level of the Cognitive domain in both Set I and Set II clearly reveal that there is improvement in the performance of Set II in all the levels. The highest improvement is seen in Analysis domain followed closely by Evaluation, Comprehension, Knowledge, Synthesis and Application domains respectively. The highest margin of improvement was seen in Analysis and Evaluation domains and the lowest improvement margin was seen in Application domain.

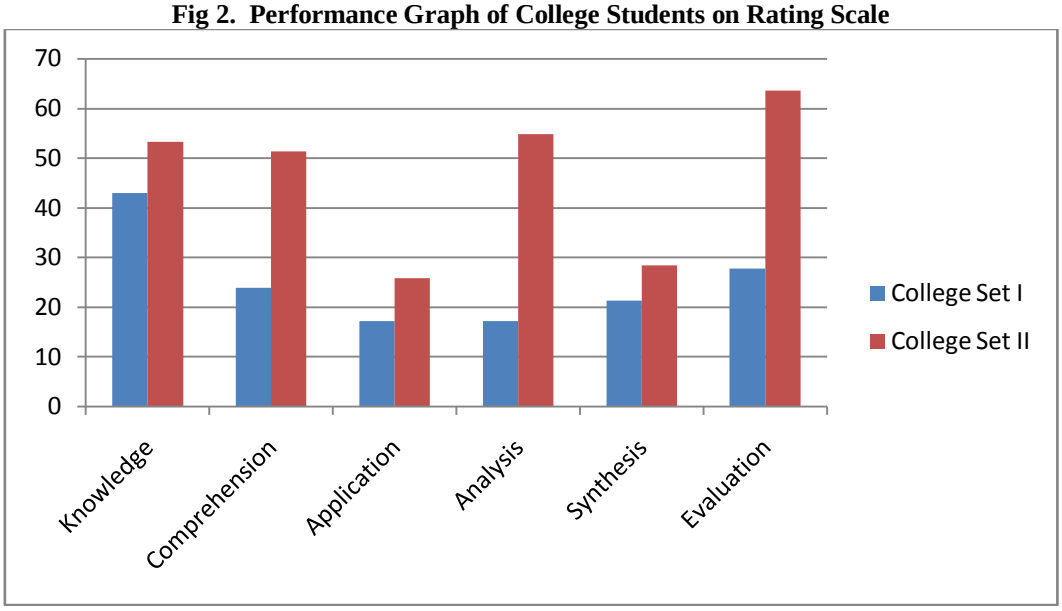
T-Test for large correlated sample (Single Group Method) was employed to find out if there was significant difference between the performance of Higher Secondary students in Set I and Set II. It was found that the calculated t-value (12.2) was much higher than the table value of t at .05 level (1.97) and .01 level (2.59). Hence, we may conclude that there is a significant difference between Set I and Set II performances and the short lecture on the Cognitive domain of Bloom's Taxonomy had a positive impact on the perception of students regarding the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy of Educational Objectives.

2) Perception of College students with regard to the difficulty level of questions set according to the Cognitive Domain of Bloom's Taxonomy: The findings on the perception of College students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy are presented below:

Table 2. Performance of College Students on Rating Scale

COLLEGE (N=310)		
Taxonomy Level	**Set I (Correct Response %)**	**Set II (Correct Response %)**
Knowledge	42.90%	53.23%
Comprehension	23.87%	51.29%
Application	17.10%	25.81%
Analysis	17.10%	54.84%
Synthesis	21.29%	28.39%
Evaluation	27.74%	63.55%

Fig 2. Performance Graph of College Students on Rating Scale



The above table shows the performance of College students on Set I and Set II of the Rating Scale. In Set I, the sampled students scored the highest number of correct answers in Knowledge level (42.90%), followed by Evaluation (27.74%), Comprehension (23.87%), Synthesis (21.29%), Application (17.10%) and Analysis (17.10%) with the same scores at the bottom. In Set II, we see the highest score in Evaluation level (63.55%), followed by Analysis (54.84%), Knowledge (53.23%), Comprehension (51.29%), Synthesis (28.39%) and Application (25.81%) respectively. In this sample, we see again that the scores in Set II are higher than the scores in Set I in all the Cognitive levels.

The percentage of correct answers in each level of the Cognitive domain in Set I and Set II clearly indicates that there is improvement in the performance of Set II in all the levels. The highest improvement is seen in Analysis domain followed by Evaluation, Comprehension, Knowledge, Application and Synthesis domains respectively. The highest margin of improvement was seen in Analysis and Evaluation domains and least improvement margin in Application and Synthesis domains.

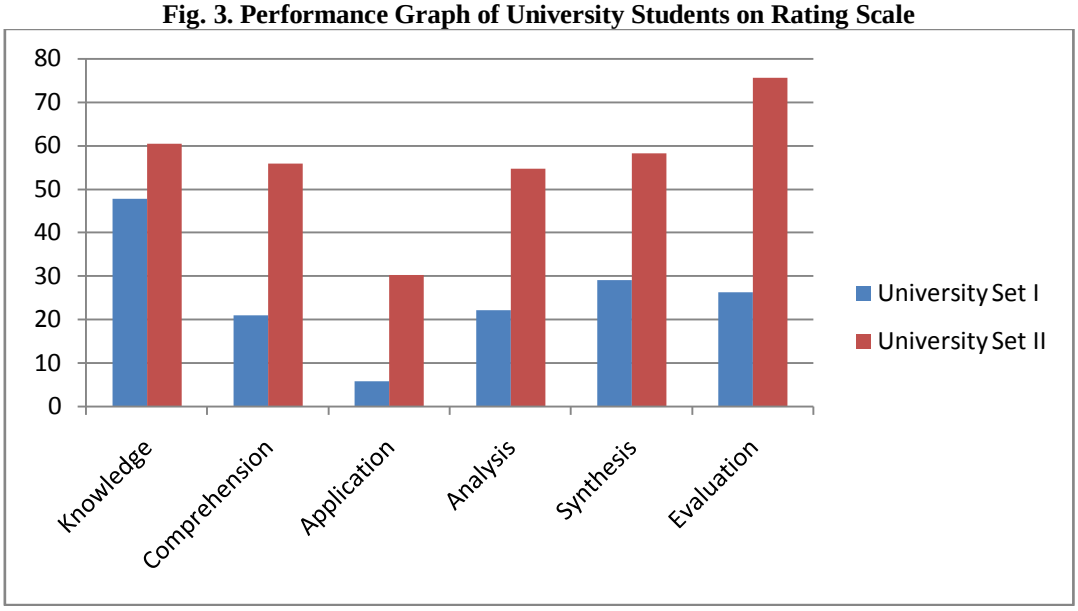
T-Test was applied to find out if there was significant difference between the performances in Set I and Set II. It was found that the calculated t-value (17.64) was greater than the table value of t at .05 level (1.97) and .01 level (2.59). Therefore, we can conclude that there is a significant difference between the performance in Set I and Set II. The short presentation given by the investigator on the Cognitive domain of Bloom's Taxonomy had a successful impact on the perception of students regarding the difficulty level of questions set according to the Cognitive Domain of Bloom's Taxonomy.

3) Perception of University Students with regard to the difficulty level of questions set according to the Cognitive Domain of Bloom's Taxonomy: The findings on the perception of University students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy are presented below:

Table 3. Performance of University Students on Rating Scale

UNIVERSITY (N=86)		
Taxonomy Level	**Set I (Correct Response %)**	**Set II (Correct Response %)**
Knowledge	47.67%	60.47%
Comprehension	20.93%	55.81%
Application	5.81%	30.23%
Analysis	22.09%	54.65%
Synthesis	29.07%	58.14%
Evaluation	26.28%	75.58%

Fig. 3. Performance Graph of University Students on Rating Scale



The above table presents the scores of University students on Set I and Set II of the Rating Scale constructed to test their perception of the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy. In Set I, the highest percentage of correct answers belonged to Knowledge domain (47.67%), followed by Synthesis (29.07%), Evaluation (26.28%), Analysis (22.09%), Comprehension (20.28%) and Application domain (5.81%) respectively. In Set II, we see the highest score in Evaluation (75.58%), followed by Knowledge (60.47%), Synthesis (54.65%), Comprehension (55.81%), Analysis (54.65%) and Application (30.23%) respectively.

The percentage of correct answers in each Cognitive level in both Set I and Set II clearly reveals that there is improvement in Set II as compared to Set I in all the levels after the short presentation by the investigator. The highest improvement is seen in Evaluation domain followed by Knowledge, Synthesis, Comprehension, Analysis and Application. The largest margin of improvement was seen in Evaluation with the smallest improvement margin in Knowledge domain.

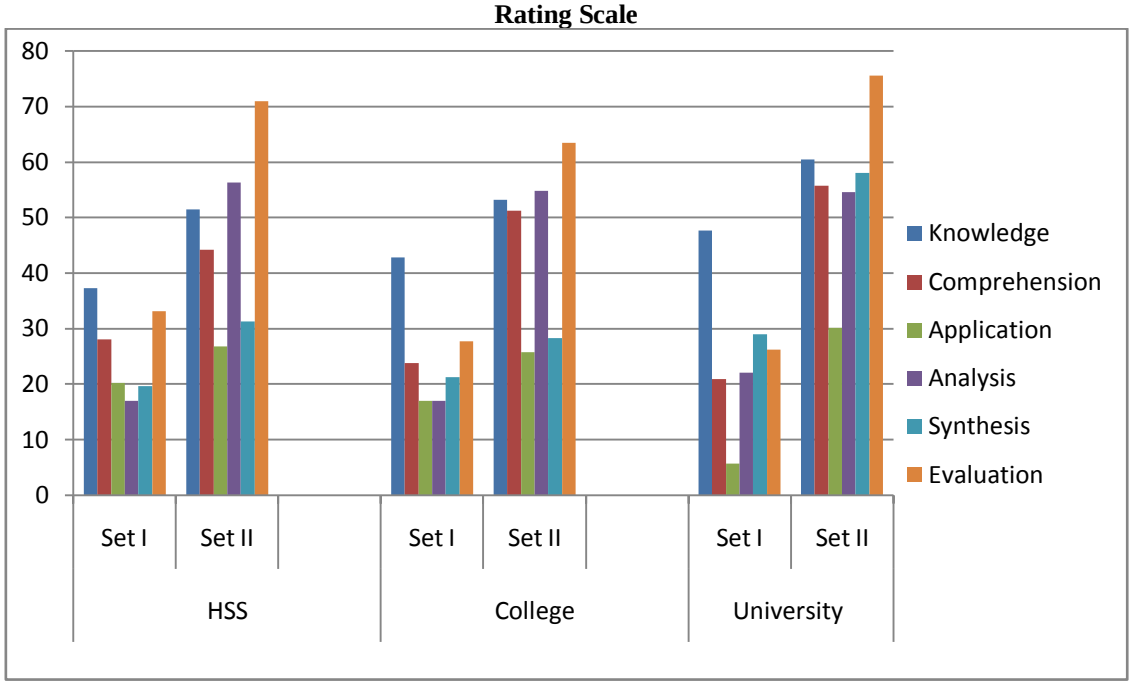
T-Test for large correlated sample (Single Group Method) was employed to find out if there was a significant difference between the scores of Set I and Set II. It was found that the calculated t-value (9.09) was much greater than the table value of t at .05 level (1.99) and .01 level (2.64). Hence, we can conclude that there is a significant difference between Set I and Set II performance and the presentation on the different Cognitive levels of Bloom's Taxonomy with key verbs, model questions, etc., had an effective impact on the perception of University students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy.

4) Consolidated View of Performance of Higher Secondary, College and University Students on Rating Scale: The perception of Higher Secondary, College and University students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy are presented below:

Table 4. Consolidated scores of Higher Secondary, College and University Students on Rating Scale

Taxonomy Levels	Higher Secondary (380)		College (310)		University (86)	
	Set I	Set II	Set I	Set II	Set I	Set II
Knowledge	37.37%	51.58%	42.90%	53.23%	47.67 %	60.47%
Comprehension	28.16%	44.21%	23.87%	51.29%	20.93%	55.81%
Application	20.26%	26.84%	17.10%	25.81%	5.81%	30.23%
Analysis	17.11%	56.32%	17.10%	54.84%	22.09%	54.65%
Synthesis	19.74%	31.32%	21.29%	28.39%	29.07%	58.14%
Evaluation	33.16%	71.05%	27.74%	63.55%	26.28%	75.58%

Fig 4. Consolidated Picture of Performance of Higher Secondary, College and University Students on Rating Scale



The above table and diagram clearly reveals the performance of Higher Secondary, College and University students on Set I and Set II of Rating Scale constructed to study the perception of students with regard to the difficulty level of questions set according to the Cognitive domain of Bloom's Taxonomy. In the Higher Secondary sample, we see that the perception of students regarding Analysis, Synthesis and Application level questions were quite low in Set I but in Set II, we see marked improvements in most levels except Application and Synthesis levels. The perception of students regarding Application and Synthesis level questions have not improved to a desirable extent.

In the College sample, we see that except for Knowledge level questions, the students have a poor perception of questions from the other Cognitive levels in Set I. We see marked improvements in Set II in most of the levels except Application and Synthesis levels where the improvement margin was quite low.

In the University sample, just like the College sample we see that except for Knowledge level questions, the students have a poor understanding of questions set from the Higher Cognitive levels. In Set II, there was much improvement in all the Cognitive levels except Application level where the improvement margin was still low.

From the above results, we can conclude that the students of higher secondary, collegiate and university stages mainly function at the lower levels of the Cognitive domain. These three groups of students are weak in their perception of questions set from Application and Synthesis levels of the Cognitive Domain of Bloom's Taxonomy. They all show poor application, synthesis and evaluative abilities. They need training to develop their creative, constructive and applicative skills.

IV. CONCLUSION

Teachers and students alike 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 and teaching-learning activities in such a way as to promote and develop the reasoning, constructive and problem solving skills of students. They 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. Interactive methods like discussions, feedback, debates, etc will surely improve the cognitive skills of students and improve the teaching – learning process.

In order to produce useful graduates who can contribute to the knowledge-based global economy, we must provide quality higher education. This means producing graduates who are intuitive and creative, and who are able to use their cognitive skills when faced with problem solving tasks. Students should posses a number of cognitive skills such as an understanding of methodologies or ability in critical analysis. 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. 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.

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