Analysis of Test Items in School Based Assessment and National Achievement Survey with Reference to Learning Outcomes in Science at Middle Stage

Manasi Goswami, R. Mohalik, Susmita Priyadarshini

Professor, Dean of Instruction, Professor in Education, Research Scholar Regional Institute of Education (NCERT), Bhubaneswar, Odisha,751022, India.

ABSTRACT

Learning outcomes in elementary education has been crucially emphasized by the Indian Education Policies as a vital source for holistic development and future learning of a child. This study probes the effectiveness of assessment practices in Science, for the students of class VIII with the mandated Learning Outcomes as designed by National Council of Educational Research and Training (NCERT) using Revised Bloom's Taxonomy as a conceptual framework. It offers a comparative study between standardized National Achievement Survey (NAS) questions and teacher made test items, which emphasizes on the broad level of cognitive distributions while adhering to the specified learning outcomes of NCERT Science Curriculum. The methodology interprets the empirical data of 300 teacher made tests and NAS data (2017 and 2021) through a mixed method approach. The findings revealed that the teacher made assessments overwhelmingly favoured lower order skills of cognition such as remembering rather than understanding whereas the NAS endured progressive skills such as applying, conceptualizing and analysing. The insights of this study jeopardizes the gaps in teacher's awareness, preparedness, implementation of curriculum as well as the ensuring the coherence between the competency bases objectives and classroom assessments. The study also accentuates the necessity for training teachers for the targeted interventions of designing the assessments to bridge and nurture the learning of science at the middle school level in meaningful manner. This analysis also reveals the unevenness in the integration of curriculum defined assessments and teacher made test questions. These highlights are crucial for educators and curriculum developers those who aim to amplify the education of science at middle school level.

Keywords- Learning Outcomes, National Achievement Survey, Revised Blooms Taxonomy, School based assessment, Science Curriculum

INTRODUCTION

The quality of learning in elementary education has always been a focal point in Indian Education Policy, subsequently mentioned in 12th five year plan aligning with the commitment of Sustainable Development Goal 4 particularly target 4.1. To ensure that quality of learning has met, regular learning assessment at elementary level has been prioritized (NCERT 2017). Continuous tests are not only help the learners to identify their learning difficulties but it also allow the teachers and administrators to recognize critical information to maintain quality education. These test habits of students and item preparation exercises of teachers, both are equally crucial indicators for exploring the efficacy of elementary education across India. For a systematic evaluation, in every three years a massive assessment drive is carried out in whole India through periodical National Assessment Survey (NAS) tests. However, most of the teachers at elementary level in India are not much aware of the criteria, or curricular expectations against which students need to be assessed and are assessed through NAS. These learning expectations are provided by objectives, more precisely by instructional objectives that in turn are translated into learning outcomes. Further the assessment of students learning outcomes (LOs) is a critical component of an effective education system and in the context of science education, well-designed assessments that measures the students all round development. The purpose of assessment is to determine whether the expectations (learning outcomes) match the standards set by schools or

national level educational administration (Chen et al., 2021). Keeping in view that learning always operates in continuum, National council of educational research and training (NCERT), India, has developed a document which includes learning outcomes in all the curricular areas at elementary stage (Learning Outcomes at the Elementary Stage, NCERT, 2017). These learning outcomes also find linkage with the curricular expectations and the pedagogical processes. These serve as the crucial indicators of what students are expected to know, understand and apply by the end of the learning. The expected learning outcomes have been developed class wise (NCERT Science text book for class VIII), to use those as evaluation criterion to guide the assessment (Bumen,2006). It is imperative that criteria used in the evaluation and assessments should be equivalent to the criteria used in the formation of curriculum.

In recent years the educational paradigm has shifted from merely rote memorization to the development of higher-order thinking skills focusing on competency based education. This necessitates a robust system for designing and evaluating learning outcomes, for which taxonomies are frequently used to maintain the standard of education (Nursa'ban et al., 2019). Taxonomies mediates a common language between learning-teaching- evaluation activities and keep alert all those involved in the transaction of curriculum, namely students, teachers, evaluators, educational administrators and planners. The taxonomy has been developed by Bloom to categorize the learning outcome according to logic of cognitive, affective and psychomotor domains (Bloom et al.,1956). However, because of the changes in cognitive psychology, meta cognitive knowledge has been introduced in the original Blooms taxonomy. As a result, a more comprehensive and all-encompassing Revised Bloom (RBT, 2001) has been developed.

The present study intend to make a comparative analysis of learning outcomes in Teacher-made questions of class VIII particularly in the subject science along with the specified learning outcomes mentioned in National Achievement Survey Questions of Class VIII Science curriculum. The preliminary reports shows that teacher prefer using items prepared by themselves more often than the standardized ones. As in contemporary science examination practices particularly in elementary level there exists an expectations that the teachers those who are recently trained with the latest pedagogical practices that aligned with achieving the learning outcomes should align their assessment items with the specified learning outcomes (Aristeidou et al., 2020) . Further the study aims to explore the intended learning outcomes of class VIII science curriculum with reference to Revised Blooms Taxonomy, the alignment of the Questions prescribed in National Achievement Survey and Teacher-made Tests with the intended learning outcomes and inter compatibility between the teacher-made test items used for frequent and regular examinations at class eight level science with standardized test items developed for National Achievement Survey (NAS). It is a large- scale survey of student's learning competencies, undertaken by Ministry of Education, Government of India. The assessment frame work is designed by NCERT to assess student's capabilities in relation to learning objectives. Since 2017, the learning outcome based test items are executed to evaluate children's progress and learning competencies as an indicator of efficiency of education system. Hence it is imperative to find the interdependency of such elements of our curriculum.

By employing Revised Bloom's Taxonomy as an analytical framework, this study provides an empirical evidence to offer practical recommendations for understanding and analysing the question patterns and developing learning outcomes and assessment items. Along with this the study reveals the NAS assessment increasingly supports higher-order thinking skills which can potentially develop the learning outcomes. The findings have notable implications for further assessment reforms and for successfully incline Competency based education in India.

REVIEW OF RELATED LITERATURE

The relationship between Curriculum defined Learning Outcomes and teacher made assessment practices have been extensively studied in elementary education particularly in the field of science education. Revised Bloom's Taxonomy have shown the importance of aligning assessments with clearly defined cognitive levels from remembering to higher order thinking skills such as creating and evaluating (Anderson & Krathwohl, 2001). Learning Outcomes and Revised Bloom Taxonomy has demonstrated that for every cognitive process there exist a learning outcome which were not homogenously distributed to the categories of cognitive process dimensions (Zorluoglu, 2020). Further he analysed that the learning outcomes are in conceptual knowledge

dimensions and the questions included is mostly in factual knowledge dimensions which creates a huge gap in the assessment and making it difficult to achieve the learning outcomes. In Indian context, the learning Outcomes for science education at the elementary stage are predetermined (NCERT, 2017), yet studies indicates persistent challenges in the implementations as there lack in the teacher training and proper understanding of Revised Blooms taxonomy (Ahmadshah, 2019).

Research on assessment practices in elementary science education reveals a persistent gap between the intended learning outcomes and the actual teacher-made classroom assessment. The distinction between testing and assessment can be made as assessment is the broader sets of comprehensive process of evaluating the student holistically whereas testing is more specific and structured event that measure the performance of the students against a pre-determined criteria (Brown, 2019). Teacher-made assessment in elementary schools, consistently finding a predominance of lower-order cognitive questions which is mostly focused on factual recall type questions rather than applying and analysing types of test items which has emphasized on standardized tests (Jansen & Möller, 2022). This aligns with the international findings of from Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) assessment, which highlights the challenges of non-alignment of curriculum expectations with the classroom assessment practice (Ehren, 2022). The rapid demand of the skill and competency based workforce, enhances the requirement of reinforcing Learning outcomes based assessment which further intends the importance of developing competency among students. This can be achieved by reflecting both learning outcomes and learning process in the assessment process (Ramona & Bran, 2014).

The Revised Blooms taxonomy again provide valuable insights for analysing the science learning outcomes. These learning outcomes are derived from the curriculum expectations and it demands teachers and stakeholders to direct the learning process in a desired manner and make them responsible and alert towards their role for ensuring quality education (Koireng, 2019). Though India's engagement in science promotion activities is diversifying but this is far away from the developed nations. There still exist a lacuna in people's passion about science and achieving the learning outcomes in science (Mochahari, 2013). The National Achievement Survey (NAS) results provide solid evidences of assessment challenges in science education, showing while in curriculum the learning outcomes like "conducting simple scientific investigations" or "applying scientific concepts to daily life" has been emphasized still students' performance remains weakest particularly in application-based areas. Improved alignment of learning outcomes with assessment could signifyingly enhance the science learning at the elementary level (Hailikari et al., 2022).

The literature finds several requirements such as better teacher and stakeholders understanding of science learning outcomes, analysing and utilising the standardized tests by NAS in the classroom assessment by the teacher, professional development in designing assessment aligning with the learning outcomes and systematic support for improvement of competency based assessment. The review underscores that while most of the work has been done to define the science learning outcomes for elementary grades, there still exists considerable challenges which are mostly undiscovered. The study intend to address these gaps by systematically comparing intended, assessed and achieved learning outcomes in class VIII Science in Indian Elementary Science Education.

OBJECTIVES

The Objectives of the Study is

- To examine the Learning Outcomes in science curriculum of NCERT with reference to the Revised Bloom's Taxonomy.

- To analyse the test items of National Achievement Survey (NAS) 2017 & 2021 with reference to Learning Outcomes as prescribed by NCERT 2017.

- To analyse the Teacher Made Questions with reference to the Learning Outcomes as per NCERT 2017.

- To compare the NAS Questions and Teacher Made Questions with reference to Learning Outcomes.

- To compare the NAS performance of students in science at state and national level in class VIII.

METHOD

The study was employed a comprehensive mixed method approach with a systematic document analysis through secondary sources, quantitative methods to examine the alignment between prescribed learning outcomes, teacher-made assessments and National Achievement Survey for Class VIII Science. Secondary sources used for document analysis are mainly NCERT's Learning Outcomes (2017) and test items of NAS Framework, classifying all 58 prescribed outcomes using Revised Blooms Taxonomy to form a baseline for intended cognitive levels. For teacher-made assessment a sample of 300 test items of class VIII science course which were already been executed for the year 2020-2021 were selected randomly from three different schools respectively i.e., Kendriya Vidyalayas of Bhubaneswar region, Demonstration & Multipurpose School (DMs) of Bhubaneswar and Utkal University High School, Bhubaneswar. The selection of the schools was based on certain criteria; schools implementing Continuous and Comprehensive Evaluation (CCE) pattern as mandated by the National Curriculum Framework and regular assessment by teacher-made questions. The inclusion of both Central Board of Secondary Education (CBSE) and state board schools serves as an important comparative factor. While the first two schools follow CBSE curriculum, the Odisha state school was deliberately selected as its textbooks have been normalized with the NCERT Publications. This normalization provides an appropriate base for comparing the learning outcomes while maintaining the curriculum consistency.

The comprehensive data was collected from the documents of National Achievement Survey 2017 and 2021 for class VIII from the NAS Reports published by Ministry of Education, Government of India along with the state Executive Summary Report for the same years prepared by Directorate of Teacher Education (TE) and State Council of Educational Research and Training (SCERT), Odisha. From these documents a complete list of LOs used in NAS assessments at national and state level, performance percentage for each LO and the specific LO codes and outcomes were extracted.

It is important to understand how both teacher-made test and NAS is developed before chalking out the differences between them. Teacher made tests are typically crafted by individual teachers with different levels of knowledge and training, whereas the NAS assessments do follow a standardized process with inputs from testing as well as trained professionals, validation methods as well as centralized question banks (NCERT, 2021). The teachers were frequently trained formally in creating test items as they are frequently attending trainings regarding the construction of test items. Additionally, some used question banks, which more or less explains the known variations seen in cognitive demands. These differences matter while comparing the results as NAS questions reflect collective expert knowledge whereas the teacher made test reflect individual training capacities.

NAS assessment is a centrally administered, competency-based assessment conducted throughout the country for various subjects like Science, Mathematics and languages. NAS assessments do not include questions that simply test memory as it mostly emphasizes on higher order thinking skills (applying, analysing, evaluating) through real-world problem-solving tasks whereas the curriculum expects the questions to be based on memory around 5.55%. This seems to be a conscious choice, following current demands of research that supports understanding as well as evaluating over rote memorization. The NAS strategy backed by OECD 2019 Directorate for Education and Skills found that the questions focused only on memory and doesn't effectively predict a student's scientific level of understanding. Elimination of memory -based questions might reduce the importance of basic knowledge among the students unintentionally. This could be aforesaid why more than 52% of teacher made tests still include such questions, possibly to make up for the gap.

The LO code, and learning outcomes for class VIII (science) taken for developing 25 numbers of NAS test items for 2017 and 2018 are as given in the Table- I.

Table 1 LO (Learning Outcomes) Codes and learning outcomes for class VIII (science**)**

LO CODE	Learning Outcomes for class VIII (Science)
SCI703	Classifies materials and organisms based on properties/ characteristics
SCI704	Conducts simple investigation to seek answer to queries
SCI705	Relates processes and phenomenon with causes
SCI708	Measures and calculates e.g. temperature; pulse rate; speed of moving objects; time period of simple pendulum etc.
SCI710	Plots and interprets graphs
SCI711	Constructs models using materials from surroundings and explain their working
SCI801	Differentiates materials, organisms and processes
SCI804	Relates processes with phenomenon with causes
SCI805	Explains processes and phenomenon
SCI807	Measures angles of incidence and reflection, etc.
SCI811	Applies learning of scientific concepts in day –to-day life
SCI813	Makes efforts to protect environment

ANALYSIS AND RESULTS

In this section, first of all, the analysis of the LOs as identified from NCERT curriculum for class VII and class VIII were carried out. The analysis has been carried out according to cognitive process dimension on RBT (Revised Blooms Taxonomy) and has been presented in Fig. 1 and Fig.2 below.
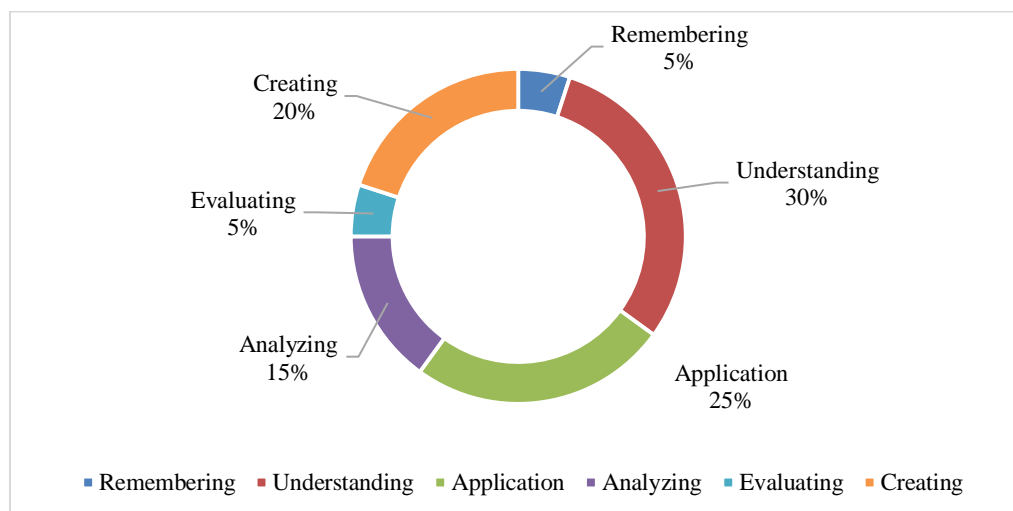

Figure 1 LO Distribution in class VII, NCERT curriculum, 2017
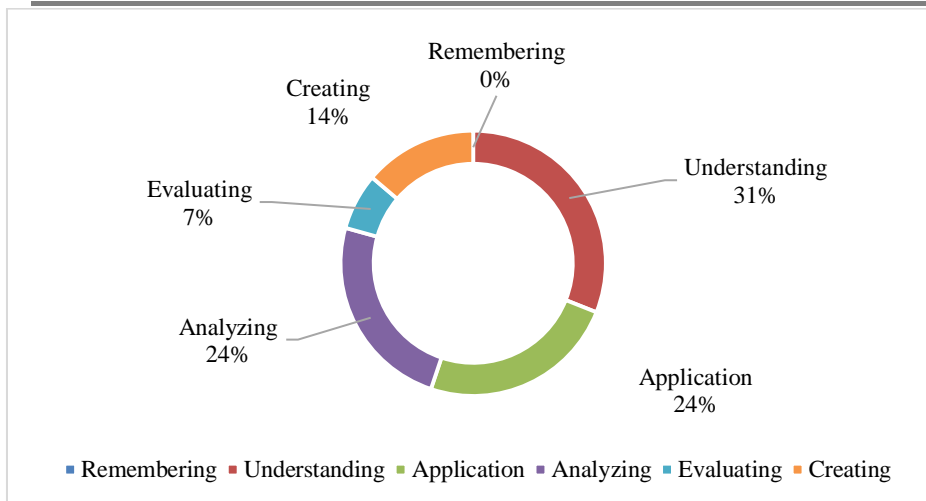
Figure 2 LO Distribution of class VIII, NCERT curriculum, 2017

A significant fact is observed in the LO codes of class VIII test items of NAS executed in 2017 and 2021. It shows an important cross-grade dimension in assessment design. Total twelve numbers of LOs which are taken for developing twenty-five numbers of survey test items for class VIII. Interestingly out of twelve LOs, six number of LOs are from class VII. Hence, this necessitates the inclusion of class VII Los while doing the analysis.

The systematic analysis of the learning outcomes in science for class VIII and VII respectively using Bloom's taxonomy revealed crucial insights about cognitive skill progression. As depicted from the figure 1 and 2 the curriculum shows intentional scaffolding across the grades. The analysis shows Class VII curriculum mostly focuses on foundational understanding (30%) and application based learning outcomes (25%) followed by creating 20% and analysing 15% , whereas Class VIII curriculum emphasized on application based learning outcomes (27.78%) with creation and understanding competency has been put at the same footing, each with 22.22% of preferences. The analysing LO (16.67%) is found to be well below of the preference percentage of understanding and application LOs. Notably both the grades shows minimal emphasis on remembering (5-5.55%), which reflects the shift from rote memorization. The analysis further uncovered a critical decline in the evaluation category for both the classes (5-5.55%), which suggest limited opportunities for the students to develop critical thinking skills.
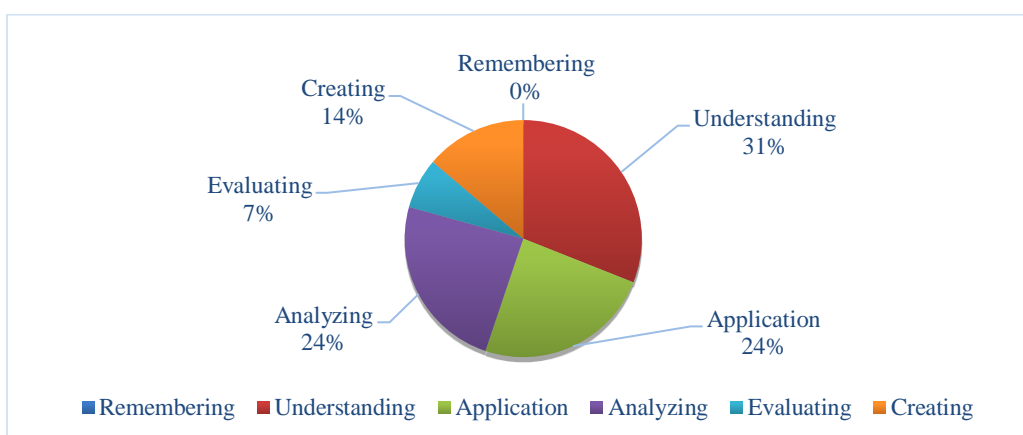

Figure 3 LO Distribution of NAS 2017 and 2021

The item analysis of 25 NAS test questions demonstrated the evolving alignment pattern with the vision of NCERT when executed for Class VIII in Science for the year 2017 and 2021. It is observed that there are twelve LO codes for twenty-five test items, but total number of LOs used for entire set is around 29. This is because each LO code SCI708, SCI710 and SCI711 contains two numbers of LOs or instructional verbs in the test items. The identified LOs are from understanding, applying, analysing, evaluating and creating category and no LO was found from remembering category. The distribution pattern of LOs as observed in NAS test

items for class VII (SCIENCE) in 2017 and 2018 surveys is presented in Fig.3. While the curriculum specifies 5.55% for remembering outcomes NAS completely removed this category potentially signalling a positive shift towards meaningful assessment. Maximum number of test items are from understanding category (31% vs curriculum's 22.22-30%) at the minimization of creating skills with (13.79% vs 22.22%). The least in the list was from evaluating category (6.89%) while interestingly both analysing and application category has got equal importance with 24.13% preferences.

Table 2 LO distribution in NCERT Curriculum and NAS

Cognitive Domains	Curriculum (NCERT)	CURIUULUM (NCERT)	NAS 2017,2021
	LOs Class VII (%)	**LOs Class VIII (%)**	**LOs (%)**
Remembering	5.55	5.55	0
Understanding	30.00	22.22	31.00
Applying	25.00	27.78	24.13
Analysing	15.00	16.67	24.13
Evaluating	5.00	5.55	6.89
Creating	20.00	22.22	13.79

While comparing the LO distribution pattern in curriculum of class VII and VIII, it is well understood that keeping constant the remembering category at around 5%, understanding percentage is reduced from 30% to 27.785 %, while slightly increasing the% preferences for categories belonging to higher cognitive domains such as applying, analysing, evaluating and creating. However, if we analyse the LO alignments in test items of NAS in 2017 and 2018 we find that understanding category is comparable with percentage prescriptions of LOs in class seven curriculum, but analysing category LOs percentage is quite higher than that of both class VII and class VIII curricula. As expected the % of LOs identified in test from applying category and evaluating   is comparable with the suggested LO percentage of those prescribed for both Class VII, and Class VIII curricula. Surprisingly the % of LOs from creating category is much below the suggested % of both class VII and VIII curricula, no test items are found from remembering category.
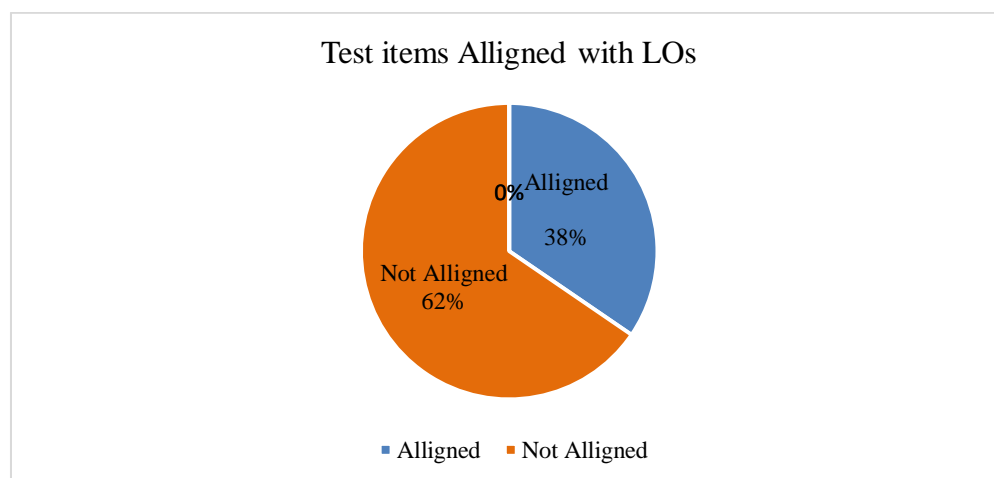

Figure 4 Test items alignment with NCERT Learning outcomes

The evaluation of 300-teacher made test items shows that there is a substantial gap in the implementation. Only 38% of the total test items are aligned with the NCERT's specified Learning Outcomes, revealing that

lower-order thinking skills (remembering- 52%, understanding-33%) are over emphasized. Learning outcomes like critical experiment designing are found only in <3% of the items despite comprising of the 12% of the total curriculum expectations. Further it has been revealed that state-board schools has lowest alignment (29%) than the CBSE Schools with (44%) further suggest that teachers are not adequately trained to align the test items with the expected learning outcomes.
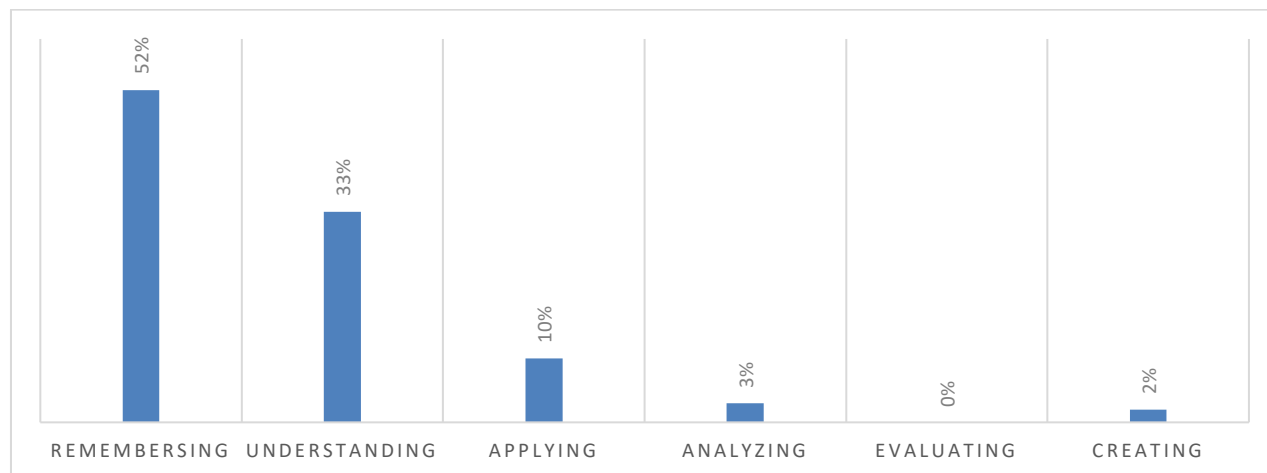

Figure 5 Test items alignment with cognitive levels

Most concerning among all is the complete absence of evaluating skill and very less amount of creating items (2%) indicating the undervaluing of these important competencies. And over dependency on lower order thinking skills such as remembering and understanding (52% & 33%) respectively. Over dependency on textbook examples (73% items from textbook) further limited the opportunities of use of real-world application based items which has emphasized in the curriculum.
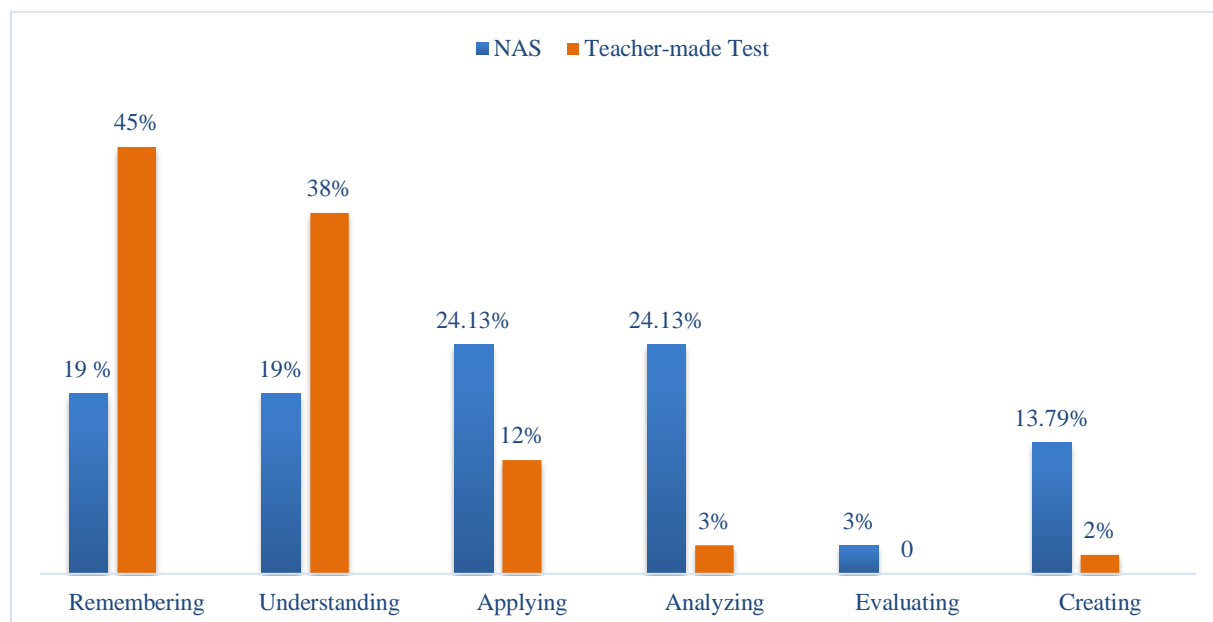

Figure 6 Comparison of items between NAS and Teacher-made test

The comparison between the teacher-made questions and NAS questions reveals the assessment mismatch. While NAS devoted 24.13% to both applying and analysing, teacher made tests has not emphasized these domains (12% & 3% respectively). The main focus in the teacher-made questions was given to the remembering and understanding domain with 45% & 38% respectively. It is more concerning that both the tests has given very less emphasize to evaluating domain (3% & 0). This further suggests that the teacher-made assessments are not preparing the learners for competency development as envisioned by NCERT and National Assessments.
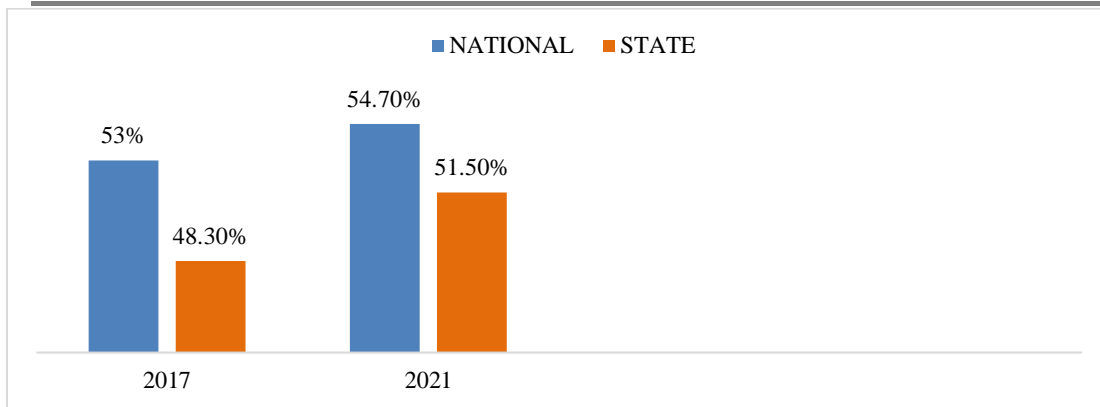
Figure 7 Performance in 2017 and 2021: State vs National

The overall analysis of NAS data for the year 2017 and 2021 in both state and national level reveals nuanced patterns in competency development across the years. While the performance of the students at National levels appears stable between 2017 and 2021 (53% to 54.7%), this specific variation shows a little improvement in the competency levels. Performance at State level shows contrasting trajectory further offers valuable insights for the assessment cycle. The performance of the students for both the years shows a little improvement throughout the years (48.30% to 51.50%).
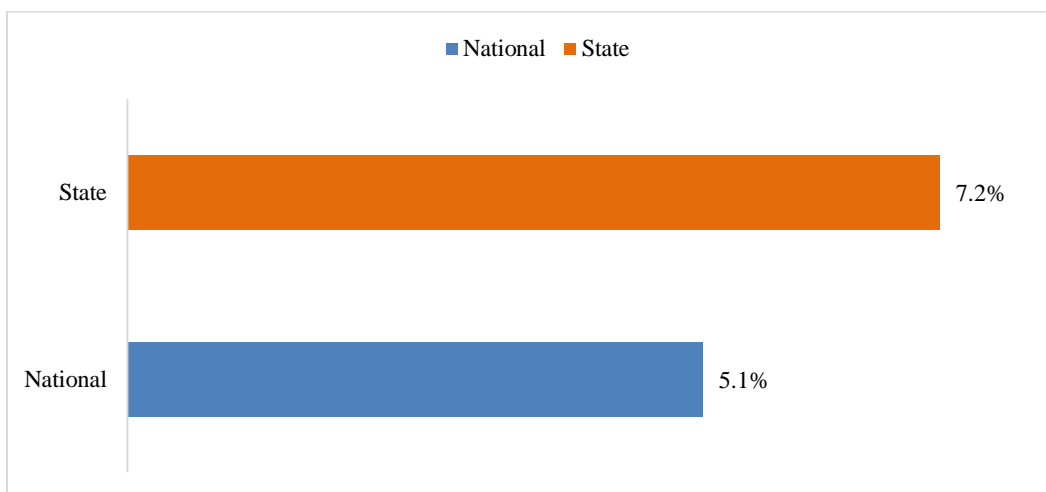

Figure 8 Improvement level: Odisha vs National

In national level three learning outcomes (SCI704, SCI705, SCI811) showed modest gains of 3-5 percentages further suggesting targeted improvements in their particular competencies but the decline in other nine learning outcomes is concerning. Learning outcome with code SCI711 (i.e., Constructs models using materials from surroundings and explain their working) shows persistently poor performance (35% nationally). In the context of Odisha six learning outcomes shows improvement as compared to the national level. The state's 7.2% overall gain in Class VII versus the national average of 5.1% suggests the effectiveness of its foundational learning interventions. The poor performances in both national and State (Odisha) level in consecutive NAS in 2017 & 2021 in LO code numbers SCI704, SCI10 and SCI711 may be attributed to the fact that all the three above mentioned codes involve three interlinked LOs namely Understanding, Application and Creativity in such a way which is otherwise entangled with available physical situation or learning opportunity of the students.

DISCUSSION

The study explores the critical insight of the evolving scenario of assessment in science curriculum across India. With referring to revised Bloom's taxonomy the National Assessment Survey provides a break though to competency based assessment which suggests the importance of alignment of learning outcomes in science assessment for middle school students (National Achievement Survey | Ministry of Education, GoI, 2021).

The findings of the study reveal significant disparities between the India's vision of competency based assessment in science and its classroom implementations. While the National Assessment Survey (NAS) has predominantly shows the progress towards aligning the learning outcomes (LOs) (NCERT, 2021), the school based assessment shows an inclination towards the lower-order cognitive skills . This implementation gap is quite evident with the over emphasising of lower-order thinking skills like remembering types test items (52%) while comparing to the curriculum recommendation. The persistence of such assessment patterns despite the NCERT's recommendation towards the higher order cognitive skills indicates the issues such as inadequate teacher training to pedagogical conversions (Ponnambaleswari & Joseph, 2024).

Anderson and Krathwohl's (2001) Revised Bloom's Taxonomy emphasizes, for an authentic Science a balanced development across all the cognitive domains is required. As per the findings of the study it has shown that creating-level question appear in only 2% of the teacher-made tests in school based assessment versus the curriculum expectations i.e., 22.22% as suggested by NAS which revels that the students are not being systematically prepared for complex-problem solving tasks (Liu & Israel, 2022). This explains the consistently poor performance across the integrated competencies like SCI711 (35% of the national average,) which happens due to neglecting the higher-order skills at the classroom and school based (NAS, 2021). The significant decline in environment related learning outcome (SCI813) further highlights the vulnerabilities of school based experiential learning. This suggests the need for more robust, multifaceted assessment approaches that can allow the development of competencies across all the diverse learning pathways (Mahajan & Sarjit Singh, 2017).

Odisha's relatively better performance trajectory provides evidence of improvement of learning outcomes can takes place with targeted interventions that includes adequate teacher training and equip learners with a classroom where they can be facilitated with the higher order competencies. The states gain (7.2%) versus national average (5.1%) suggests the effectiveness of its foundational learning programs. The constant urban-rural divides (15.3 points in Odisha vs 11.7 nationally) shows the ongoing challenges of equitable access to science education (Ainscow, 2020).

CONCLUSION

In conclusion, the study underscores the critical need for the systematic alignment of competency-based science curriculum, school-based assessment and national evaluations to ensure achievement of meaningful learning outcomes. The persistent dominance of lower order cognitive skills across all the test items of school based assessment despite the NCERT's guideline for emphasizing on higher order thinking skills further highlighting a significant implementation gap that undermines the learners potential to deal with the real-world problems. The disparities between NAS's competency based assessment and traditional teacher made assessment design particularly in rural belts reveals an urgent need for teachers professional development across the curriculum. Therefore, reforms must be made to prioritize standardized assessment frameworks, equitable access and robust monitoring mechanism to bridge the gap between the prescribed curriculum , policy aspiration and grounded classroom practices, ensuring the shift towards the competency based education.

REFERENCES

1. Ahmadshah, D. (2019). Teacher Education in India, Issues and Challenges. European Journal of Business and Social Sciences, 7, 520–530.
2. Ainscow, M. (2020). Inclusion and equity in education: Making sense of global challenges. Prospects, 49(3), 123–134. https://doi.org/10.1007/s11125-020-09506-w
3. Anderson, L. W., & Krathwohl, D. R. (2001). A Taxonomy for Learning, Teaching and Assessing A Revision of Bloom's Taxonomy of Educational Objectives Complete Edition. New York Longman. -References—Scientific Research Publishing. https://scirp.org/reference/referencespapers?referenceid=1223916
4. Aristeidou, M., Scanlon, Eileen, & and Sharples, M. (2020). Learning outcomes in online citizen science communities designed for inquiry. International Journal of Science Education, Part B, 10(4), 277–294. https://doi.org/10.1080/21548455.2020.1836689

5. Brown, G. T. L. (2019). Is Assessment for Learning Really Assessment? Frontiers |https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2019.00064/full

6. Chen, K.-D., Wan, X., & Chen, P.-K. (2021). Learning Outcomes for Improving Science Entrepreneurship in Higher Education. SAGE Open, 11(1), 2158244020974678. https://doi.org/10.1177/2158244020974678

7. Ehren, M. (2022). International Large-Scale Assessments and Education System Reform. In T. Nilsen, A. Stancel-Piątak, & J.-E. Gustafsson (Eds.), International Handbook of Comparative Large-Scale Studies in Education: Perspectives, Methods and Findings (pp. 97–118). Springer International Publishing. https://doi.org/10.1007/978-3-030-88178-8_36

8. Hailikari, T., Virtanen, V., Vesalainen, M., & Postareff, L. (2022). Student perspectives on how different elements of constructive alignment support active learning. Active Learning in Higher Education, 23(3), 217–231. https://doi.org/10.1177/1469787421989160

9. Jansen, T., & Möller, J. (2022). Teacher judgments in school exams: Influences of students' lower-order-thinking skills on the assessment of students' higher-order-thinking skills. Teaching and Teacher Education. https://doi.org/10.1016/j.tate.2021.103616

10. Koireng, R. R. (2019). Conceptualizing Learning Outcomes in Science at the Upper Primary Stage and its Integration in Classroom Processes. Voices of Teachers and Teacher Educators 8 (1). 120-124.

11. Liu, T., & Israel, M. (2022). Uncovering students' problem-solving processes in game-based learning environments. Computers & Education, 182, 104462. https://doi.org/10.1016/j.compedu.2022.104462

12. Mahajan, M., & Sarjit Singh, M. K. (2017). Importance and Benefits of Learning Outcomes. IOSR Journal of Humanities and Social Science, 22, 65–67. https://doi.org/10.9790/0837-2203056567

13. Ministry of Education, GoI. (2021). National Achievement Survey | https://dsel.education.gov.in/nas

14. Mochahari, M. (2013). Revisiting India's science communication and journalism: issues and challenges. Global Media Journal 4 (1). 1-14

15. NAS. (2021). Improving learning outcomes in schools. https://www.greaterkashmir.com/opinion/nas-2021-improving-learning-outcomes-in-schools/

16. NCERT (2017). Learning Outcomes at Elementary Stage NCERT https://www.ncert.nic.in

17. Nursa'ban, E., Masykuri, M., & Yamtinah, S. (2019). Improving student learning outcomes in science subjects through the implementation of PBL-based module. JPBI (Journal Pendidikan Biology Indonesia), 5(2), 269–276. https://doi.org/10.22219/jpbi.v5i2.7534

18. Ponnambaleswari, D. M., & Joseph, R. (2024). From Policy to Practice: A Study on Teacher Preparedness for Competency Based Education in Secondary Schools. Journal of Emerging Technologies and Innovative Research (JETIR) 11(10). 276-280

19. Ramona, L., & Bran, C.-N. (2014). The Assessment of Learning Outcomes. Procedia - Social and Behavioral Sciences, 163. https://doi.org/10.1016/j.sbspro.2014.12.297