ACER

SRI AUROBINDO SOCIETY
Rupantar
TRANSFORMING EDUCATION

Auro PBL
Impact Assessment Report

Australian Council for Educational Research (India)

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Abbreviations and acronyms

ACER	Australian Council for Educational Research
CBA	Competency-Based Assessment
EDA	Exploratory Data Analysis
NEP	National Education Policy
NCF	National Curriculum Framework
NCFSE	National Curriculum Framework for School Education
PBL	Project-Based Learning
PBLI	Project-Based Learning Initiative
SAS	Sri Aurobindo Society
UDISE	Unified District Information System for Education

Executive summary

This report evaluates the early efficacy of the design and implementation of the Sri Aurobindo Society's (SAS) Project-Based Learning Initiative (PBLI), Auro PBL. This experiential learning initiative is aimed at fostering 21st century skills and enhancing numeracy and literacy skills among primary grade children. It aligned with the National Education Policy (NEP) 2020 by emphasising critical thinking, collaboration, and problem-solving over traditional teaching methodologies based on rote memorisation.

Key research questions

The study examined four broad questions:

1. How are students using Auro PBL in schools?
2. What are the performance levels of Auro PBL students on foundational skills and 21st century skills?
3. Is there any evidence of a relation between the use of Auro PBL and enhancement in student outcomes?
4. What are the enablers and challenges in the design and implementation of Auro PBL?

Methodology

The methodology of the study employed a mixed-method approach. Evidence of implementation and intended outcomes was gathered using multiple sources:

- The evaluation of responses on PBL tasks completed by a sample of students in grades 2 and 4 as a proxy measure of the quality of implementation of PBL.
- Competency-based assessment (CBA) for the above set of students to assess competencies related to literacy, numeracy, and 21st century skills.
- Teacher survey and focus group discussion (FGD) to gather implementation-related qualitative data.

ACER subject experts used a detailed rubric to analyse the PBL tasks completed by the students in grades 2 and 4 towards the end of the academic year. CBAs comprised both pen-and-paper tests and observation-based performance tasks aiming to evaluate foundational skills as well as 21st century skills. Students sat for the CBA after the completing grades 2 and 4, and in the beginning of grades 3 and 5, respectively. This approach was adopted to develop a comprehensive understanding of the possible impact of PBL on students' competencies, along with the implementation fidelity of PBL.

Additionally, ACER conducted a teacher survey using online questionnaires and focus group discussions (FGD) to build a holistic understanding of the PBL implementation and its effectiveness.

Tools for exploratory data analysis, as well as qualitative methods, were used to provide actionable insights to refine the implementation quality as well as intended outcomes.

Key findings

Major findings of the study are:

- Students demonstrated strong engagement with PBL tasks, with over 60% of students completing more than 80% of their booklets.
- Students showed deeper engagement with the Auro PBL curriculum, with 49% of the students in grade 2 and 41% students in grade 4 showing proficiency, based on the responses analysis of PBL tasks.
- Students showed strong 21st-century skills in their CBAs, indicating the program's effectiveness in developing crucial competencies. However, the CBAs also revealed notable gaps in foundational skills across subjects - Hindi, English, and Mathematics among grade 3 students. About 50% grade 5 students were found to be proficient in Hindi literacy skills.
- Further analysis showed a positive association between student performance on PBL tasks and their scores in CBAs in English, Hindi, and Mathematics highlighting. It implies that students who showed better performance on PBL tasks were more likely to score high on CBA.
- No clear association was observed between the performance on PBL tasks and CBA for 21st century skills. One of the possible reasons may be the lack of alignment between the PBL task design or assessment criteria. It requires deeper investigation into this area using a targeted study.
- More than 80% of the teachers surveyed agreed or strongly agreed that they effectively plan the Auro PBL activities in advance and integrate them with instructional strategies in the classroom.
- Above 90% of the surveyed teachers agreed or strongly agreed with the positive possible impact of Auro PBL on target outcomes of the initiative.
- More than 50% respondents expressed the need for adequate resources, training, and support to be able to effectively implement PBL in the classroom.

Recommendations

Study shows some preliminary evidence of impact on Auro PBL on classroom practices and intended outcomes. However, a robust implementation framework along with support for teachers through additional training to effectively integrate and manage PBL activities is more likely to enhance the implementation quality and intended outcomes. It is further suggested to reassess the PBL tasks for its features to enhance 21st century skills. Once design features have been enhanced, a quasi-experimental study may be considered to provide a higher degree of validity and precision to the impact measurement of PBL interventions on intended learning outcomes.

Conclusions

The study highlights a positive correlation between PBL engagement and the performance of students on CBA in foundational subjects, underlining the potential of PBL to boost academic outcomes. However, this relation was not consistent for booklet completion and performance on CBA. It shows that task completion is not the sole predictor of academic performance. While completing a task matters, its quality matters more. While there is evidence of perceived benefit based on teacher survey, the analysis also points out the necessity for robust teacher support and tailored resources to ensure the successful implementation of PBL across diverse classroom settings.

1. Introduction

Education is continuously evolving, and the roles of schools, teachers, and educational systems are increasingly being viewed as a means of preparing students to meet the challenges of the 21st century. The shift from traditional teaching methodologies to more dynamic, student-centred learning approaches has paved the way for innovative educational paradigms (Bell, 2010). One such paradigm is Project-Based Learning (PBL), widely recognised as an effective model for promoting deeper learning, critical thinking, collaboration, and real-world problem-solving skills (Larmer, 2015). It is a teaching approach in which students actively engage in real-world and meaningful activities.

PBL embodies the learner-centred and experiential learning philosophy highlighted in the National Curriculum Framework (NCF), 2023. A key aspect of PBL is its robust framework, which is aligned with the NCF's focus on holistic assessment (Revathy & Mitchell, 2023). In addition to academic knowledge, PBL learning material intends to inculcate and assess essential 21st century skills such as critical thinking, collaboration, and problem-solving, resonating with the NCF's call for a shift from high-stakes, content-heavy exams to continuous, skill-based evaluations. These holistic activity-based learning and assessment tasks support students' progress in a dynamic, real-world learning environment.

Auro Project-Based Learning Initiative (PBLI) by the Sri Aurobindo Society (SAS) strives to transform the learning experience of children through a project-based approach by converting classrooms into dynamic, experiential learning environments. Launched across 19 states in India, the initiative covers students in grades 1 to 5. The model of intervention is outlined in Figure 1.

This transformation aligns with the goals of fostering essential 21st century as emphasised by the NEP 2020. The initiative utilises custom-designed booklets aligned with NEP 2020 to enhance both foundational academic skills and 21st century skills. These booklets contain a series of tasks that prompt students to engage in problem-solving and critical thinking projects that mirror real-world challenges. The integration of these activities into classroom practices ensures interactive, inclusive learning facilitated by peers and creates a supportive learning environment that encourages active participation and ownership of learning processes.

SAS has partnered with the Australian Council for Educational Research (ACER) to find preliminary evidence of the impact of the Auro PBL initiative and insights into what is working and what needs to be further strengthened to help students achieve intended outcomes. This collaboration is part of a broader commitment to enhance educational outcomes through innovative and effective educational practices.

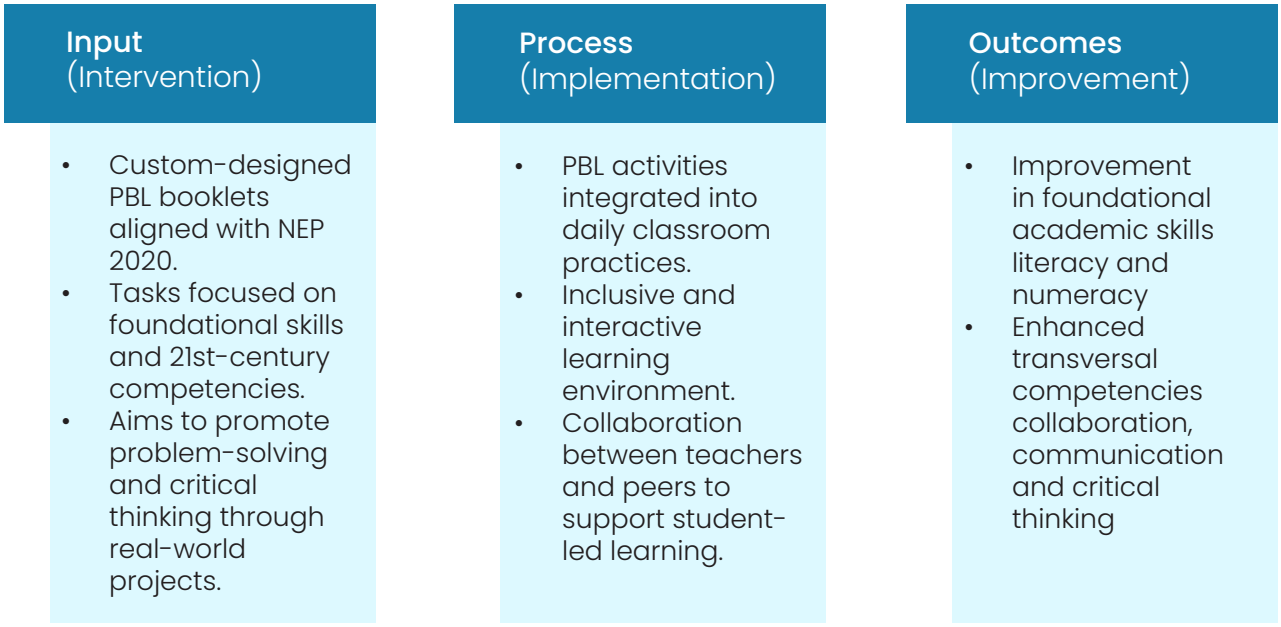


Figure 1: Model of Auro PBLI

As illustrated in Figure 1, custom-designed Auro PBL booklets, aligns with the National Education Policy (NEP) 2020 aim to improve foundational competencies and 21st-century skills among the students. By integrating real-world projects into daily classroom practices, they intend to foster problem-solving and critical thinking within an inclusive and interactive environment. This student-led learning is supported through collaboration between teachers and peers, aiming to enhance literacy and numeracy skills, as well as develop transversal competencies.

1.1 Objective of the impact assessment

The study aims to understand the feasible impact of the Auro PBL initiative on student learning and competencies. The insights gained from these assessments are intended to provide preliminary evidence of the initiative's efficacy, helping to identify the design and/or implementation gaps if any, and refine the initiative to enhance its effectiveness.

Key research questions:

This study aimed to find answers to four broad questions related to the efficacy of the PBL initiative:

1. How are students using Auro PBL in schools?
2. What are the performance levels of Auro PBL students on foundational skills and 21st century skills?
3. Is there any evidence of a relation between the use of Auro PBL and enhancement in student outcomes?
4. What are the enablers and challenges in the design and implementation of Auro PBL?

The report is organised into 8 sections.

The first section serves as an introduction, setting the stage by exploring the shift from traditional teaching methodologies to Project-Based Learning (PBL).

The second section elaborates on the evaluation techniques used in the study, from the design of the assessment framework to data collection and analysis methods, offering a clear blueprint of the research approach and tools employed.

Sections three to five present key findings from the analysis of student responses to PBL tasks as an indicator of implementation quality, performance of students on CBA – the measure of intended outcomes, and relation between the PBL implementation and student outcomes, respectively.

The sixth section synthesises insights from teacher surveys and FGDs, offering perspective of educators on the enablers and challenges associated with PBL implementation.

Finally, conclusions and actionable recommendations are discussed for enhancing the PBL initiative in sections 7 and 8 respectively, aimed at stakeholders and policymakers interested in adopting or refining project-based learning methodologies to enhance outcomes.

2. Methodology

2.1 Analytical framework

A mixed-methods approach was employed, leveraging multiple data sources to evaluate both the implementation and outcomes of PBL. The study centres on the following analytical aspects:

- **Student work evaluation:** Analysis of responses was conducted in terms of completion of tasks and the quality of student responses in the PBL booklets, for a sample of grade 2 and grade 4 students. This data served as a proxy measure of the implementation level of the PBL.
- **CBA:** Competency-based assessments were designed to measure learning achievements in literacy, numeracy, and 21st century skills for the above cohorts as they advance to the next grade levels. This dual focus aims to examine any association between the Auro PBL initiative and improved student performance in literacy, numeracy, and transversal skills.
- **Teacher survey and group interviews:** Surveys and focus group discussions (FGDs) were conducted with teachers to collect qualitative data on the fidelity and challenges of PBL implementation.

2.2 Sample description

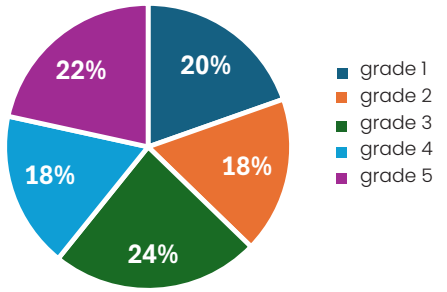
The Auro PBL initiative, implemented across 19 states in India, targets on students in grades 1 to 5. This study employed purposive sampling to select the grades to match the objectives of the ongoing educational research. In the 2023-2024 academic year, students in grades 2 and 4 were chosen for their critical transitional stages in early learning and intermediate skills development, respectively. Their competency was assessed when they completed their present grade and moved to the next grade in the subsequent year, 2024-2025, to assess the learning gains and developments in competencies as these cohorts advanced in their learning journey.

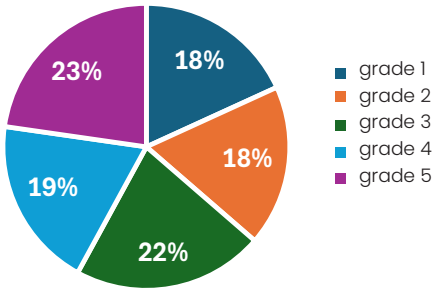
The sample for teacher survey consisted of 39 teachers across four different states and 1 Union Territory: Madhya Pradesh, Uttar Pradesh; Jharkhand, Uttarakhand and Andaman and Nicobar Islands was selected for the survey. These teachers were involved in the pilot implementation of Auro PBL in their classrooms. Out of the 39 teachers who participated in the online survey, 30 teachers provided their consent to participate in the FGD. Table 1 provides a detailed breakdown of the student and teacher sample sizes involved in the study.

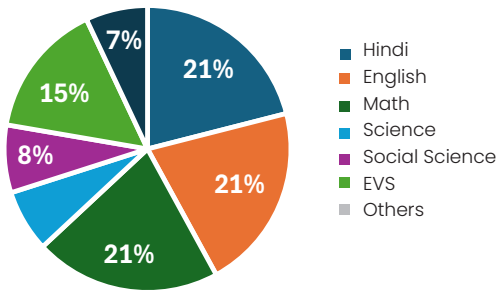
Table 1: Summary of student and teacher sample sizes

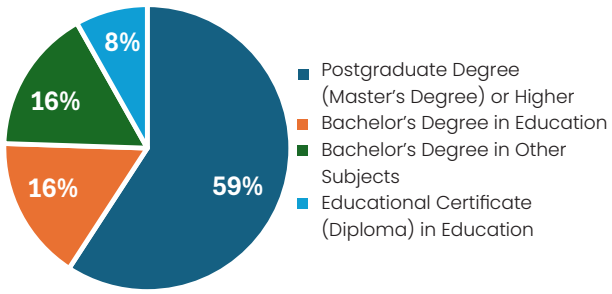
Student sample size		Number of students
For the analysis of responses from PBL booklets	grade 2	517
	grade 4	602
Common students available for competency-based assessment	grade 3	122
	grade 5	219
Teacher sample size		**Number of teachers**
Teacher feedback	Survey group	39
	FGD	30 teachers from the survey group

Figure 2 presents a detailed profile of the teachers who participated in the survey and FGD, highlighting the diverse educational backgrounds and experience levels across different grades and subjects. Analyses of respondent profile indicated diverse educational backgrounds and experience levels of the teachers across different grades and subjects. Majority of the respondents were teaching more than one grade and more than one subject reflecting a versatile and well-rounded teaching staff involved in the implementation of Auro PBL.









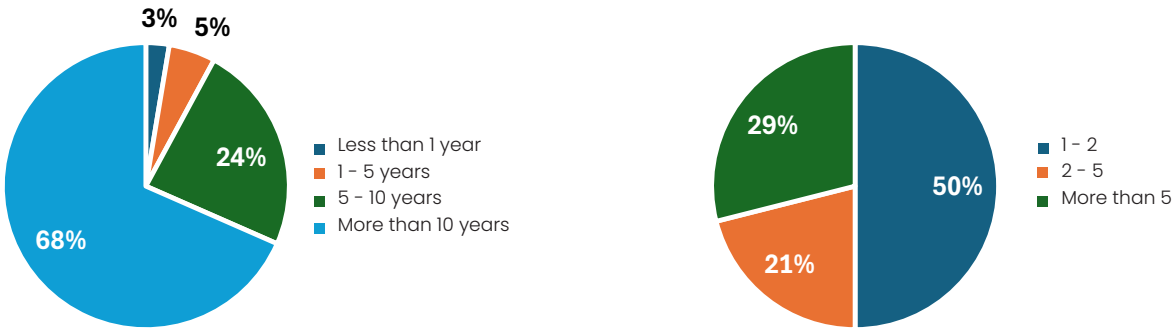


Figure 2: Profile of the teachers who participated in the survey and interviews

The sample also demonstrated an even implementation of Auro PBL booklets across all primary grades, with grade 5 having the highest implementation rate in 23% classrooms. Around 59% of the teachers surveyed held a master's degree or higher qualification indicating sound academic background of the respondents. It was also noticed that 16% respondents had a bachelor's degree in education, while others had Diploma. It can further be seen that 68% of the teachers had more than 10 years of teaching experience, while a very small proportion of 3% respondents had a professional experience of less than 1 year. 50% of the teachers indicated having participated in 1-2 in-service trainings/ courses in the last one-year.

2.3 Student work evaluation

ACER subject experts conducted a comprehensive evaluation of the PBL booklets completed by grade 2 and grade 4 students, using a detailed rubric.
The criteria for the assessment of tasks were as follows:

1. **Booklet completion criteria:** Students were assessed on completion of tasks in the booklet such as less than 40% of tasks completed, or between 40- 60% tasks completed, or more than 60% tasks completed.
2. **Learning related criteria:** Students were assessed based on specific tasks in the booklet related to transversal competencies, literacy, and numeracy.
    - **Transversal competencies:** The skills assessed were problem solving, creativity, and critical thinking. There was no scope to assess skills such as collaboration and communication through the written responses in the booklet.
    - **Literacy:** The skills assessed were reading, writing letters, words, and sentences in both Hindi and English.
    - **Numeracy:** This criterion comprised skills ranging from counting and number recognition to basic arithmetic operations such as addition and subtraction and understanding numerical relationships.

The rubric for booklet completion is described in Table 2.

Table 2: Rubric for booklet completion

Performance level	Description and percentage
Level 1	Less than 40% tasks in the booklet are complete.
Level 2	40-60% tasks in the booklet are complete.
Level 3	Greater than 60% tasks in the booklet are complete.

The holistic rubric for evaluating learning related criteria is described in Table 3

Table 3: Holistic rubric for the evaluation of learning related criteria in the PBL tasks

Proficiency level	Beginner	Progressing	Proficient
Description	• Students at this level are beginning to engage with the skills and may require significant guidance. • Response analysis scores for these students are < 30%	• Students demonstrate a growing understanding and application of the skills, though they may still make mistakes. • Response analysis scores for these students are in the range of 30 – 70%.	• Students have mastered the skills and can perform tasks independently and competently. • Response analysis scores for these students are > 70%.

2.4 Competency-based assessment

To evaluate the learning gains of students who engaged with the PBL booklets, ACER developed a comprehensive CBA for students advancing from grades 2 and 4 to grades 3 and 5. This assessment was designed to measure the retained knowledge and skills and the application of learned competencies in new academic settings.

2.4.1 Assessment framework and design

An assessment framework was designed for the development of CBAs. The major domains of assessment were competency-based literacy and numeracy along with 21st century skills.

The CBA consisted of a pen-and-paper format with distinct sections for Hindi, English, and Mathematics. The assessment comprised of 30 multiple-choice questions (MCQ) as per the design outlined in Table 4. A test implementation manual was developed to ensure that the assessment was conducted in a fair and uniform manner across all sampled schools.

Table 4: Assessment design of the pen-paper test for CBA

Section	Subject	Number of questions	Type of questions
Literacy	Hindi	10	MCQ
Literacy	English	10	MCQ
Numeracy	Mathematics	10	MCQ

2.4.2 Sample assessment items and tasks

Hindi and English language proficiency:

Questions in these sections were designed to assess reading comprehension, vocabulary, grammar usage, and written expression — factors critical in determining the students' ability to communicate effectively in both languages.

The sample item in Figure 3 tests the ability of students to identify letters in Hindi while the sample item in Figure 4 tests the ability of students to read small sentences and relate it with the given picture. Sample item in Figure 5 tests vocabulary and contextual information.

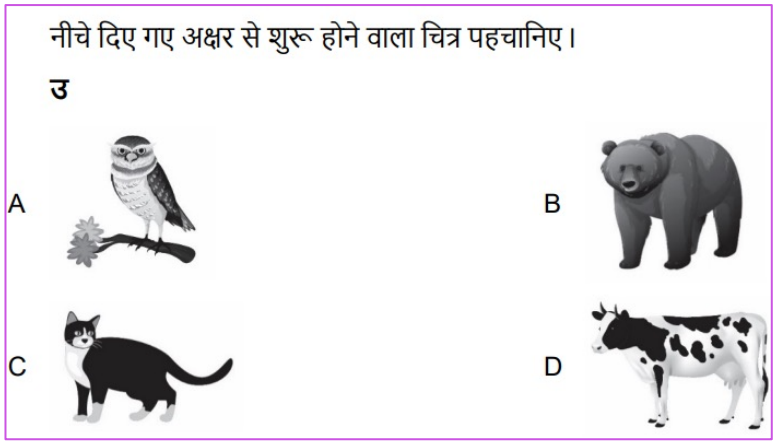


Figure 3: Sample item assessing competency: ability to read letters in Hindi

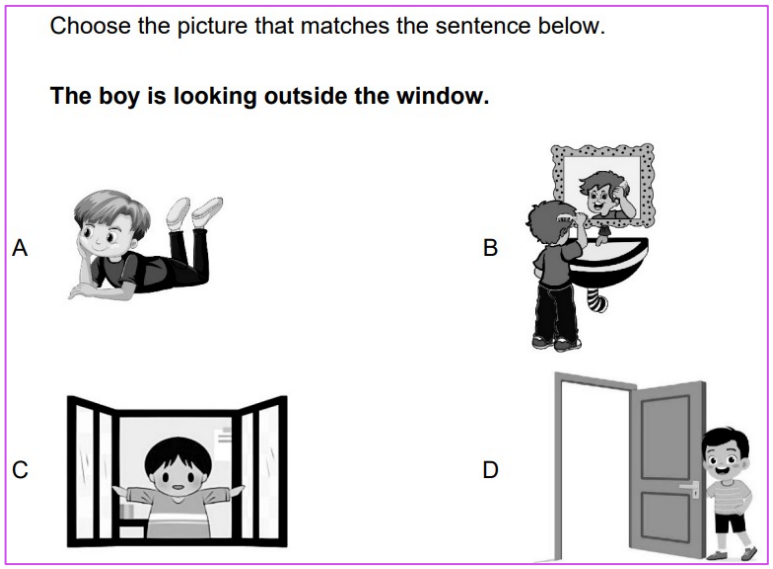


Figure 4: Sample item assessing competency: ability to comprehend sentences in English

15 Select the word to fill in the blank.

"When the clock struck twelve, the bell rang _____. I woke up because of the noise."

A largely B loudly C easily D slowly

Figure 5: Sample item assessing competency: vocabulary and contextual information

Mathematics:

The Mathematics section tested fundamental arithmetic skills, problem-solving, and the ability to apply mathematical concepts to different scenarios. The assessment items shown below indicate the competency assessed. They focus on scenario-based questions used to gauge students' arithmetic skills and their ability to apply mathematical concepts in diverse contexts focusing on numerical reasoning and problem-solving capabilities.

The sample item in Figure 6 tests the ability of students to count two-digit numbers, while sample item in Figure 7 tests the ability of students to make estimates.

Pooja scored below given marks in two tests.

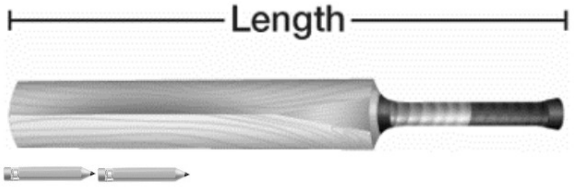
Test 1: 35

Test 2: 43

How many marks did Pooja score altogether?

A 8 B 75 C 78 D 88

Figure 6: Sample item assessing competency: ability to count two-digit numbers



How many pencils long is the bat?

A 2 B 4 C 6 D 10

Figure 7: Sample item assessing competency: ability to make estimations

Assessment of 21st century skills:

In addition to literacy and numeracy items, the assessment included specific tasks aimed at evaluating 21st century skills, which are crucial for navigating the complexities of the modern world. These tasks were designed as oral tasks and group activities to measure:

- **Critical thinking:** Students were presented with problems that required them to analyse information, draw conclusions, and devise solutions, reflecting their ability to think deeply and critically about various subjects.
- **Communication:** Through oral tasks, students demonstrated their proficiency in articulating ideas and information clearly and effectively, a key component of successful interpersonal and intrapersonal communication.
- **Creativity:** Group activities provided a platform for students to express original ideas and innovative solutions, showcasing their creative capabilities.
- **Collaboration**: Working in groups, students were assessed on their ability to cooperate, share ideas, and contribute effectively to team objectives, highlighting their teamwork and leadership skills.

The sample activity in Figure 8 is a collaborative task where students are required to discuss in groups, think critically, and create a plan for shopping with a given budget and available resources.

Unit: A shopping plan for Diwali

The table shows the price list of different to objects.

Object	Price per unit
Coloured chart paper (1 bunch)	Rs. 50
Glue	Rs. 10
Sketch pen (1 packet)	Rs. 50
Ribbons (1 packet)	Rs. 20
Glitter pen (1 packet)	Rs. 50
Balloon (1 packet)	Rs. 20
LED diya (1 packet)	Rs. 100
Scissors (1 piece)	Rs. 20
Stickers (1 packet)	Rs. 10

Task A. Group activity (each group containing 4 students)
Skills Assessed (Critical Thinking and Collaboration)

Make the students sit in the group of four.
"There is annual day celebration in your school.
Your class teacher has given Rs. 200 for decorating the classroom.

(i) Make a shopping list using **at least** five objects from the table for the decoration. (3 marks)

Figure 8: Sample task assessing critical thinking and collaboration

2.4.3 Test administration and data collection

ACER team conducted orientation of test administrators on operation aspects of the CBA, which was conducted in a traditional pen-and-paper format, complemented by observation-based modules to gather 21st century skills data. The assessments targeted students who had previously engaged with the PBL booklets, maintaining continuity in evaluating the same cohort. These schools were selected from among those where the PBL booklets had been previously administered, allowing for analysing a possible relation between the two.

2.5 Teacher feedback

Teacher survey and FGDs were conducted to gather qualitative data from teachers regarding challenges encountered during the implementation of booklets in the class.

Teacher survey
Teacher survey was conducted with the help of a structured questionnaire using Likert scale, providing numerical data regarding teacher understanding, perception and satisfaction. The survey was administered in online mode using Microsoft Forms. Questions aimed to assess teachers' understanding and execution of PBLI, as well as to gather feedback on support needs for enhancing the implementation process.
It was followed by an in-depth semi-structured FGD to collect qualitative data to understand the enablers and challenges faced during implementation of Auro PBL.

Focus group discussions
FGDs were conducted with selected teachers who expressed interest in providing more detailed feedback. These discussions aimed to delve deeper into teachers' experiences, discussing specific successes and challenges encountered during the PBLI implementation. This allowed for a richer, more nuanced understanding of the initiative's practical implications in diverse classroom settings.

2.6 Data analysis and reporting

The data analysis phase of this project was crucial in synthesising the findings from the response analysis of the PBL booklets and the CBA. This phase was carefully structured to ensure that the analysis provided robust and insightful conclusions about the effectiveness of the PBL initiative.

2.6.1 Analysis of Auro PBL booklet responses

Figure 9 illustrates the methodical process flow of data analysis for Auro PBL booklet responses, encompassing data collection, cleaning, examination, summarisation, and visualisation.

Figure 9: Process of analysis of Auro PBL booklet responses

Data collection

The dataset for the PBL booklet response analysis comprised a set of fields that detail both student identifiers and their overall performance. Each record included a student name, the name of the school, and the UDISE (Unified District Information System for Education) code to uniquely identify the educational institution. The dataset tracked the performance metrics across each assessment criteria and included a field for specific comments. These comments from subject matter experts provided qualitative feedback, offering deeper insights into individual performances and notable trends within the data.

Data cleaning

The initial step in the analysis involved a data cleaning process to ensure the accuracy and reliability of the dataset. This was crucial for ensuring the integrity of the data, identifying flawed data patterns rather than genuine student outputs. These outliers were carefully examined and excluded from the dataset to prevent skewing the results.

Data examination

After cleaning, the data was carefully examined to identify and categorise student responses according to the proficiency levels defined in the rubric (Table 1) for each criterion.

Data summarisation

Data summarisation was then conducted to provide a clear picture of the distribution of proficiency levels across the student population. This summary included calculating the frequency and percentage of students at each proficiency level—Beginner, Progressing, and Proficient—in each core domain.

Data visualisation

To aid in the interpretation and presentation of these results, various data visualisations were employed. These visualisations included stacked bar graphs, which illustrated the proportion of students achieving each level of proficiency, providing a visual representation of the areas where students excelled or required further support.

2.6.2 Analysis of CBA

The CBA data required a different analytical approach since the tests conducted in subsequent years were not identical to the initial PBL evaluations but were designed to measure comparable skills and knowledge in English, Hindi, Mathematics, and 21st century skills.

To ensure comparability between the different sets of assessment data, we adopted a standardisation process where scores were categorised into 3 proficiency levels: Beginner, Progressing, and Proficient. This categorisation was based on cut-offs provided by subject matter experts, which were specifically tailored to reflect meaningful distinctions in student performance across each skill area. The cut-offs enabled the development of a consistent evaluation framework that could be uniformly applied to both the PBL booklet responses and the CBA scores. This alignment was crucial to assess the differences in student competencies over time accurately and determine the impact of the PBL initiative.

In comparing the two sets of data, the analysis focused on differences in student performances between PBL booklet responses and CBAs over the academic years. Although a direct longitudinal comparison was not feasible due to the differences in the test formats and content, the analysis was structured to highlight trends in student learning outcomes and skill development. We employed exploratory data analysis (EDA) techniques, utilising graphical representations to visually compare the proportions of students categorised as Beginner, Progressing, and Proficient in both datasets. This included evaluating the progression in literacy and numeracy skills as well as advancements in critical thinking, communication, creativity, and collaboration abilities.

2.6.3 Analysis of teacher's feedback

For the quantitative and qualitative analysis of teachers' feedback gathered from surveys and FGDs, thematic analysis was utilised to identify and evaluate recurrent patterns and themes within the data. This method involved a systematic coding process to categorise responses, enabling a comprehensive understanding of the teachers' experiences and perceptions regarding the PBL implementation. Teachers' responses, measured on a Likert scale, were analysed using descriptive statistics and data visualisation to capture general trends. The analysis focused on areas such as challenges faced during implementation, perceived effectiveness of PBL activities, and areas requiring additional support, which helped to understand the practical implications of the PBL initiatives in the classroom environment.

2.6.4 Reporting and insights

The findings of data analysis were compiled to provide actionable insights and recommendations. The findings aim to inform stakeholders, including SAS programme leaders and educational practitioners, about the effectiveness of the PBL initiative and

the areas requiring enhancements to maximise learning outcomes.
Employing a detailed and methodical approach to data analysis and reporting provided a well-rounded evaluation of the PBL initiative, supporting data-driven decisions to refine and improve educational strategies.

3. Key findings from response analysis on PBL tasks

The analysis of the PBL booklet responses for grade 2 and grade 4 students reveals insightful trends across various competencies, reflecting the effectiveness of the PBL initiative in nurturing essential skills.

3.1 Language proficiency in Hindi

The distribution of language proficiency levels in Hindi is shown in Figure 10 for grade 2 and Figure 11 for grade 4.

- **Reading skills:** In grade 2, most students show considerable proficiency in reading skills, with 85% of them proficient in reading letters, 65% proficient in reading words, and 52% proficient in reading sentences. By grade 4, while 82% of students are progressing in reading sentences, only 16% are proficient, suggesting that while the ability to comprehend sentences is improving, achieving mastery in reading sentences remains a challenge.
- **Writing skills:** Writing proficiency also progresses with age; by grade 4, 71% of students are proficient in writing words, up from 45% in grade 2. The ability to write sentences improved markedly by grade 4 with a balanced distribution of 34% progressing and 38% proficient, compared to grade 2 where 52% were still developing this skill and only 21% were proficient.

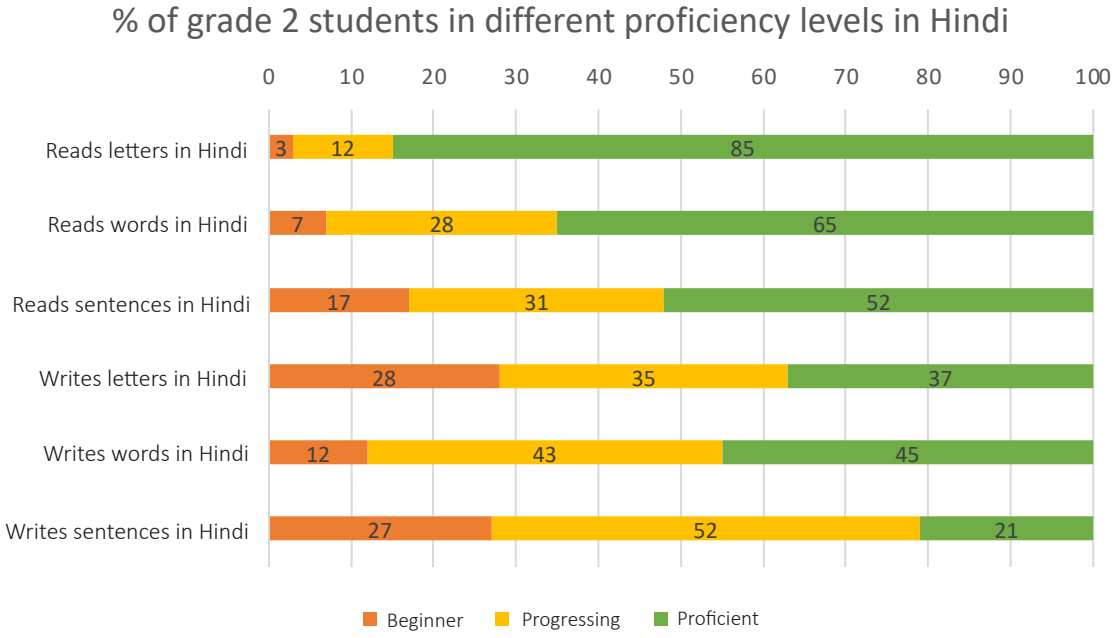


Figure 10: Distribution of proficiency levels in Hindi literacy skills for grade 2

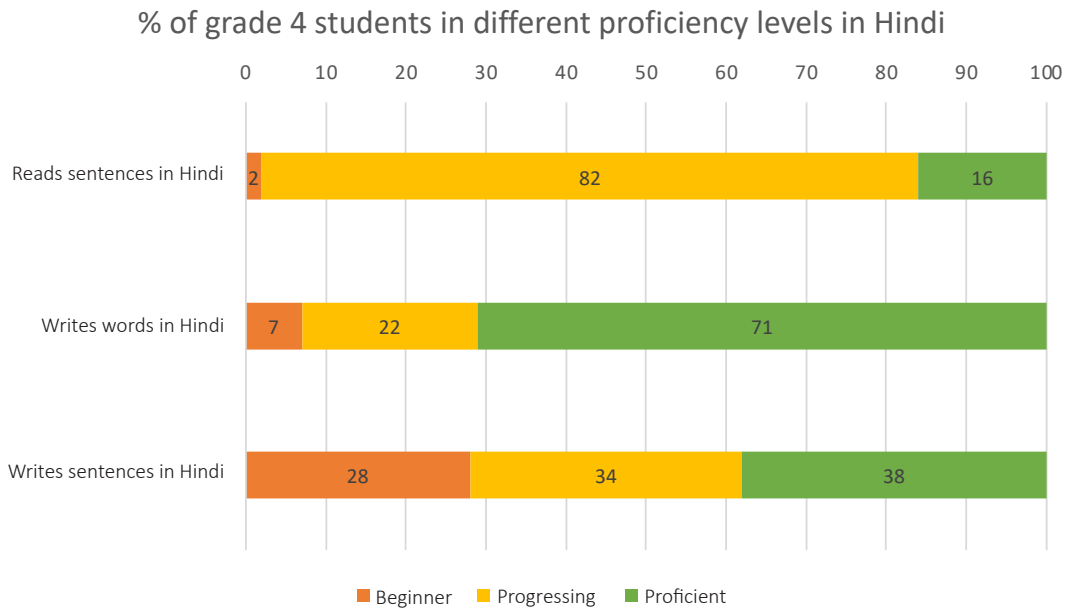


Figure 11: Distribution of proficiency levels in Hindi literacy skills for grade 4

3.2 Language proficiency in English

The distribution of language proficiency levels in English is shown in Figure 12 for grade 2 and Figure 13 for grade 4.

- **Reading Skills:** In grade 2, most students demonstrate foundational reading abilities, with 38% progressing in reading words and 47% of them proficient. By grade 4, these skills are further developed, as evidenced by 62% proficiency in reading words. Achieving mastery in reading sentences in English remains a challenge, with 68% progressing and only 7% proficient in grade 2 and 83% progressing and 0% proficient in grade 4.
- **Writing Skills:** At grade 2, the students show early writing skills, with 71% proficient in writing letters, 31% proficient in writing words and 32% proficient in writing sentences. In grade 4, there is advancement in writing words, with 53% of students proficient in writing words. However, the challenge lies in sentence writing, where 60% remain at the beginner level, suggesting ongoing gaps in developing sentence writing abilities that require targeted educational strategies to support skill development in complex writing.

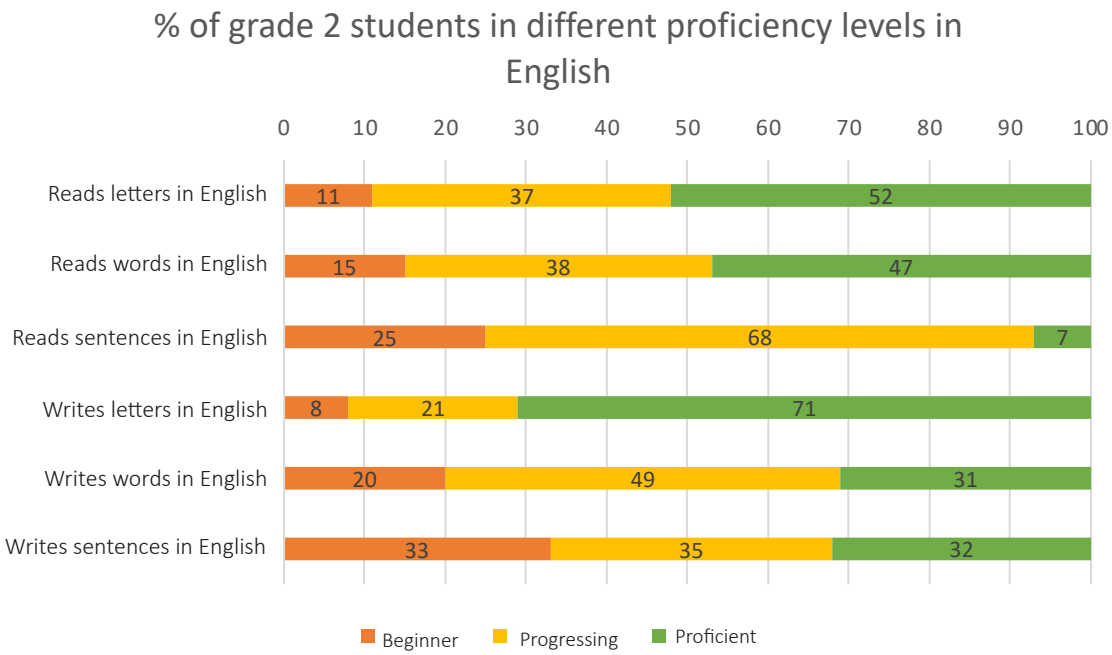


Figure 12: Distribution of proficiency levels in English literacy skills for grade 2

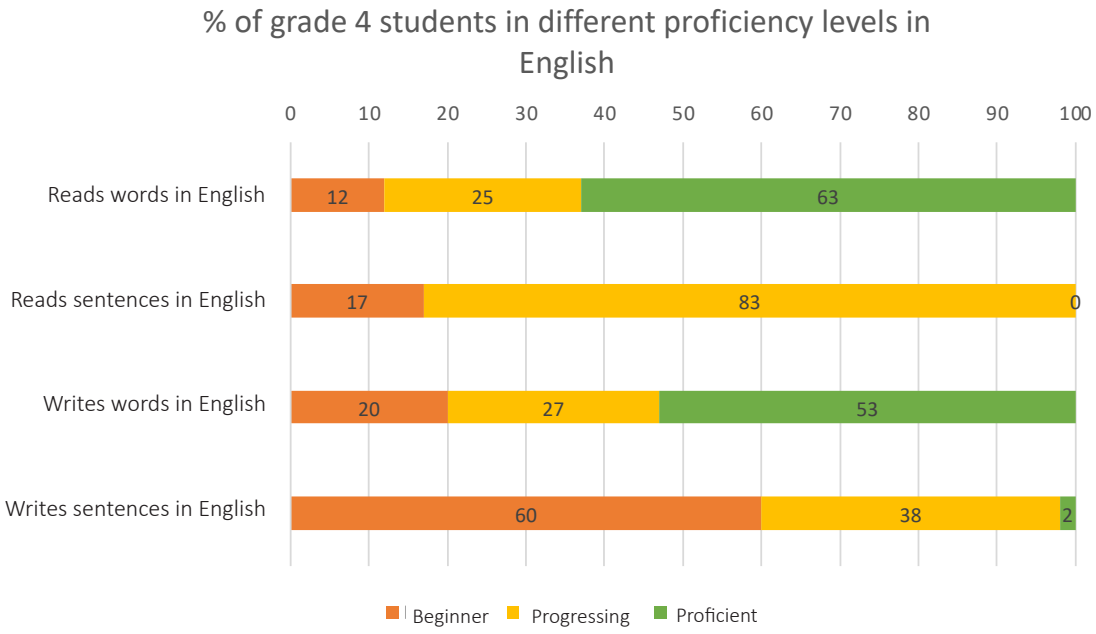


Figure 13: Distribution of proficiency levels in English literacy skills for grade 4

3.3 Language proficiency in Numeracy

The distribution of proficiency levels in numeracy skills is shown in Figure 14 for grade 2 and Figure 15 for grade 4.

- **Counting numbers:** In grade 2, a significant majority (71%) of students achieved proficiency in counting numbers, showcasing strong foundational numeracy skills. However, in grade 4, the situation is reversed with all students (100%) categorised

at the beginner level, which might reflect specific challenges or anomalies in the data, as numeracy skills were assessed in fewer than 100 booklets.

- **Addition and subtraction:** In grade 2, 36% are in the beginning stages of addition and subtraction while 42% of students reached proficiency. By grade 4, the results show a concerning trend with 78% of students at the beginner level, suggesting a potential decline in arithmetic skills or possibly limitations in the assessment's scope given its limited coverage.
- **Comparing numbers:** The ability to compare numbers shows starkly different outcomes between the two grades. While 44% of grade 2 students were proficient, none of the grade 4 students reached proficiency with all (100%) rated as beginners. This discrepancy may point to issues with the instructional approach or assessment method used in grade 4, particularly considering the small sample size involved in numeracy assessments.

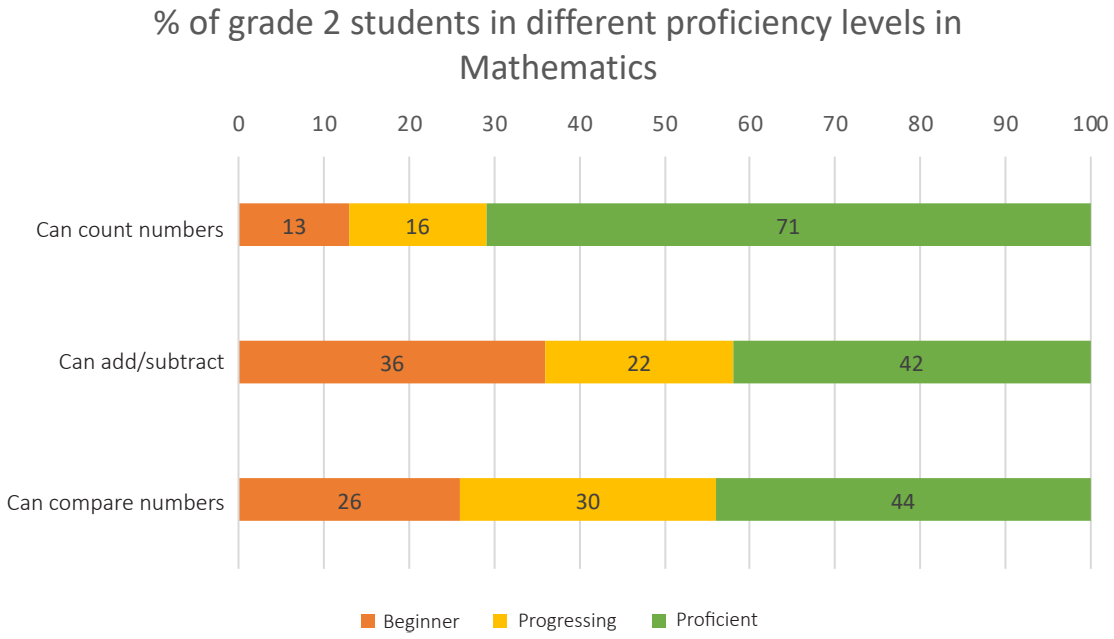


Figure 14: Distribution of proficiency levels in numeracy skills for grade 2

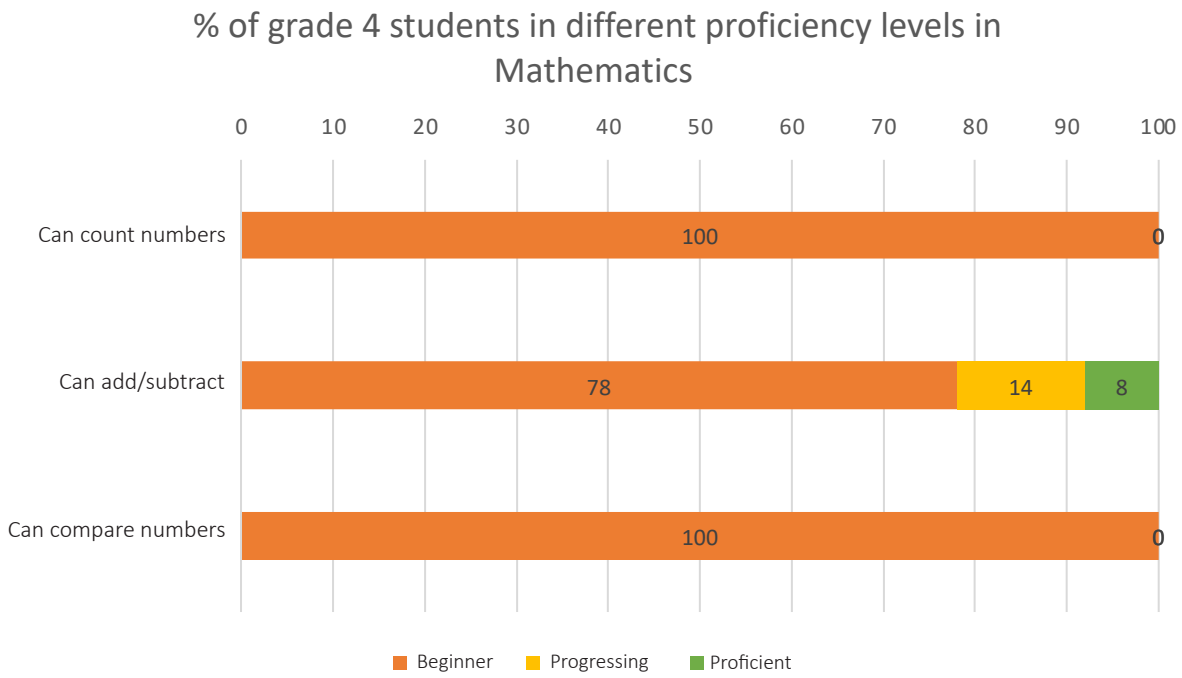


Figure 15: Distribution of proficiency levels in numeracy skills for grade 4

3.4 21st century skills

The distribution of proficiency levels in 21st century skills is shown in Figure 16 for grade 2 and Figure 17 for grade 4.

- **Critical thinking:** In grade 2, a balanced distribution is observed with 30% of students at the beginner level, 39% progressing, and 31% proficient. By grade 4, more students have moved into the progressing category with 42%, and 26% are proficient, showing a slight improvement in critical thinking skills as students advance.
- **Creativity:** Grade 2 shows 41% of students beginning to develop creativity, 37% making progress, and 21% displaying proficiency. In grade 4, the proficiency level rises to 33%, with 36% still at the beginner level and 31% progressing, indicating gradual development in creative thinking skills.
- **Problem solving:** At grade 2, 12% are beginners, 43% are progressing, and 45% are proficient, showing a strong ability in problem-solving at early stages. This trend continues into grade 4, where proficiency decreases to 34%, although the percentage of students progressing remains significant at 40%.

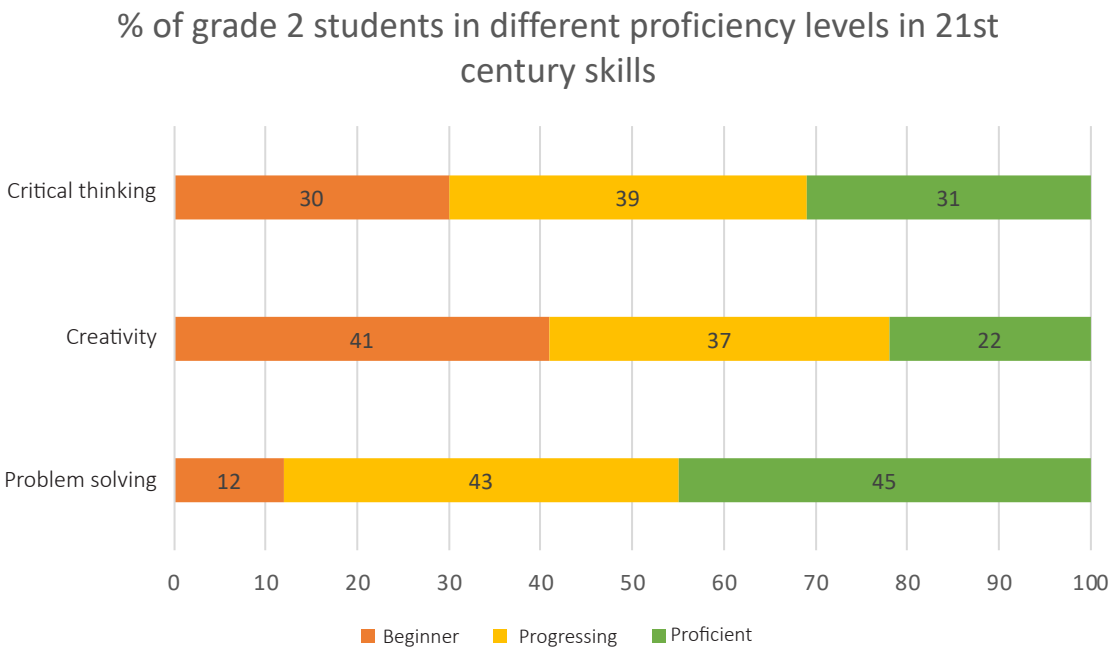


Figure 16: Distribution of proficiency levels in 21st century skills for grade 2

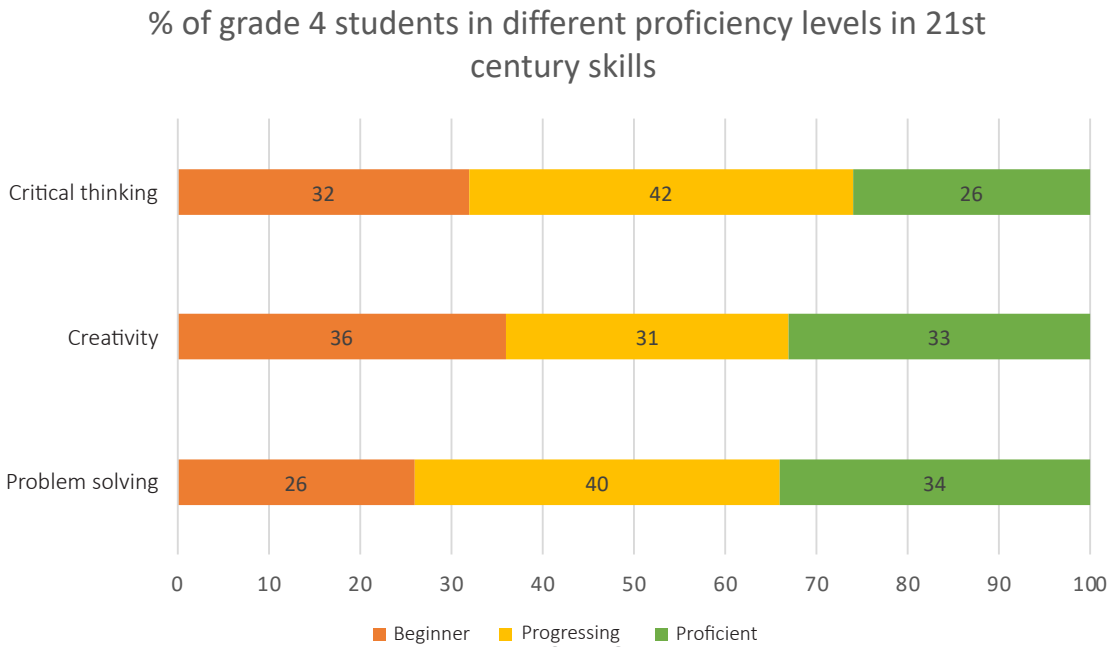


Figure 17: Distribution of proficiency levels in 21st century skills for grade 4

3.5 Completion of PBL tasks

The completion level of booklets is illustrated in Figure 18. For grade 2, only a small fraction (7%) completed less than 40% of the tasks, suggesting that most students were able to interact extensively with the learning resources provided. A significant majority of students (77%) completed over 60% of their PBL booklets, indicating a high level of engagement with the materials.

In grade 4, a notable portion (23%) completed less than 40% of the tasks, while over half of the students completed more than 60% of the booklet. This suggests some variability in engagement or possibly the complexity of tasks, indicating that while the majority remained engaged, a substantial number found the booklets more challenging or less accessible.

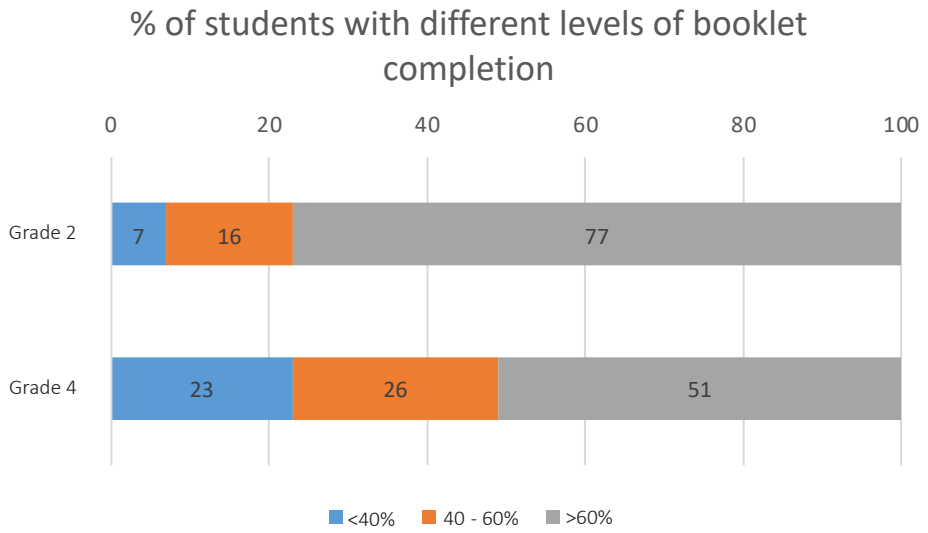


Figure 18: Completion levels of PBL booklets

Overall proficiency distribution:

The overall distribution of proficiency levels for students in grades 2 and 4 is illustrated in Figure 19. In grade 2, nearly half of the students (49%) have achieved proficiency, reflecting a solid foundation in the curriculum. By grade 4, the proportion of proficient students slightly decreases to 41%, but this is coupled with a lower percentage of beginners and a stable proportion of students still progressing. This suggests that while most students continue to build on their foundational knowledge, there remains a consistent need for interventions to support those who are not yet proficient, indicating the importance of sustained and focused educational strategies to support all students as they progress through the grades.

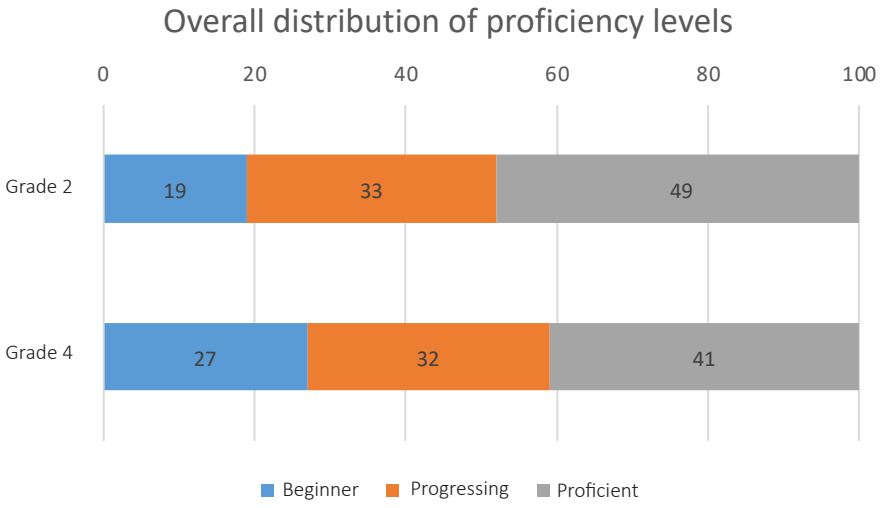


Figure 19: Overall distribution of proficiency as per PBL response analysis

4. Key findings of the competency-based assessment

4.1 Grade 3

The impact assessment of grade 3 students, who previously engaged with PBL booklets in grade 2, provides a comprehensive understanding of their achievements in literacy, numeracy, and 21st century skills. The performance in literacy and numeracy skills is shown in Figure 20.

Hindi: The majority of grade 3 students are still developing foundational skills in Hindi, with 43.9% at the beginner level and 56.1% progressing. The absence of students at the proficient level highlights a need for targeted instructional strategies to enhance Hindi language mastery.
English: In English, the distribution of proficiency levels is relatively more balanced across proficiency levels, with 28.8% of students at the beginner stage, 37.9% progressing, and 33.3% proficient. This suggests that while many students are still in the process of mastering English language skills, a substantial number have a good grasp of the subject.
Mathematics: For Mathematics, a large number of students are at the beginner stage, with 39.4% indicating difficulties in grasping fundamental concepts. 59.1% are progressing, but only 1.5% have achieved proficiency, suggesting the necessity for enhanced mathematical instruction and support at this educational level.

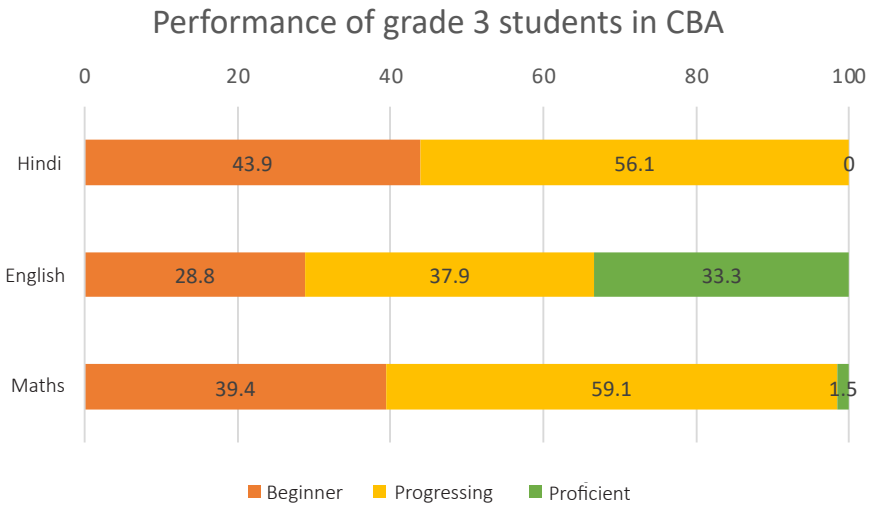


Figure 20: Performance of grade 3 students in CBA

21st century skills performance

The average performance of grade 3 students in 21st century skills is shown in Figure 21.

- **Critical thinking:** Students exhibit a strong average performance in critical thinking, with a score around 81%, suggesting that they are effectively engaging with analytical tasks that require evaluating information and making reasoned decisions.
- **Creativity:** Creativity scores are also high, around 76%, indicating that the students are being well encouraged to use their imagination and develop innovative solutions in their learning processes.
- **Collaboration:** Collaboration scores, at about 56%, are lower than creativity and critical thinking but still indicate that students are gaining some experience in working together, an essential skill for success in both academic and future career settings.
- **Communication:** Communication skills are notably high, at 83%, indicating that students excel in expressing ideas and understanding effectively.

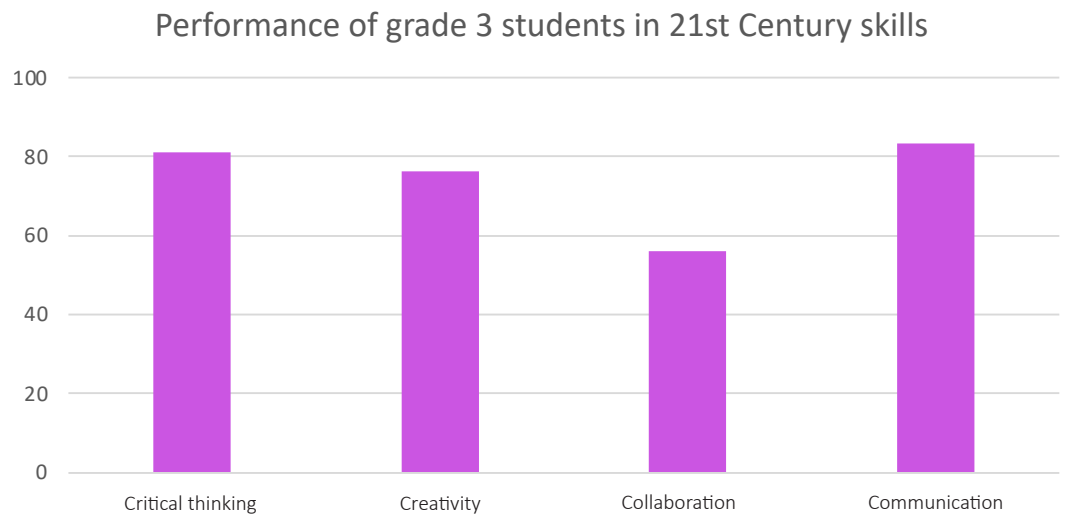


Figure 21: Average performance of grade 3 students in 21st century skills

It should be noted that the assessments of collaboration and communication skills using the rubric were not possible at the PBL booklet response data evaluation stage. This was due to the inherent limitations of such evaluations without directly observing the students. Consequently, these skills were evaluated during the CBAs, where observation-based tasks allowed for a direct assessment of the students' abilities to collaborate and communicate

Grade 3 analysis summary

Overall, the relatively low scores in traditional academic subjects suggest significant areas where instructional methodologies require enhancement. This is crucial for preparing students to navigate the multifaceted challenges of future academic and real-world environments effectively.

The strong performance in 21st century skills suggests that students are developing key competencies crucial for their ongoing educational success and were specifically

measured in the CBA. However, the lag in core academic skills highlights a critical disconnect that needs addressing to ensure balanced student development.

Adjusting the curriculum to better match competency-based goals can create more well-rounded teaching strategies. These strategies focus on both teaching knowledge and showing students how to use that knowledge in different situations. By addressing the identified gaps in Hindi, and Mathematics, teachers can help students not just learn, but also effectively use what they have learnt in various real-life scenarios. This helps ensure that students are prepared and skilled, capable of applying their academic abilities wherever needed.

4.2 Grade 5

The CBA of grade 5 students provides a nuanced view of their achievements across literacy, numeracy, and essential 21st century skills. The performance of literacy and numeracy skills is shown in Figure 22.

Hindi: Most grade 5 students show good development in Hindi, with 47.8% progressing and another 47.8% achieving proficiency. This suggests the use of effective Hindi instruction that has helped students develop and master the language skills at this level.
English: In English, a majority of the students are progressing, with 67.9% in this category, indicating that they are effectively building on their language skills. However, only 1.5% have reached proficiency, highlighting the need for enhanced strategies to advance more students to full mastery.
Mathematics: Mathematics performance shows a significant number of students still at the beginner stage, with 44% beginning and 55.2% progressing, but very few, only 0.7%, reaching proficiency. This underscores a critical need for continued focus on building foundational skills and conceptual understanding in mathematics to increase proficiency rates.

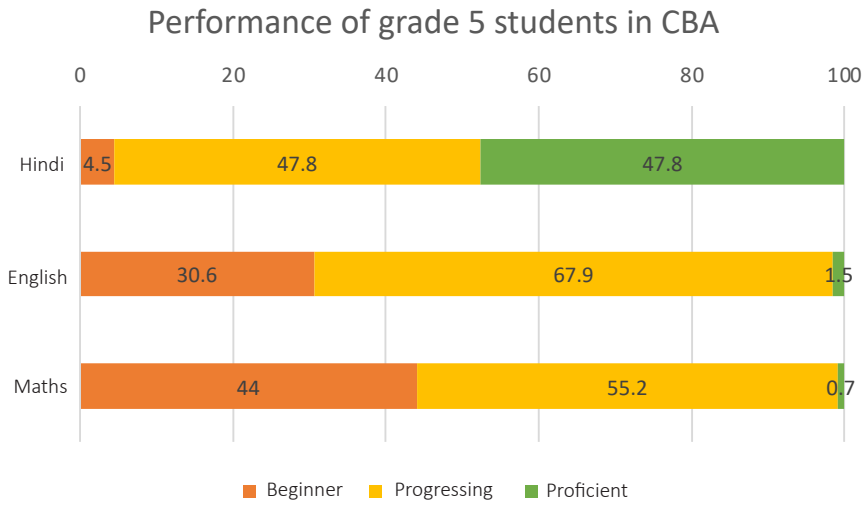


Figure 22: Average academic scores of grade 5 students in CBA

21st century skills performance

The average performance of grade 5 students in 21st century skills is shown in Figure 23.

- **Collaboration:** Students exhibit strong performance in collaboration, with a score of about 73%, suggesting effective group interaction and teamwork skills.
- **Creativity:** The scores for creativity, at around 49%, indicate room for enhancement in fostering innovative thinking and problem-solving.
- **Critical thinking:** Critical thinking appears to be an area of challenge, as evidenced by the lower scores of around 31%, highlighting a need for focused development in analytical and reasoning skills.
- **Communication:** Communication skills are notably high, at around 86%, indicating that students excel in expressing ideas and understanding effectively, which is a key component for academic and social success

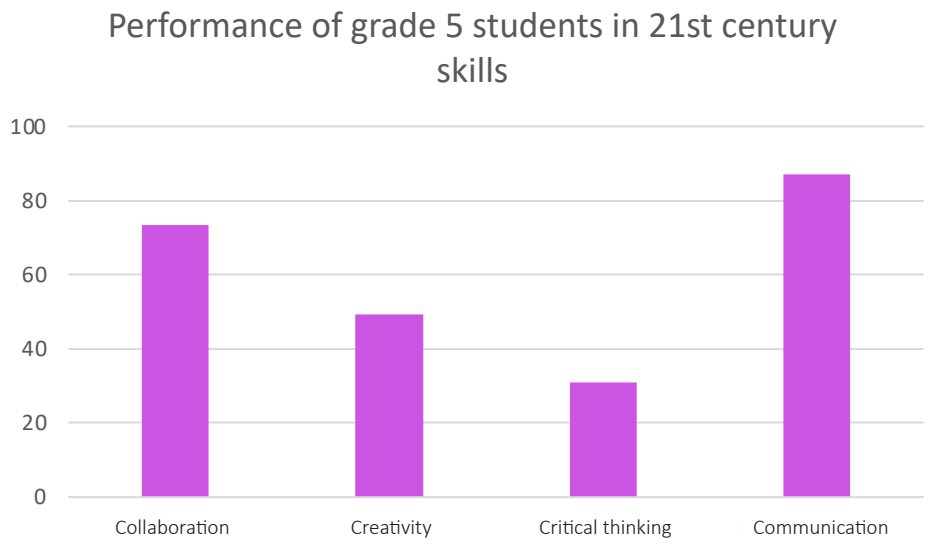


Figure 23: Average performance of grade 5 students in 21st century skills

Grade 5 analysis summary

The results of the CBA for grade 5 underscore the strong performance made in certain areas, particularly in Hindi language skills and communication, while also highlighting critical areas requiring focused attention, such as English, Mathematics, and critical thinking. By tailoring educational strategies to bridge these gaps, educators can better equip students with the comprehensive skill set required to navigate and succeed in their future academic endeavours and beyond.

5. Analysis of PBL implementation and student outcomes

5.1 Performance analysis of PBL response and CBA

This section provides the analysis of the performance outcomes for a cohort of students who engaged with PBL booklets in grades 2 and 4 and subsequently took CBAs in grades 3 and 5.

The results have been standardised to percentages for consistency in comparison across the two assessment types. Figure 24 provides performance analysis of the same cohort of grade 3 students across two different assessment formats: PBL booklets from grade 2 and a CBA in grade 3. The graph illustrates the proportions of students classified as Beginner, Progressing, and Proficient in Hindi, English, Mathematics, and 21st century skills.

Grade 3 analysis

- **Hindi:** The results show a notable shift in proficiency levels from PBL to CBAs in Hindi. In PBL booklets, a significant number of students showed progressing and proficient understanding, while CBA results predominantly classify students as beginners, indicating potential gaps in effectively transitioning from PBL learning to more formal testing environments.
- **English:** In English, students displayed a strong progression in the PBL setting but struggled to reach proficiency in the CBA, and a larger fraction remained at the beginner stage. This suggests the need for enhanced support in English to better prepare students for structured assessment criteria.
- **Mathematics:** Mathematics results show a balanced distribution across proficiency levels in the PBL booklets, while the CBA highlighted a substantial increase in beginners. This discrepancy underscores a need for reinforcing foundational mathematical skills to improve performance in standardised tests.
- **21st century skills:** 21st century skills, contrarily, show a significant improvement when transitioning from the PBL setting to the CBAs. While the PBL approach helped a substantial number of students reach a proficient level, the CBA demonstrated a remarkable increase in student's progressing, with a reduction in beginners. This suggests that the CBA may offer a more rigorous evaluation of 21st century skills,

challenging students to apply their skills in more demanding contexts effectively, reflecting a strong development and application of critical thinking, communication, creativity, and collaboration.

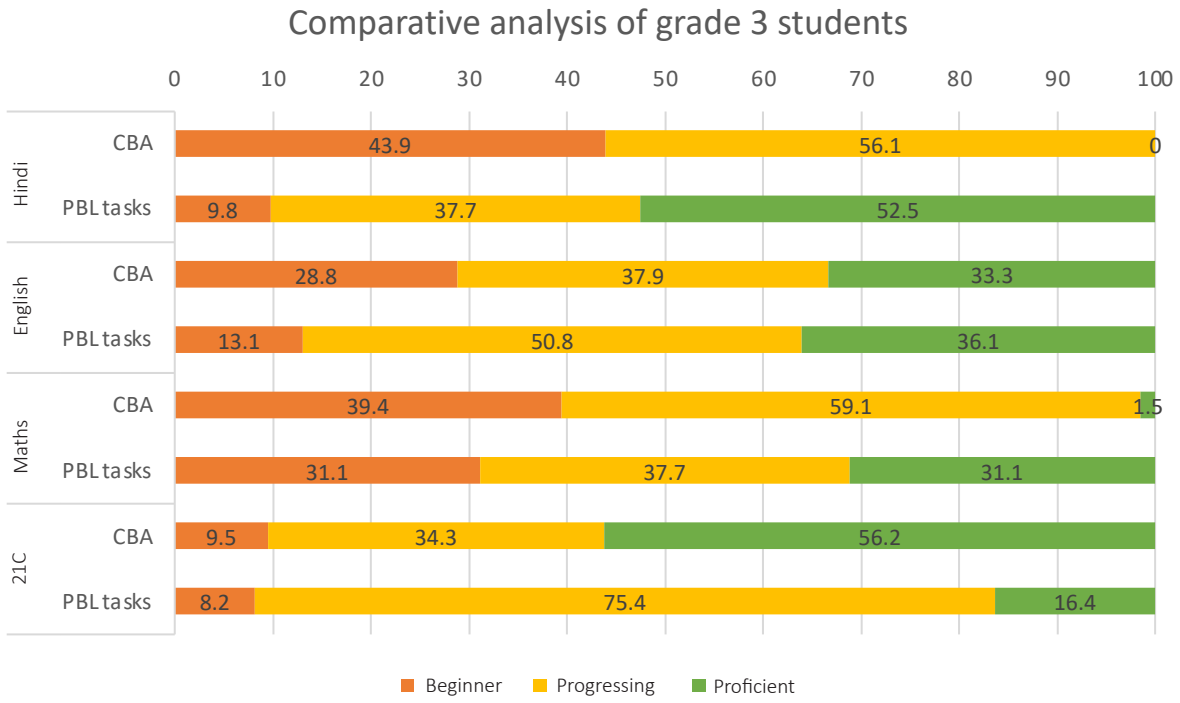


Figure 24: Distribution of students' performance in CBA and PBL booklets for grade 3

Grade 5 analysis

The performance analysis for grade 5 students is shown in Figure 25.

- **Hindi:** The results for Hindi show a higher percentage of students achieving proficiency in the PBL setting compared to the CBA. While both assessments indicate a majority of students at progressing and proficient level, the project-based environment might be more conducive to applying Hindi language skills.
- **English:** A decline in proficiency in the CBA compared to PBL responses may point to challenges in sustaining language achievements under less guided conditions.
- **Mathematics:** For Mathematics, the CBA reveal a significant proportion of students still at the beginner stage, with only a small fraction reaching proficiency. This suggests that despite the hands-on and engaging nature of the PBL approach, there remains a substantial need to enhance mathematical teaching strategies to improve understanding and application of more complex mathematical concepts.
- **21st century skills:** The analysis of 21st century skills shows an improvement in the competency-based assessment, with more students advancing to the proficient level compared to those in the PBL setting. This suggests that while PBL effectively initiates skill development, competency assessments may better evaluate these skills, pushing students to demonstrate more advanced capabilities in critical thinking, communication, creativity, and collaboration.

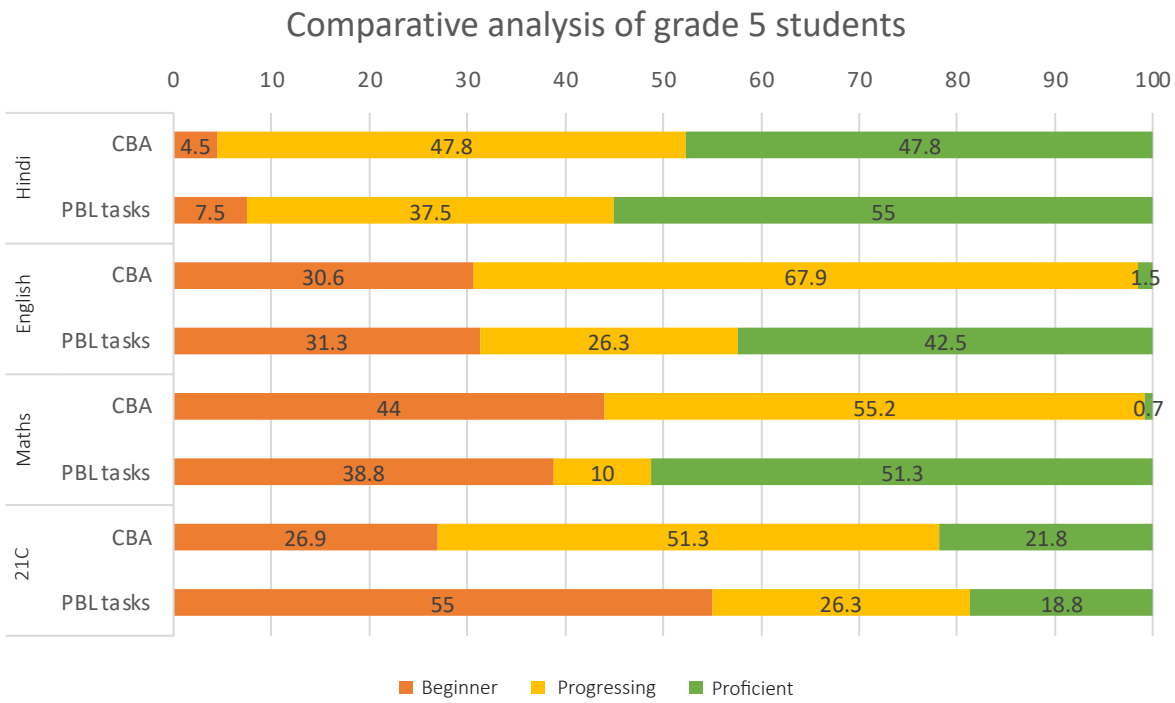


Figure 25: Distribution of students' performance in CBA and PBL booklets for grade 5

The performance analysis across grades 3 and 5 shows varying outcomes between PBL engagements and competency-based assessments:

- While academic scores in Hindi, English, and Mathematics generally declined or showed minimal improvement, there was a consistent enhancement in 21st century skills as students progressed.
- While the PBL approach may engage students effectively in developing essential soft skills, the translation of academic learning into CBAs has scope for improvement.
- The performance in the grade 3 CBA was notably lower, which may suggest that the competencies targeted at this stage are not yet fully developed in younger students.

The analysis presented in this report illustrates the impact that PBL has on the development of both academic and 21st century skills among students. The findings highlight the strengths and weaknesses of current educational strategies and underscore the potential of PBL in enhancing student learning outcomes when effectively integrated with CBAs.

5.2 Analysis of the CBA scores and PBL performance

In this analysis, we explore the association between the performance of students on PBL tasks in grade 2 (or grade 4) and their subsequent scores on CBAs in grade 3 (or grade 5). The graphs presented illustrate how prior engagement with PBL tasks

correlates with their achievements in the standardised assessments across subjects English, Hindi, Mathematics, and 21st century skills. This analysis helps to identify patterns in learning progression and the effectiveness of PBL in preparing students for more formal testing environments. Each graph details the distribution of CBA scores across PBL performance levels Beginner, Progressing, and Proficient.

Relative performance in English

The distribution of CBA scores in English for both transitions from grades 2 to 3 (Figure 26) and grades 4 to 5 (Figure 27) shows a clear association between previous PBL performance levels and subsequent CBA outcomes. In grade 3, students scored an average of 20 (Beginner), 43 (Progressing), and 60 (Proficient) on the CBA, demonstrating a clear progression in competency with higher PBL levels. By grade 5, the average scores were 27.6 (Beginner), 40 (Progressing), and 41 (Proficient). Students who performed well in PBL tasks consistently achieved higher CBA scores, indicating that early proficiency in PBL environments correlates with better performance in formal CBAs. This trend suggests that skills developed during PBL tasks are being effectively translated into competencies that are measurable in subsequent academic evaluations.

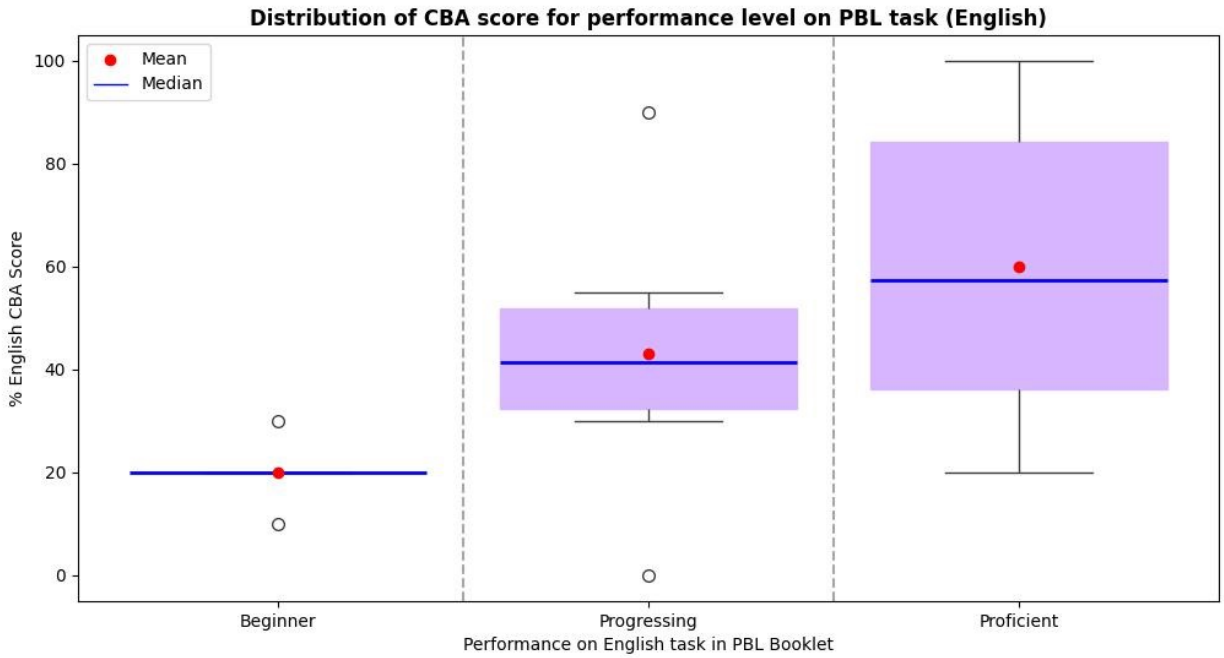


Figure 26: Distribution of CBA scores and performance on PBL tasks (grade 3) in English

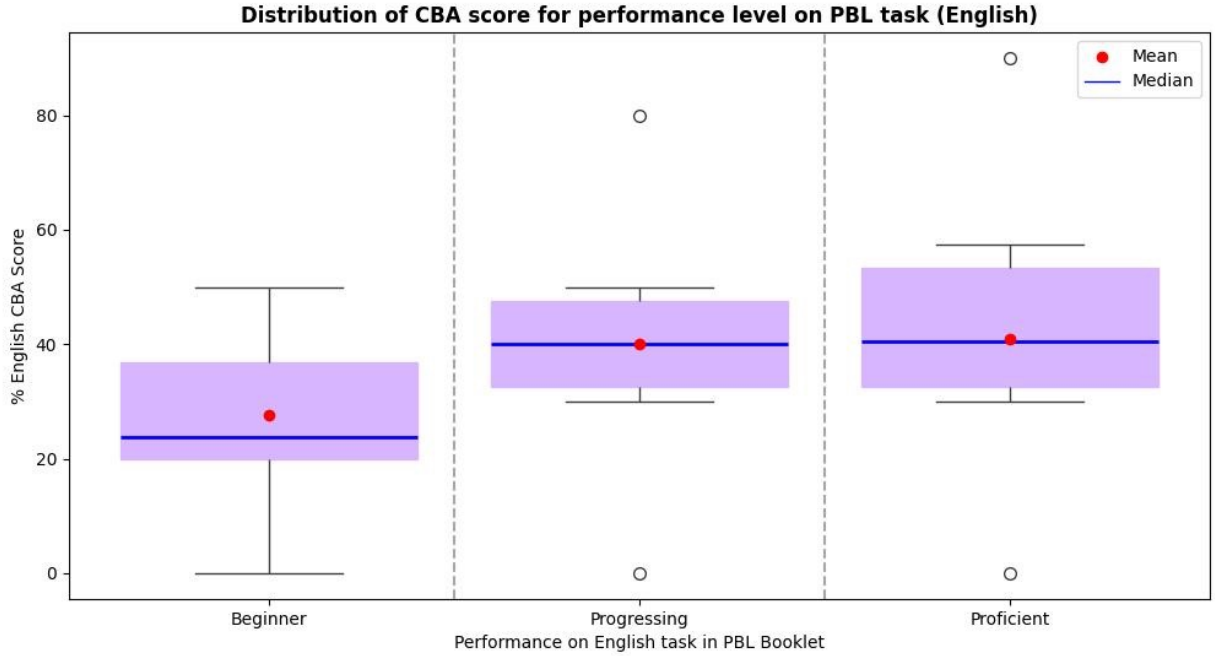


Figure 27: Distribution of CBA scores and performance on PBL tasks (grade 5) in English

Relative performance in Hindi

The data on Hindi language proficiency also demonstrates a consistent trend across both grade transitions from PBL performance to CBA scores. As students progressed from grade 2 to 3 (Figure 28) and then from grade 4 to 5 (Figure 29), those who exhibited higher proficiency in Hindi tasks within the PBL framework consistently achieved higher CBA scores in the subsequent grade. Specifically, in grade 3, students scored averages of 5 (Beginner), 24 (Progressing), and 44 (Proficient) on the CBAs. By grade 5, these scores substantially increased to 51.7 (Beginner), 69 (Progressing), and 73 (Proficient). This suggests a strong association between the level of task mastery in PBL settings and subsequent academic performance in Hindi.

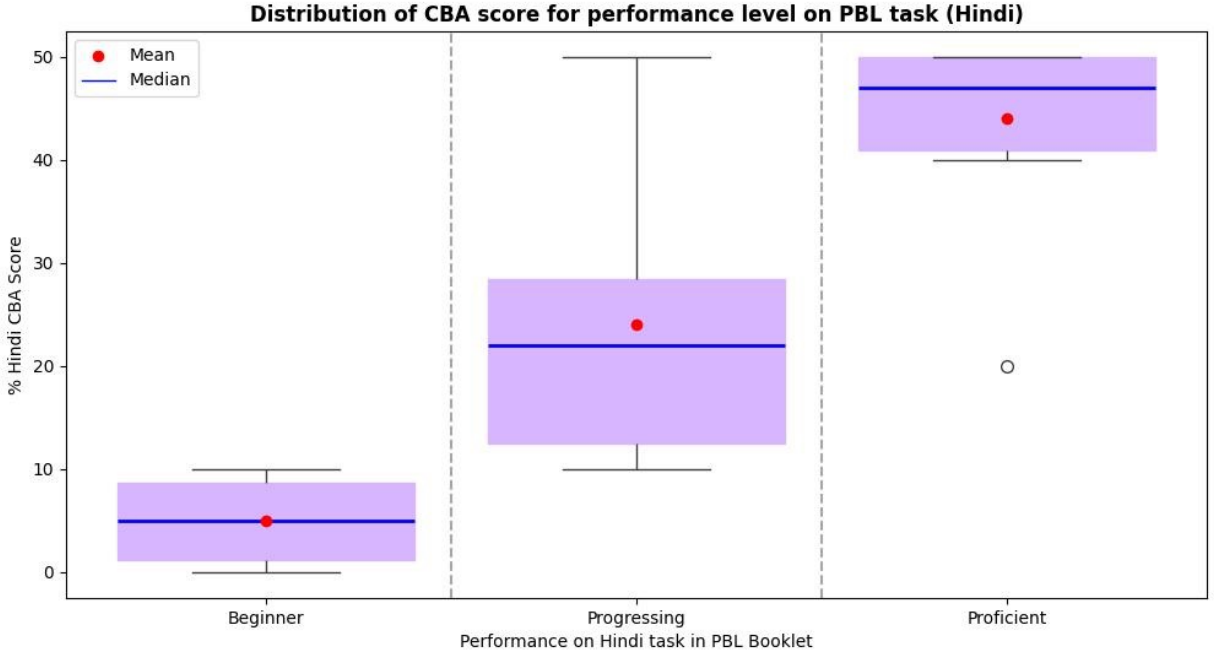


Figure 28: Distribution of CBA scores and performance on PBL tasks (grade 3) in Hindi

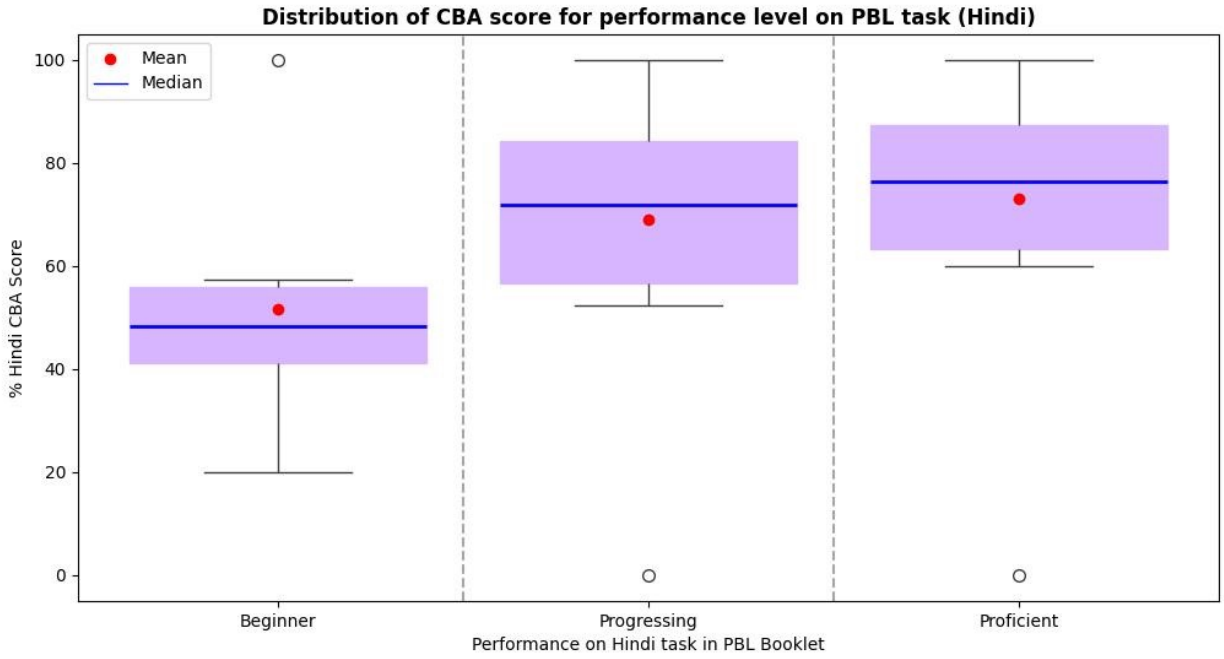


Figure 29: Distribution of CBA scores and performance on PBL tasks (grade 5) in Hindi

Relative performance in Mathematics

The distribution of CBA scores in Mathematics for grades 2 to 3 (Figure 30) shows a clear association between previous PBL performance levels and subsequent CBA outcomes, with students scoring an average of 20 (Beginner), 36 (Progressing), and 56 (Proficient) in grade 3. However, this trend is not evident for grades 4 to 5 (Figure 31) transition, where the average scores shifted to 19.7 (Beginner), 48 (Progressing), and 28 (Proficient) in grade 5.

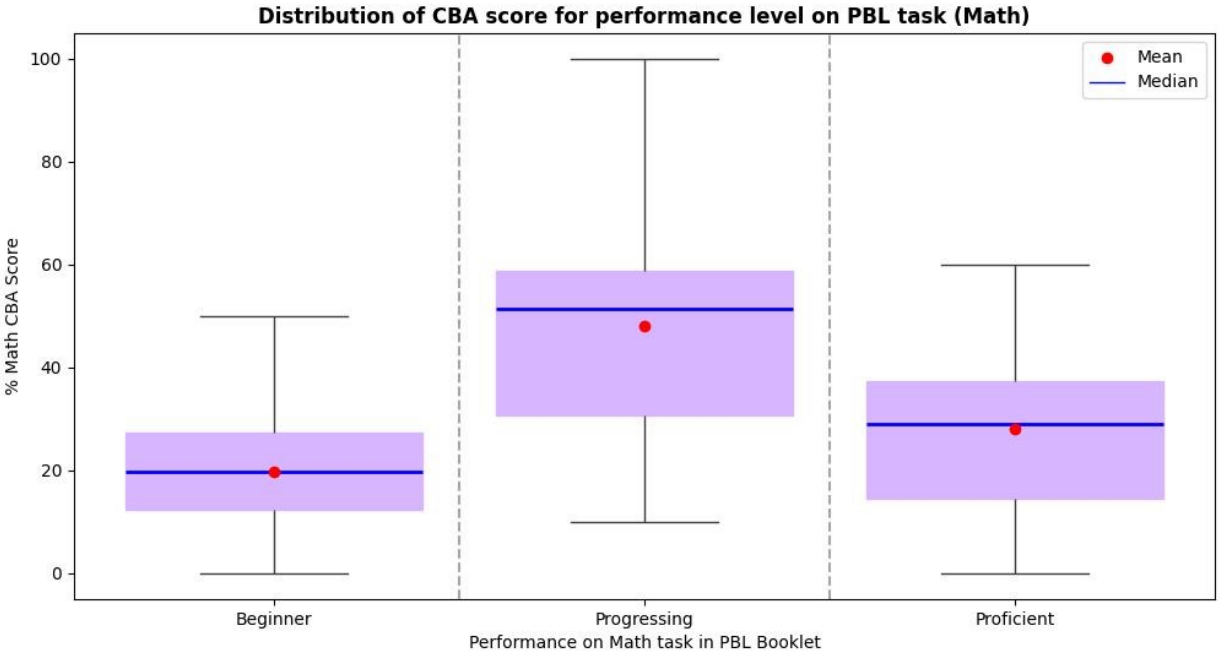


Figure 30: Distribution of CBA scores and performance on PBL tasks (grade 3) in Mathematics

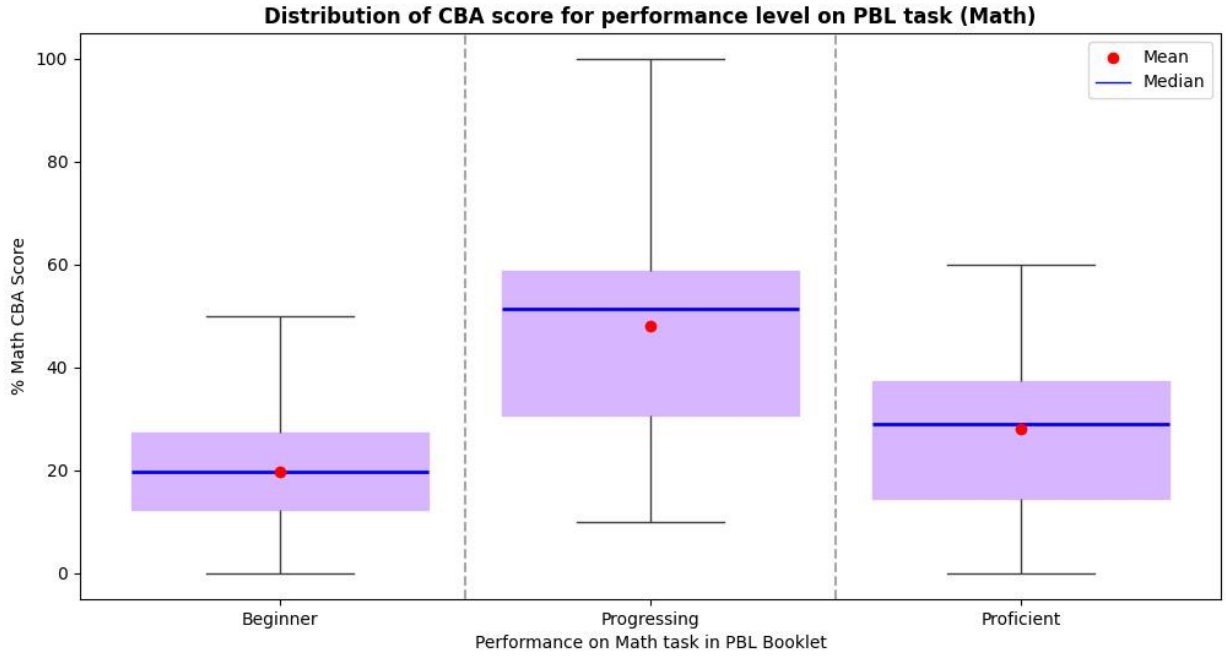


Figure 31: Distribution of CBA scores and performance on PBL tasks (grade 5) in Mathematics

Relative performance in 21st century skills

The analysis of CBA scores for 21st century skills shows mixed results indicates no clear association between performance levels on PBL tasks and subsequent CBA outcomes (Figure 32 and Figure 33). In grade 3, students recorded mean scores of 90 (Beginner), 64 (Progressing), and 77 (Proficient). However, in grade 5, scores were 57 (Beginner), 63 (Progressing), and 72 (Proficient). This disparity could suggest a need to re-evaluate the quality or relevance of the tasks within the PBL booklet designed to assess 21st century skills. Further investigation might be required to understand if the design of these tasks aligns effectively with the skills being assessed.

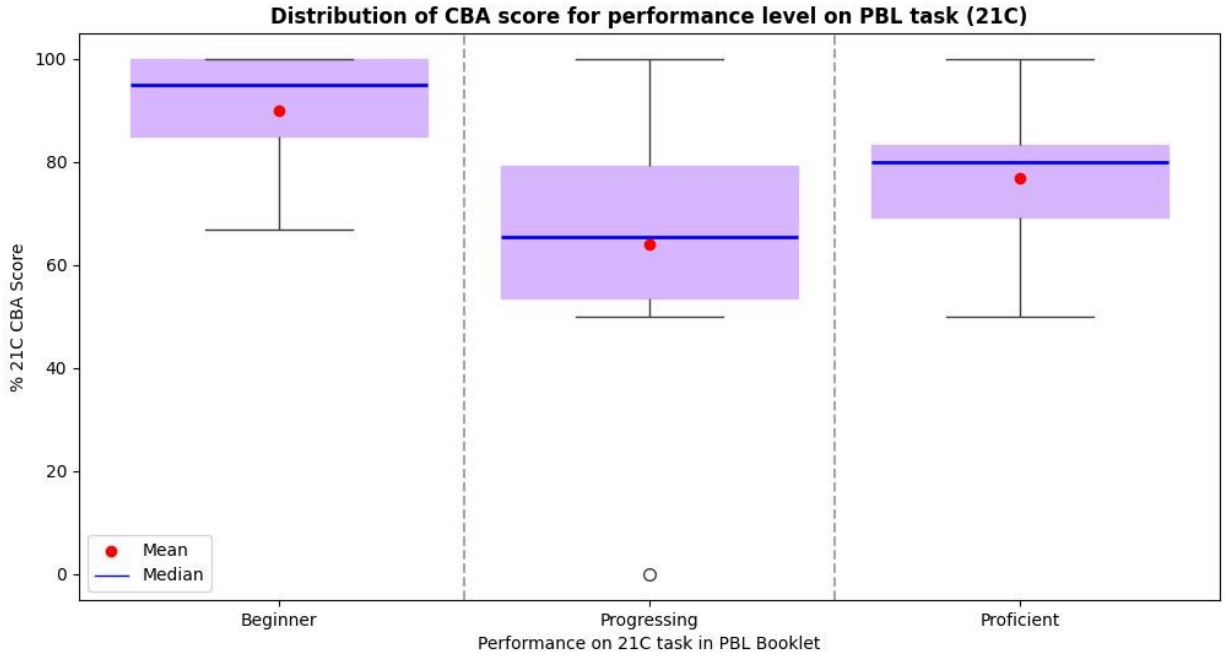


Figure 32: Distribution of CBA scores and performance on PBL tasks (grade 3) in 21st century skills

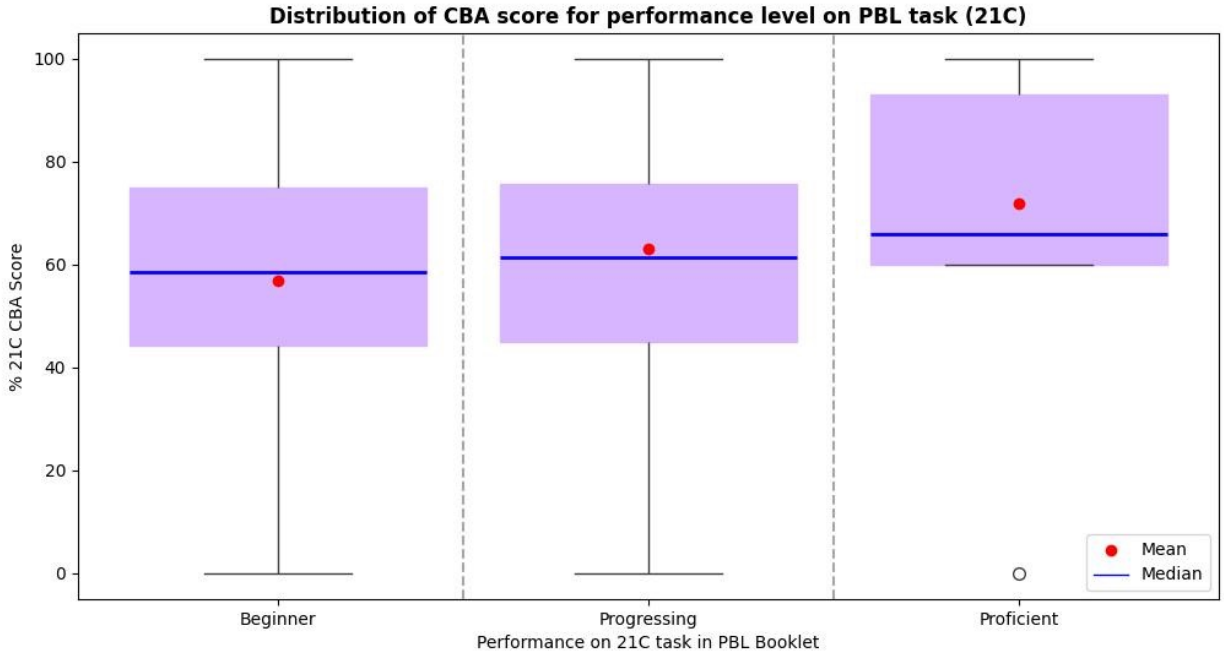


Figure 33: Distribution of CBA scores and performance on PBL tasks (grade 5) in 21st century skills

Relative CBA performance with PBL booklet completion

For grade 2 to grade 3 students, the data shows a positive association between PBL booklet completion and subsequent CBA performance, with mean scores of 18 (Beginner), 24 (Progressing), and 52 (Proficient) (Figure 34). Conversely, for students transitioning from grade 4 to grade 5 (Figure 35), where mean scores were 48 (Beginner), 41 (Progressing), and 45 (Proficient), there appears to be no clear association between PBL booklet completion and CBA performance. This discrepancy suggests that for older students, merely completing the tasks may not directly translate to higher performance in later assessments.

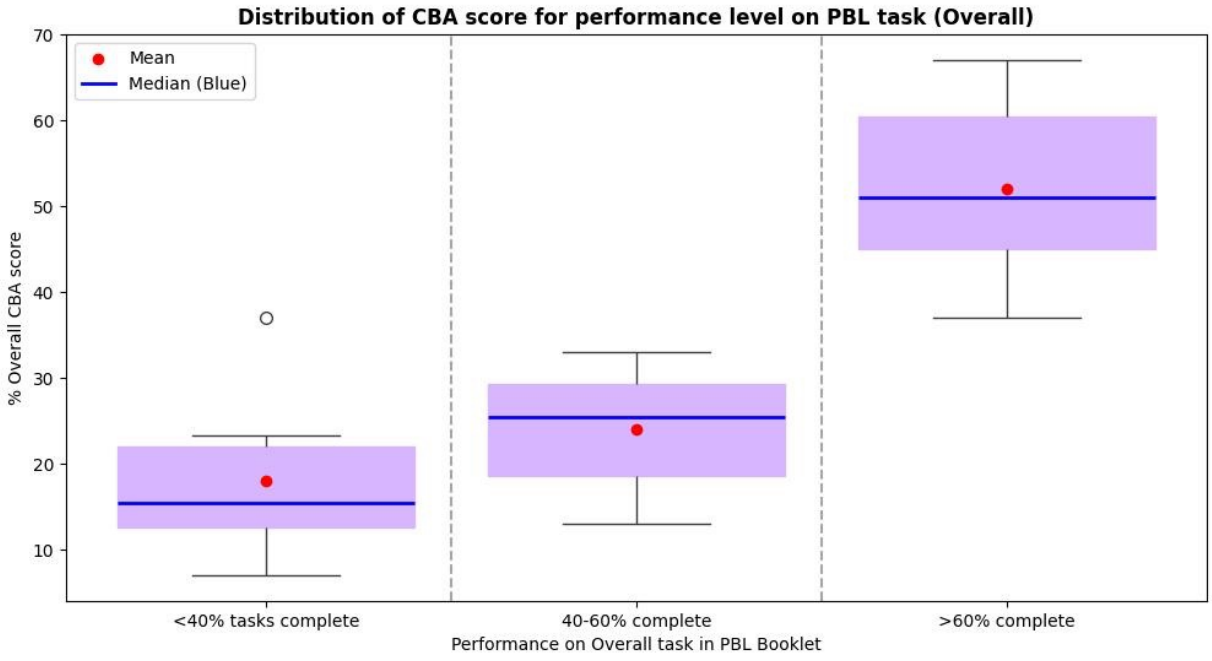


Figure 34: Distribution of CBA scores in relation to PBL booklet completion (grade 3)

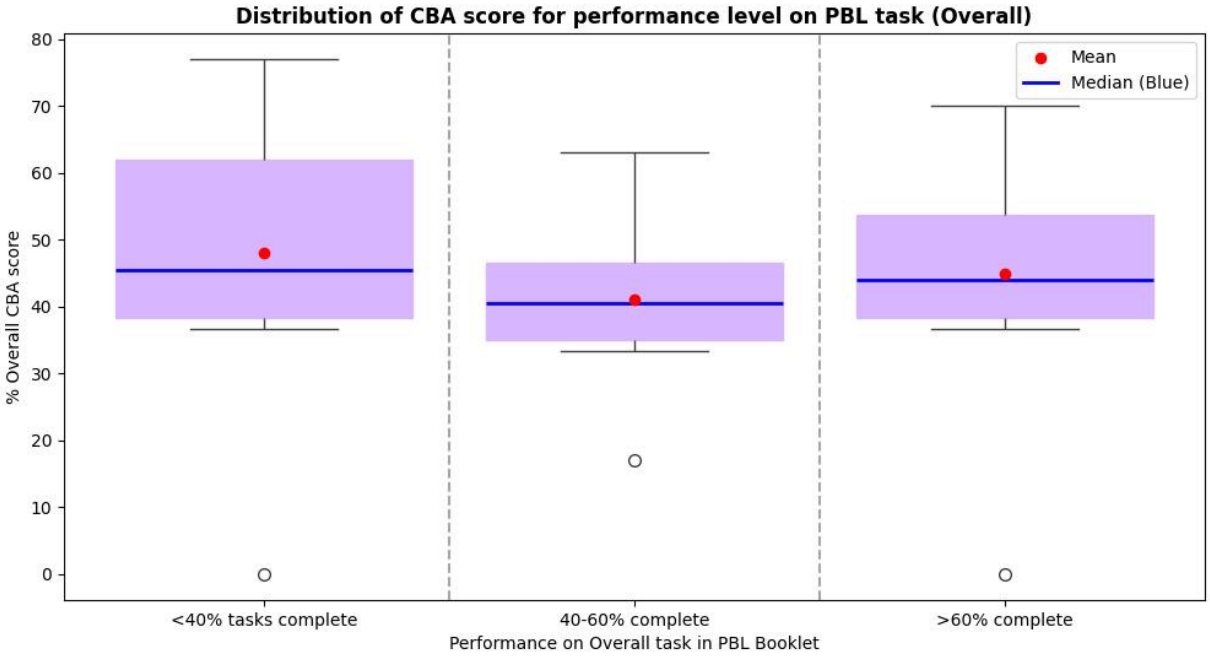


Figure 35: Distribution of CBA scores in relation to PBL booklet completion (grade 5)

The analysis predominantly reveals positive associations between students' performance on PBL tasks in specific subjects and their subsequent CBA scores, particularly noticeable in transitions from grade 2 to grade 3 across English, Hindi, and Mathematics. However, this trend does not consistently extend to 21st century skills, where no clear association is evident between PBL tasks and student CBA scores, hinting at possible areas for enhancing the relevance or assessment criteria of PBL tasks. Additionally, while there is a notable positive correlation between PBL booklet completion and CBA performance for younger students, this association diminishes in older grades, indicating that task completion alone may not be a reliable predictor of future academic success as students mature.

6. Key findings from the teacher survey and focus group discussions

6.1 Teacher survey

A teacher survey was conducted to investigate teachers understanding of PBL, implementation challenges, and the impact of the learning approach on students.

Teachers' responses to the questionnaires indicated that around 90% teachers understand the alignment between curricular goals and PBL approach of teaching, while a similar percentage of teachers either agreed or strongly affirmed their understanding of PBL and its components. Above 80% of the teachers surveyed agreed to having a fair understanding of the need to implement PBL in classrooms (Figure 36). Teachers who implemented the Auro PBL booklets in the classrooms displayed a positive attitude toward the PBL approach to learning during FGD. They also demonstrated a fair understanding of PBL and its policy significance. This is in sync with the increasing global recognition of PBL as a powerful pedagogical tool for fostering 21st-century skills, including collaboration, critical thinking, and problem-solving (Thomas, 2000).

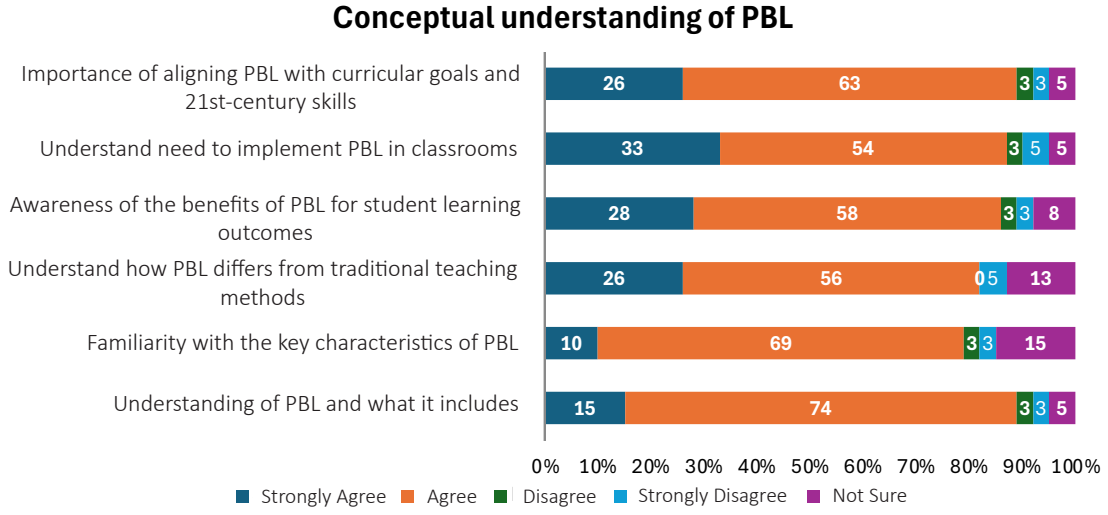


Figure 36: Teacher's understanding and perspectives on PBL

Figure 37 shows teachers' perception on the impact of Auro PBL on students. Survey data indicated a positive outlook of respondents towards the PBL. Almost 90% teachers agreed or strongly agreed with the statement that PBL fosters student motivation resulting in improved understanding of concepts and achievement of competencies. Previous research also indicates that PBL enhances intrinsic motivation and deepens conceptual understanding by engaging students in meaningful, authentic tasks (Barron & Darling-Hammond, 2008; Thomas, 2000).

A significant number of respondents demonstrated a strong perception that such approaches don't only equip students to better manage real life problems but also help them achieve traditional curricular goals. This aligns with prior research showing that PBL fosters both academic achievement and the development of transferable skills, such as critical thinking and collaboration (Han et al., 2015). The same was reinforced during FGDs, where teachers recognized the role of Auro PBL in fostering a more hands-on, engaging, and student-centered learning environment compared to traditional methods.

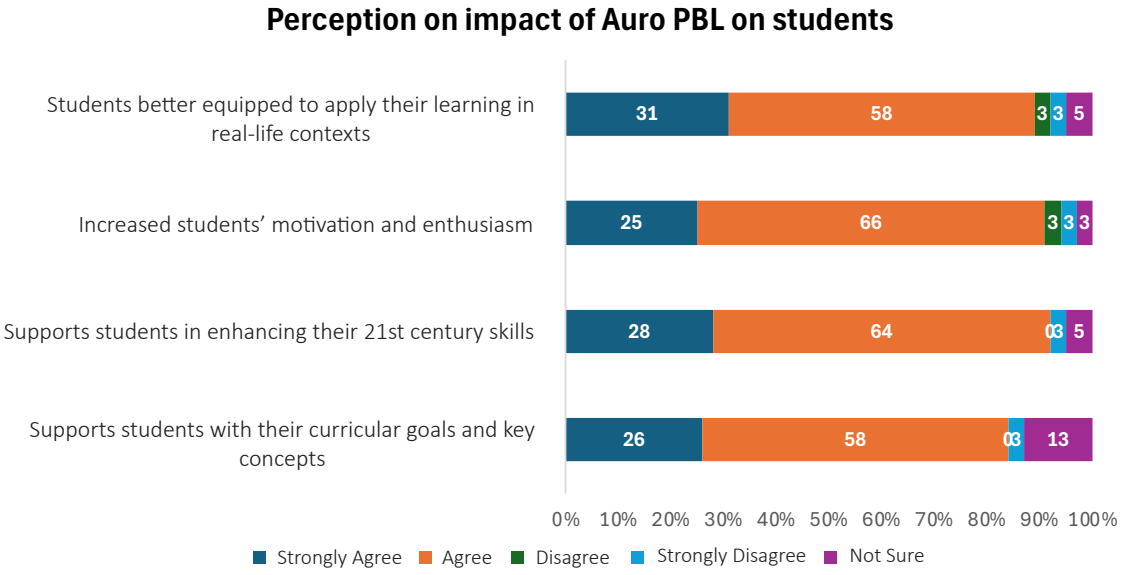


Figure 37: Teacher's perceived impacts of Auro PBL on student outcomes

More than 80% of the teachers surveyed strongly agreed or agreed to effectively planned and balanced PBL activities and ease of integrating them with instructional strategies in the classroom. However, more than 50% teachers felt that they need adequate resources, training, and support to be able to effectively implement PBL in classroom (Figure 38).

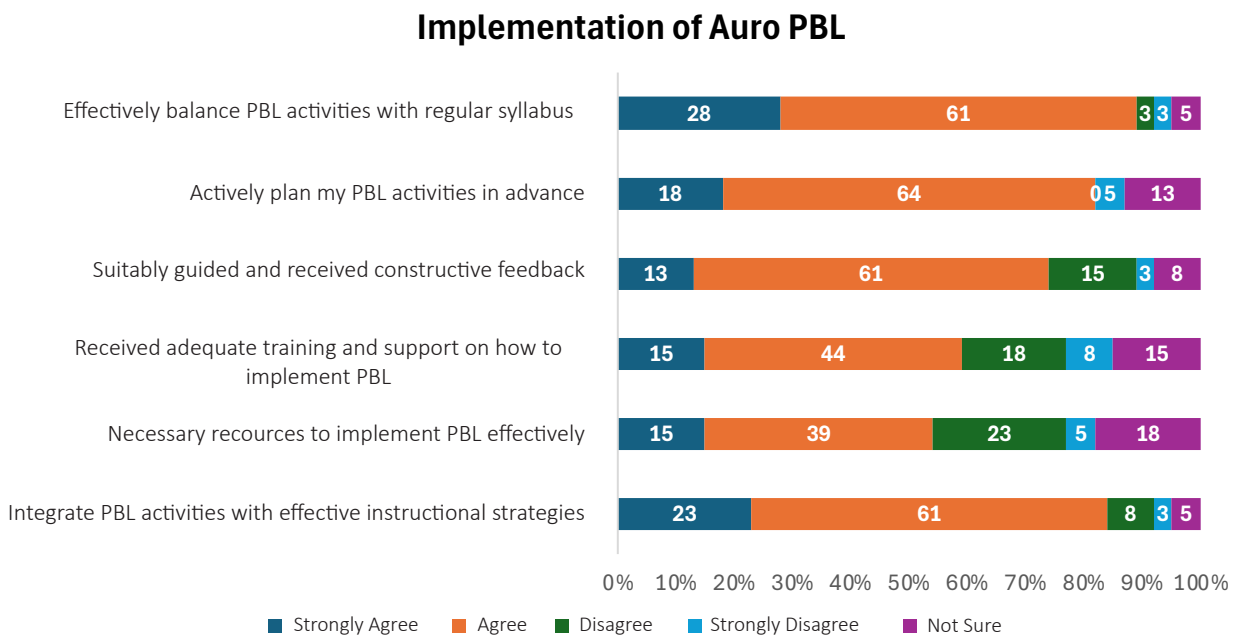


Figure 38: Teacher's experience with implementing Auro PBL in the classroom

Overall, 88% teachers expressed satisfaction with their experience of implementing Auro PBL in the classroom (Figure 39).

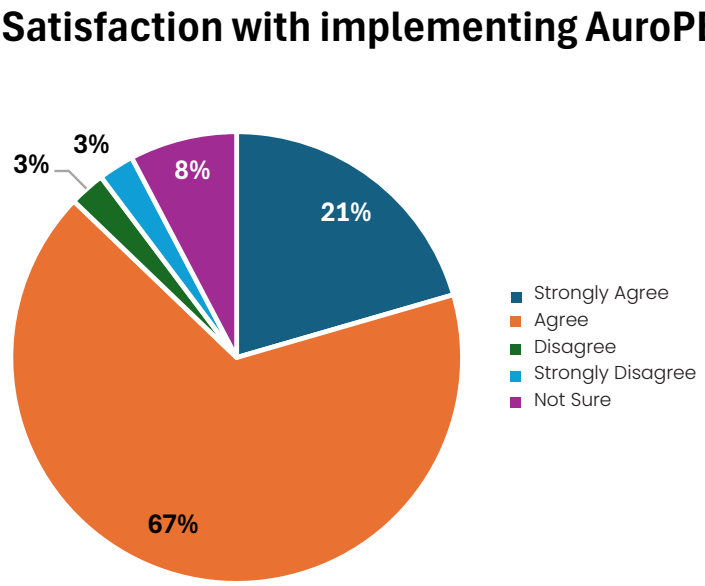


Figure 39: Teacher satisfaction with the implementation of Auro PBL in their classrooms

While the findings are encouraging, further research should explore the extent to which teachers' stated understanding translates into effective PBL implementation in real-world classroom settings. The same was reinforced during FGD. While they recognized the role of Auro PBL in fostering a more hands-on, engaging, and student-centered learning environment compared to traditional methods, they expressed concern over the time taken to complete the activities.

This also highlights the disparity noted in the CBA results, where students showed gaps

in performance—potentially due to the lack of a supportive environment similar to that of PBL activities, contrasting with the self-dedicated nature of competency assessments.

6.2 Focus group discussion

While 88% teachers claimed to be satisfied with their experience of implementing Auro PBL in the classroom, more than 40% teachers felt that they need adequate resources, training, and support to be able to effectively implement PBL in classroom. Therefore, FGDs were held with teachers to gain deeper insights into challenges faced by teachers while implementing Auro PBL.

Group discussions indicated that teachers who implemented the booklets in the classroom in general displayed a positive attitude toward the PBL approach. They recognised the importance of PBL in fostering a more hands-on, engaging, and student-centred learning environment compared to traditional methods.

However, several gaps were identified in the Auro PBL implementation.

Gaps identified by the teachers in the implementation of Auro PBL

A summary of the implementation gaps identified are listed below:

- **Lack of grade specific guidelines for booklet implementation:** Teachers expressed confusion regarding the grade and age-level appropriateness of the booklets. They were unsure whether these booklets were meant to be used across different grades or were specifically designed for certain grade levels. Additionally, they demonstrated lack of understanding on the number of booklets to be introduced at each grade level.
- **High content complexity for the intended grades:** Many teachers found the booklets to be too complex both in terms of content and cognition for the intended grades. Teachers suggested that lengthy writing tasks for early grades (grades 1 and 2) were not suitable. Few teachers also raised concern about reading load acknowledging that majority of students in lower grades can only read very simple sentences, while a few students cannot even do that.
- **Limited teacher responsibility:** Teachers acknowledged their minimal role in the implementation of booklets. They did not demonstrate a clear understanding of the progress made by the students in terms of booklet completion, as intended. They admitted transferring the responsibility of booklet completion to parents. In cases, where parents were not adequately literate, booklet completion became either problematic or mere a formality of copying from another student. This was indicative of a huge disconnect between the intended implementation and the execution at the classroom level.
- **Insufficient tracking and oversight of student progress:** Teachers shared that there was no mechanism for tracking students' progress either in terms of completion or progress of learning.

- **Excessive task load of teachers:** Teachers reported that the volume of tasks in each booklet was overwhelming, especially when many schools are single-teacher schools. This made it challenging to complete the required tasks, when dealing with large class sizes and limited staff resources. Teachers struggling to complete the curriculum perceived the booklets as added workload.
- **Language and accessibility issues:** Another revelation by the teachers was that the language used in the booklets was often difficult to comprehend, with even some teachers struggling to interpret instructions. The small font size, poor paper quality, and black-and-white format further hindered the usability of the materials.
- **Challenges of rural contexts:** It was highlighted that some activities required access to technology (e.g. Google search), which was not feasible for students in rural settings. There was a common perception that the content was more aligned with urban contexts rather than rural settings, and contexts. This highlighted the challenge of implementing a programme that assumes access to resources not available in all contexts.

Suggestions for the areas of improvement of PBL

The teacher feedback suggests that while the PBL initiative is well-regarded for its pedagogical intentions and design, its success is hampered by implementation challenges. Based on feedback the following areas of improvement emerge.

- **Design and effective dissemination of implementation guidelines:** Clear instructions should be provided for teachers and students regarding the appropriate use of booklets at each grade level. Specific guidelines on the number of booklets to be used at each grade level would also help to ensure intended implementation. Teachers should be explained about their roles and responsibilities in the implementation. Regular communication and feedback mechanisms should be established to ensure that teachers understand their role in implementing the programme and tracking student progress.
- **Contextually appropriate content:** The complexity of the booklets should be reduced to better align with the developmental stages of the students in each grade. Content should be adapted to suit both urban and rural contexts to ensure relevance and feasibility in different settings.
- **Accessible learning materials:** The physical quality of the booklets should be improved. Larger print, better paper quality, and colour printing would enhance the usability and appeal of the materials. Additionally, simpler, digestible language should be used to ensure accessibility for teachers and students alike.
- **Implementation support platforms for teachers:** A platform for teachers to collaborate, share implementation experiences, and discuss challenges would be beneficial. This would allow for the exchange of successful strategies and solutions, fostering a community of practice.

7. Recommendations

Based on the findings from the teacher survey and FGDs and the insights gained from the analysis of both PBL booklets and CBAs, the following recommendations are offered to optimise the implementation strategies and bridge the gaps in the design and implementation of the Auro PBL initiative:

1. **Refinement of the PBL booklets:** SAS may consider incorporating feedback from teachers, who have pointed out the need for clearer implementation strategies and identified areas for improvement in PBL content. While the use of activity-based learning is evident in the booklets, and the themes chosen are broadly related to real-life challenging scenarios with a notable attempt to connect each activity to students' prior knowledge and understanding, however, a scope to improve the booklet content was expressed by teachers to further enhance the initiative. Doing so could significantly advance the initiative's objectives, making the PBL approach more responsive to the needs of educators and students.
2. **Refinement of the PBL implementation processes:** Clear implementation framework supported with detailed implementation manual would be helpful to enable the consistent execution of PBL activities across various educational settings, ensuring all participants understand their roles and objectives. Ensuring the accessibility of resources and materials for both teachers and students is crucial to minimise disparities in learning experiences.
3. **Mapping of PBL booklet activities with curricular calendar and academic plan:** Aligning themes of PBL booklets with the curricular calendar might enable seamless integration into the existing academic plan. This mapping might help teachers identify the most suitable point to introduce specific PBL activities, ensuring that they complement rather than disrupt the prescribed learning trajectory. Additionally, structured integration would also allow for better planning of assessments, ensuring that learning objectives are met effectively within the given academic timeline.
4. **Training on integrating PBL booklets into routine classroom activities:** Teachers should be provided with targeted training to effectively incorporate PBL booklet activities into their daily classroom practices. This includes strategies for embedding PBL tasks within existing lesson plans, balancing traditional teaching methods with hands-on, inquiry-driven learning, and managing time efficiently to cover both PBL and standard curriculum requirements. Enhanced teacher support through targeted training programmes will empower educators with the skills necessary to effectively implement PBL strategies and facilitate student learning.
5. **Research and continuous improvement:** It may be beneficial to continually research and refine the PBL design and implementation approach, drawing on ongoing evaluations and current educational research to maintain its relevance and effectiveness. Keeping abreast of pedagogical advancements and integrating new teaching and learning technologies could also enhance its impact.

8. Conclusion

The report illustrates the impact of PBL on the development of both academic and 21st century skills among students. The findings of this study demonstrate the effectiveness of PBL in enhancing student competencies in foundational competencies in different curricular areas such as English, Hindi, and Mathematics. Students who excel in PBL tasks tend to perform better in CBA. Conversely, the lack of a similar positive association between PBL task performance and CBA scores in 21st century skills point to possible misalignment in task integration and assessment. Performance of younger students shows a positive correlation between PBL task completion and their performance on CBAs, and this linkage does not hold as strongly for older students, reinforcing that simply completing tasks is not sufficient for ensuring academic success.

Inadequate teacher training and resource constraints in diverse classroom contexts emerged as the barriers in implementing the initiatives as intended. Structured guidelines, professional development, contextually relevant materials, and collaborative platforms may be helpful to integrate PBL seamlessly into classrooms.

Moving forward, SAS and its academic partner need to focus on refining PBL content, aligning it with core principles, and fostering a learning environment that ensures skill development along with academic growth. The goal should be to create a learning environment that not only fosters skill-based competencies but also ensures robust academic growth. This may require re-evaluating the instructional strategies and enhancing teacher training to provide a more adaptive and personalised learning experience. Above all, task quality needs to be emphasized over mere completion, for sustaining academic improvement through Auro PBL.

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