EVALUATION REPORT

MINDSPARK
MATHEMATICS
GRADES 3-5

Evaluated in January 2021
1. What Does This Report Contain?

The section, 'Overview of the Product', provides a brief description of the product and its key features to give the context for the evaluation. The two sections following that present the findings from the evaluation. The Executive Summary provides the overall rating and offers implications in terms of benefits and limitations for teachers and learners. The Detailed Review section provides an in-depth evaluation of the product, categorized under three dimensions (or constructs) – Content Quality, Pedagogical Alignment, and Technology & Design. For each dimension, the product is reviewed on the criteria along with explanations for the rating, and grouped into clusters. Specific examples have been provided in this report to support and elaborate on the evaluation ratings.

The terms, ‘Exemplary’, ‘Valuable’, and ‘Potential to Improve’, used in the report refer to the rating scale for evaluating the product.

- **'Exemplary'** indicates that the product has been designed as per recommended learning theories and research-based evidence.
- **'Valuable'** indicates limited adherence of the product’s design to the recommended learning theories and research-based evidence.
- **'Potential to Improve'** indicates unsatisfactory or lack of adherence of the product’s design to the learning theories and research-based evidence.

2. Overview of the Product

This report evaluates the product Mindspark, Mathematics (Grades 3-5). Mindspark is an adaptive, self-learning platform aimed at providing a unique learning path to each learner based on his or her needs. It is designed using data on learners’ learning gaps and difficulties. It consists of a series of questions, activities, and challenges presented to the learner along with corresponding feedback. Adaptivity is based on learner profile and performance.
3. Executive Summary

Mindspark | Mathematics | Grades 3-5

Content Quality: Exemplary
Pedagogical Alignment: Exemplary
Technology and Design: Valuable

Potential benefits of this product

- Learners can be assured of the correctness of the content and can use the product independently to learn different concepts aligned to their curriculum.
- The product can be used as a great supplement to school and classroom learning as it helps to address common learning gaps for the students.
- Learners at different levels will be able to benefit from the product due to its adaptive nature and presence of features like ‘Effort Mode’ and ‘Challenge Questions’.
- Due to the constructivist approach used for learning, it can also be used as an independent learning resource for practice and to explore and advance beyond the class.
- The learning content is relatable to a good extent for the concerned age group.
- The interface is intuitive to use for learners and Grade 3-5 students will be able to use it independently after a basic introduction to the product.
- Teachers can use Mindspark to track student progress and levels which can help inform their classroom instruction. Also, teachers can create and assign worksheets on the platform directly.

Potential limitations of this product

- The feedback quality is inconsistent across various topics which might be a hindrance to effectively grasp the concept, especially for a struggling learner.
- Learners might be disengaged when too many similar questions are presented upon making a few mistakes. Also, the inability to skip questions or even navigate to a different sub-topic might add to the learner’s frustration.
- The lack of a conversational or personalized tone in the language of the questions could also lower the engagement of the learners.
- The product doesn’t have sufficient mathematical tools for some topics where they are required. Having these tools would enhance the learning experience and lead to a better understanding of the concepts.
**Mindspark (Grades 3-5): Summary of Review Ratings by Criteria**

**Content Quality: Exemplary**

<table>
<thead>
<tr>
<th>C1 Content accuracy</th>
<th>Not applicable as the product did not contain separate content videos or text; instead “content” in the product was entirely in the form of questions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2 Correctness and clarity in assessment</td>
<td>The assessment questions are clear and solutions contain accurate explanations for the majority of the topics.</td>
</tr>
<tr>
<td>C3 Language comprehensibility</td>
<td>The language used is easily understandable by the learners of Grade 3 to 5.</td>
</tr>
<tr>
<td>C4 Mathematics skill coverage</td>
<td>Mathematics mindset and skills required for grade 3-5 (recommended by NEP 2020 and NCF) are covered.</td>
</tr>
<tr>
<td>C5 Curriculum alignment</td>
<td>The content is aligned to NCERT and logically sequenced.</td>
</tr>
<tr>
<td>C6 Inclusivity in representation of learners</td>
<td>There is an adequate representation of the relevant sections of society in terms of gender, race, socio-economic class and religion.</td>
</tr>
</tbody>
</table>

**Pedagogical Alignment: Exemplary**

<table>
<thead>
<tr>
<th>P1 Constructivist approach</th>
<th>The learner has an opportunity to make meaning of the concepts, to apply the understanding and do problem solving.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2 Addressing learning gaps/ alternate conceptions</td>
<td>The learner has an opportunity to make meaning of the concepts, to apply the understanding and do problem solving.</td>
</tr>
<tr>
<td>P3 Content in context</td>
<td>Most of the topics have some real world context but context is not sufficient in some topics to make the learner care about the topic.</td>
</tr>
<tr>
<td>P4 Learner scaffolding</td>
<td>The questions are ordered from simple to complex. Hints are present in some learning units which help in simplifying the problems but hints are required in other learning units and should be included.</td>
</tr>
<tr>
<td>P5 Cognitive engagement</td>
<td>There is sufficient highlighting and signaling in the product but personalization is missing.</td>
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</tbody>
</table>
### Executive Summary

**Summary of Review Ratings by Criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P6 Motivational features</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>P8 Learning objective – assessment alignment</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>P9 Pedagogy – assessment method alignment</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>P10 Cognitive levels covered</strong></td>
<td>🙂</td>
</tr>
<tr>
<td><strong>P11 Feedback Quality</strong></td>
<td>😓</td>
</tr>
<tr>
<td><strong>P13 Adaptivity</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>P14 Teacher support</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>T1 Interface design: Enable intuitive use</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>T2 Interface design: Assess consequences of an action</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>T3 Learner navigation &amp; pace</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>T4 Universal Design</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>T5 Analytics for learners’ progress</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>T6 Tools to support problem solving</strong></td>
<td>😊</td>
</tr>
<tr>
<td><strong>T7 Meaningful interactivity</strong></td>
<td>😊</td>
</tr>
</tbody>
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**Technology and Design: Valuable 😊**

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4. Detailed Review

4.1 Content Quality

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4.1 Content Quality

Content Quality measures the accuracy and content/skill coverage for the grade targeted and the specific domain. This dimension focuses on content accuracy and clarity, alignment to national standards, and inclusivity in content representations.

4.1.1 Content Accuracy and Clarity

Correctness and clarity in assessment (C2) is rated Exemplary. The assessment questions are clear and solutions contain accurate explanations for the majority of the topics. The questions are unambiguous and clearly inform the learner on what to think about and what is expected as a response. The solutions are complete with proper reasoning in most of the learning units of the sample set evaluated.

Illustrative example: Learning Unit: Measurement: Grade 3

A clearly labelled image accompanying the question is given. The learner is required to observe the distance of various cities from a school. The question and the options are clear and unambiguous. Similarly, the correct answer is shown clearly with help of a number line.

In rare instances, there are some inaccuracies, which can lead to confusion among the learners.
Despite these inaccuracies observed, the content accuracy can be considered as exemplary since these are observed in less than 5% of the sampled learning units. Within those units as well, everything is mostly correct except for a few instances.

**Language Comprehensibility (C3) is rated Exemplary.** Across most topics, the language used is easily understandable by the learners of Grade 3 to 5. The vocabulary used is familiar. Simple, short, and easy-to-understand sentences are used. Even in the case of complex problems the phrasing of the sentences is simple, sequenced accurately so that the learner can follow the question as well as solutions. A potential longer sentence is broken into 3 smaller sentences.

**Illustrative example**

For example, “Arun has a collection of stamps. He writes down the number of stamps he has of each country in a table. How many stamps does he have from Sri Lanka?”

However, there are a few questions (especially in Higher Order Thinking Skills) where long sentences are used which will likely be difficult for the intended learners.

### 4.1.2 Alignment to National Standards

<table>
<thead>
<tr>
<th>Mathematics Skill coverage (C4)</th>
<th>Curriculum alignment (C5)</th>
</tr>
</thead>
</table>

**Mathematics skill coverage (C4) and Curriculum alignment (C5) are rated Exemplary:** It is observed that, broadly, all the topics and sub-topics covered were aligned with the content present in NCERT textbooks for Grade 3-5. The chapter names do not exactly match, which might make it difficult to navigate for a child trying to practice a particular chapter independently. However, all content is comprehensively covered, as long as the appropriate topics and sub-topics are activated by the teacher. The overall Mathematics mindset and skills required for grades 3-5 (recommended by NEP 2020 and NCF) such as developing a liking towards Math, seeing a connection of mathematical thinking to their daily lives, identifying patterns, arithmetic fluency, data handling, and estimation are covered across various topics across the grade range.
4.1.3 Inclusivity in Content Representation

Inclusivity in the representation of learners (C6) is rated Exemplary: The content includes gender diversity as the names used in the questions show a balanced representation of boys and girls. Examples of names used in the questions - Khushi, Masood, Mariam, Eshan, Nimit, Mary, Lucy, Manjeet, Shivam, Maya, Bhavana, Jaya, Ali, Aarya.

The product does not specifically include examples pointing towards only one particular religion or culture, even the names used show a balanced representation of common names from various religions. Similarly, the content also covers different socioeconomic backgrounds and includes Indian contextualization, since the objects such as Roti, Roses, Sunflower, Diwali lightings, Rockets, Pizza, etc. are a part of the examples.

Although there seem to be more examples in an urban setting as compared to a rural setting, they are still relatable to learners in rural areas. No extreme examples biased towards a particular culture, gender or socio-economic class are present. Thus a systematic effort has been implemented to include diversity in various components of the product. There is an adequate representation of the relevant sections of society in terms of gender, race, socio-economic class, religion, looks, etc.

4.2 Pedagogical Alignment

Pedagogical Alignment focuses on Adaptivity, learner-centered pedagogy, enhancing learner experience, assessment of learning, and teacher support. It measures the extent of alignment of the pedagogical strategies with national educational policies, Learning Sciences theories and design principles to create a meaningful learning experience.

4.2.1 Learner- Centred Approach

Constructivist approach (P1)

Addressing learning gaps (P2)

Constructivist approach in pedagogy design (P1) is rated Exemplary. The product helps the learners construct an understanding of the knowledge, rather than merely transmitting information. To some extent, this aspect is inherent due to the assessment adaptive nature of the product, but that itself would not have been sufficient if the kind of questions and progression were not based on a constructivist approach.
Several topics begin with a question that connects to the prior knowledge of the learner or a general understanding of the world, which likely helps the learner in making sense of a new idea without directly mentioning it. Sometimes, animations or interactivities, or appropriate problems, aid the construction of understanding.

**Illustrative example:** Topic Area, Grade 4

The concept begins with a set of questions showing different shapes. With animation, the shapes try to overlap each other, where generally one is larger than the other and occupies more area. The question asked in these scenarios is simply, “Which of these shapes covers more space?”. From there on, the idea of area is introduced, while also addressing some common learning in the process. For example, whether certain actions impact the area of a shape are made clear—painting a shape or rotating does not change its area, while stretching or cutting a piece from it does change the area.

Also, questions are asked in multiple different ways which allow the learner to apply the understanding and use a problem-solving approach.

**Illustrative example:** Topic: Representing numbers up to 999 and place value, Grade 3

- Which number do the blocks show?
- Which blocks or abacus show 467?
- What is a better way of showing this number?
- Which is a larger number: One shown using blocks and the other with abacus.
- How do you reduce 569 by 40 by changing only 1 digit?
- What happens to the number if 4 beads from the hundred’s place are given to the one’s place?

Grade 5 also has various examples showing the learner-centric pedagogy of the product, where the questions and activities allow the learner to construct meaning and the learner has the freedom to think in different ways and make connections.

**Illustrative example:** Topic: Factors & Multiples, Grade 5

- An image of a chart of numbers is shown, with some numbers colored (multiples of 7). The question is “Which other numbers, among the given options, will be colored?”
- Another activity "Factor selection factory" allows drag and drop on a graph paper to make rectangles of a given size(area), for geometric interpretation of factors. Children can respond and explore multiple possibilities.

Many more such instances are observed in the topics like angles, fractions, and mirror symmetry. However, some topics do not have sufficient activities to help the learner construct an understanding of the topic. For example, the unit of line symmetry (grade 5) requires some experimentation and interactivity to be able to visualize and figure out where the lines of symmetry lie.
Addressing learning gaps/ alternate conceptions (P2) is rated Exemplary: The common learning gaps have been identified as well as addressed very well in many topics.

Illustrative example: Topic: Length, Grade 4
- Curved lines vs. straight lines appearing the same but are actually of different lengths
- Comparing the length of objects with different starting points.

Illustrative example: Topic: Factors & Multiples, Grade 5
The possible learning gap is that there can be only one way to draw a factor tree. This is resolved by showing multiple ways to draw the factor tree of a number. Some common learning gaps are also dealt with effectively. For example, a learner might be confused between factors and multiples. Questions explicitly illustrate the distinction between factors and multiples, with the help of a drag and drop activity. "Separate the multiples and factors of 12 and drag them in the given boxes."

Illustrative example: Topic: Angles
Possible learning gaps in angles have been addressed. For example, "longer arms don't mean larger angles", the angle doesn't depend on the length of the arm. Another idea that is clearly put across here is changing the orientation of the shapes doesn't change the angles.

4.2.2. Enhancing learner experience

<table>
<thead>
<tr>
<th>Content in context (P3)</th>
<th>Learner scaffolding (P4)</th>
<th>Cognitive Engagement (P5)</th>
<th>Motivational Features (P6)</th>
</tr>
</thead>
</table>

Content in Context (P3) is rated Valuable: Most of the topics have some real-world context for learners (Grades 3-5) in terms of the objects commonly used in daily life. Some of these include fruits, sweets, bangles, toys, pens, mobile phones, cookies, stamps, bread, water jugs, etc. which a learner can easily relate to. Many topics have numerous examples from daily activities like going to school, reading books, counting, etc.

Illustrative example: Topic: Money, Grade 3
This unit presents multiple examples related to pocket money, dealing with vegetable vendors, etc. that help the students understand the topic and care about the topic.

However, in some learning units, the context has been provided in terms of examples but an introductory context required to help the learner appreciate the importance of studying the topic is missing.
**Learner Scaffolding (P4) is rated Valuable.** The product provides scaffolds in many instances to help the learner form the correct mental model of the concept being taught. Assessment questions are supported with diagrams and animations that scaffold the learner to visualize and understand the problem better, as the questions progress further, the animations and diagrams are gradually faded to enable the learner to accomplish the task without needing them. The way questions are presented helps the learner to form a correct mental model of the concept in most cases. Solved examples are embedded within the question to teach the concept since the product does not contain explanatory videos.

**Illustrative example:**

In the unit of *Introduction to Tally* (Grade 3) - Questions such as “Why is Tally important? Why do we need such a representation?” have not been covered. Similarly, in the unit of *Symmetry* (Grade 5), the focus is on understanding symmetry and various elements associated with it. However, it does not provide a real-life application or does not answer the question of why symmetry is important to learn.

**Illustrative example:**

In the unit of *Data Representation* - the question includes a solved example of how to read the data from the given table of a class and the number of girls in each class. The number of girls in class 2 has been illustrated and explained properly with arrows and highlighting which scaffolds the learner to solve the question of finding the number of girls in class 4. Also, step-wise, solved examples help the learners to solve the task.

Some questions also have hints to help the learner reflect and solve the problem.

**Illustrative example:**

In the unit, *Time* (Grade 3), the learner is supposed to calculate how much time it takes for the minute hand to move from 12 to 3 - hint provided is (1 hour = 60 mins; one minute hand completes one round in 60 minutes). Similarly, in word problems of the learning unit of *Division of numbers* (Grade 3) - a reminder prompt is given to identify the divisor (i.e. divide by 3, if the pens are to be divided among 3 people)

Animations and interactive in the questions are effective to teach the learners about the concept and prompts the learners to think and reflect.
The animation used to teach Subtraction (Grade 3) visually explained the concept of aligning numbers, regrouping, and the transition from ones to tens. Animations as scaffolds are well-utilized in learning units that require visualization. For example, in the learning unit of Informal understanding of Area (Grade 4), the animation used to teach overlapping of shapes to visualize the comparison of areas is highly effective. Interactivity in the learning unit of Mass and Capacity (Grade 4) allows the learner to drag and place the objects on the weighing scale and observe the effect. They are supposed to try to balance it - such interactivity helps the learners reflect and helps them form a correct mental model.

As the learning unit progresses scaffolds such as animations, interactivities, hints, etc. fade towards the end. The complex tasks are broken down into simple steps in several questions.

However, in some learning units, there is a lack of sufficient scaffolds to support the learners. In such learning units, the questions are very difficult but there is not enough support to be able to solve the questions. The final answer is shown but there is no help for a learner to be able to figure it out by themselves. Hints or a scope of some experimentation or some reflective nudges are required in such problems.

In this example, the learner is expected to imagine and figure out the number of green and yellow tiles needed to fill the rectangle. Without being able to experiment (try out by actually placing the tiles in the rectangle) or any other hints, it will likely be difficult for many learners to solve the problem.

More questions are also observed where scaffolds are necessary but missing.

**Cognitive Engagement (P5) is rated Valuable:** The product has paid careful attention to cognitively engage the learners. There are many visual cues provided such as highlighting the important text (making it bold or different colors), having a border on some aspects of the image, or using dashed lines where appropriate. For example important words in the questions such as ‘GREATER', 'measure', ‘LEAST', have been highlighted, graphics indicating corners, angle measures have been highlighted using red which makes it easier for the learner to grasp the information.
Illustrative example: Topic: Symmetry, Grade 5

Visual cues have been very effectively utilized to help the learners understand the concept of symmetry. For example, the line of symmetry has been appropriately highlighted with a dotted line, and the corresponding points on the object have been clearly marked.

While most of the learning units are rated valuable for cognitive engagement, it was observed that some learning units have the potential to improve and require more highlighting of important parts especially in questions with a lot of short sentences. The conversational style is not particularly personalized in any topic and formal book language is used for question and solution presentation. Questions are still in the third person and don't necessarily invite the learner to engage deeply with the problems, hence it is recommended to apply a conversational style in the content representation to improve the personalization aspect.

Motivational features (P6) is rated Exemplary. The product has enough features to make sure the learners are motivated in their learning journey. There is a points system (Sparkies), which a learner earns upon high accuracy as well as completing a unit. If the learner answers 3 questions correctly in a row (consecutively), they collect one Sparkie. These Sparkies feed into a leaderboard announcing the names of learners at various levels (class, standard, city, national level), etc. thus providing some competitive motivation.

Another motivational feature is the visibility of a learner’s level for each learning unit. This is shown with the help of stars (one, two, or three) based on accuracy in the attempted questions. The system periodically introduces ‘challenge questions’ for learners who answer five consecutive questions correctly. If they answer it correctly, they receive a Sparkie. A progress map is also shown along with stars earned for various concepts in each topic which is motivating for learners since it brings visibility into the learning journey.

4.2.3 Assessment of Learning

Learning objective – assessment alignment (P8) is rated Exemplary. The assessment questions are mostly aligned to the learning objective of the topic. However, we see some instances (only in grade 3) where some irrelevant questions show up, which are not related to the current topic but from another chapter.

An example is the question on Time but asked in Mass and Capacity: “Which of the following activities can you do in 1 second?”. However, such instances are rare, and the questions are from the same grade. Hence, it doesn't impact the overall learning experience much, and the questions are largely aligned to the objective.
Pedagogy-assessment method alignment (P9) is rated Valuable: A pedagogical strategy is recommended for each grade group in NEP, 2020. The pedagogical strategy recommended for Primary School (Grades 3-5) is Scenario based teaching - Giving real-life, relatable examples. (Making connections with daily life), Teaching by using Activities and Observation.

There is some variation in the alignment of the pedagogical strategies. Some pedagogical strategies (e.g. activities, examples) used are aligned to the assessment methods used. Questions in some learning units are scenario-based and the interactivities wherever present are aligned to the activity method and observations. However there were quite a few learning units such as Spatial understanding, Dividing a 2-digit number by a single-digit number by separating into tens and ones, Understanding the meaning of factors and multiples, Tiling of one shape by another, etc. where the aspect of scenario-based teaching and a real-life connection was found to be missing.

Cognitive levels covered (P10) is rated Exemplary: The questions are present at various cognitive levels as required, ranging from understanding and identifying, to application and estimation. There is good coverage of Higher Order Thinking Skills (HOTS) questions in a lot of topics, going much beyond just recalling or identifying. The maximum HOTS are at an apply level, but there are some instances of create level questions as well. Most topics have problems where learners need to apply the concept, solve problems and make connections between different ideas.

Illustrative example: Topic: Factors, Grade 5

Apply Level:
- 2, 3, and 5 are all factors of Tanya's age. Which of the following could be Tanya's age?
- A number has 7 and 10 as its factors. Which of these will also be a factor of that number?

Create Level:
- Create the longest chain of factors and multiples, where there are multiple possibilities.
- Tiling (Grade 4): Create level: Which of these shapes can you put together to make a given shape? A lot of imagination is exercised with such questions.

More examples of higher order questions are observed in the concept of right angles, Mass, Division, and Place value where multiple ideas need to be brought together to answer the questions. However, some topics lack HOTS questions:

Illustrative example:

- Grade 4: 3D Shapes: Most questions are at an 'Identify' level. Apply/Create level questions were possible and would be helpful, but are missing.
- Grade 5: Intro to Volume: Most questions are at an understanding and calculation level. (Understanding the idea of volume, and then calculating the volume of shapes with given dimensions.)
Feedback Quality (P11) is rated Valuable: There is a lot of variation observed in the quality of feedback provided, especially in the explanations of questions.

Explanations and reasoning: Some topics provide good explanations with a clear ‘why’ for the correct response, while some units have a lot of binary responses. Here are some examples highlighting different aspects of the quality of explanations.

• Exemplary: Some units have clear explanations with proper reasoning. Some animations are present and appropriate signaling is also present to make the concept clear. The units of Angles does it well. The angles and rays are properly marked and animations are included; for example, showing that turning of figures doesn't change the angle.

• Some units have a few missing aspects of a good quality explanation. In some units, feedback is binary, most observed in the starting few questions in such units. Some questions require better explanations.

Illustrative example:

How many unit cubes will she be able to pack in the box exactly? [A diagram of the box is given]. Since the concept is introduced for the first time, having the answer given out directly might not help a learner to make sense of the concept. The explanation should have a simple animation showing the packing process (layer by layer) and how the final answer comes about. Similarly, in Symmetry (Grade 5), the explanations are clear and explain why it is the correct response. What's missing is the process to arrive at that response. Similarly, in Grade 4, Problems based on length, weight and volume: Questions in the beginning don't have any explanation, while there are few instances where a proper explanation with reasoning is missing.

Real-time and Instant feedback is present in some of the interactivities.

• The interactivity 'Longest Chain of factors/multiples' has wonderful feedback at every step and action that a user takes. It is worth mentioning that the feedback prompts the user to think and reflect.

The aspect of providing remedial content directly in the feedback is completely missing, but this seems mainly due to the assessment adaptive nature of the product. This is somewhat catered to by providing appropriate questions based on the user's performance.

Overall, the feedback quality is valuable. Improvement is needed in some of the topics for it to be called exemplary.
4.2.4. Adaptivity

Adaptivity (P13) is rated Exemplary: The product adapts according to the performance of the learner. Questions of various difficulty levels are present which are presented to the learner based on the performance. The questions simplify gradually in various respects as the learner continues giving a wrong answer.

**Illustrative example:** Problem Solving, Grade 4

The first question asks the students to apply two concepts (A & B), if the option chosen by the student is wrong and the potential mistake is one of the concepts (A), the following questions would only focus on concept A.

An explicit effort mode is also present which shows up upon too many wrong attempts. The effort mode has easier questions. However, it is observed in some instances that the effort mode has a set of questions repeated which the learner may have attempted correctly earlier. On the other hand, when the learner is performing with high accuracy, there are some challenging questions of higher difficulty which are posed.

The product also takes some initial information (like their grade, age) from the student and demonstrates basic adaptation by showing relevant content for that grade.

There is however no evidence of adaptivity based on the learner’s interaction with the system. For example, if questions are answered at an unreasonable pace, there is no check or a prompt. There aren’t any user interaction patterns (such as always entering a particular option with thinking) which the system tries to identify and adapt accordingly.

Since the performance and profile-based adaptivity is present, the product rates Exemplary on this criterion.

4.2.5. Teacher Support

Teacher support (P14) is rated Exemplary. Appropriate teacher support is available in the product. Robust mechanisms to create homework, worksheets and dashboards to track student progress are available. Teachers can create and customize their questions or, use textbook questions, choose individual topics for particular students and curate personalized student journeys, and track class performance at an aggregate level.
4.3 Technology and Design

Technology & Design measures how well the technological affordances integrate with the pedagogy and content to promote a meaningful learning experience for all learners. This dimension focuses on user interface design and affordances that facilitate learning.

4.3.1. User Interface Design

Interface design: Enable intuitive use (T1) is rated Exemplary. The product is very intuitive to use, and all user events lead to the expected effect. All buttons are clearly visible, with text or other cues (like a tick mark on the submit button), and are placed in meaningful locations on the screen. Only meaningful actionable items are present on the interface and it doesn’t contain any distracting elements.

Interface design: Assess consequences of an action (T2) is rated Valuable. For conveying the consequences of an action, the product misses out on a few important aspects. There isn’t much feedback present, for example when the user progresses to a new subtopic within a learning unit while the learner is solving, a simple prompt should be shown indicating the progress. Also, the error handling isn’t effective as there are no warnings or prompts when the user performs certain actions like ‘Logout’ or ‘Done with this topic’. The system prompts ‘You’ve gone idle’ if the learner gets inactive.

In the unit of Addition and Subtraction - if the question required the learner to perform ‘Subtraction’ but performs ‘Addition’ by mistake, the system prompts them to “Did you add? Check again?” However, such opportunities to reverse the actions which might have happened by mistake are very few.

Learner Navigation and pace (T3) is rated Valuable. Learner navigation is important so that learners can move across different topics as and when they wish, and can work on a particular topic whenever they want. Also, the pace at which the learner wants to attempt the questions is completely flexible, apart from some timed activities which are intended to make some aspects playful. However, it is not possible to switch between subtopics, go to the desired interactivity (which is usually present at the end of a subtopic), go back to the previous question, or skip a certain set of questions. But for each topic, the learner does get to see all the questions attempted so far in a section called ‘How I Did’, which helps him/her revisit the entire set of questions along with the solutions.
Universal Design (T4) is rated Valuable. The product caters to a few simple aspects of universal design. Concerning operability, some key actions can be performed from the keyboard (without needing a mouse), like submitting an answer and moving to the next question. Many expected and important aspects are missing which would help make the content accessible to a diverse set of learners. This includes having a text alternative or captions for images, a voiceover option for reading questions (which is especially essential for this grade range), or voice input for sharing answers. Some interactivities do have a voiceover explaining the task, but such instances are rare.

### 4.3.2 Affordances that Facilitate Learning

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**Analytics for learners’ progress (T5) is rated Valuable:** The product has a teacher dashboard which is useful to the teacher in terms of the information it presents, which can help guide a teacher’s instruction in the classroom. It shows each learner’s learning trail (the topics and questions which they solved), as well as the overall performance on different topics. The teacher can also see the overall class performance on various topics and subtopics. However, it does not provide sufficient guidance to the teacher on identifying where the learner needs to put in the effort or where additional support should be provided to make progress. The dashboard doesn’t allow the teacher to assign different topics or questions or activities to specific sets of students based on their performance or interaction with the system. There is, however, a possibility to activate or deactivate a particular topic for the entire class.

A dashboard for the learner is present as well, where the student can see the questions they have attempted so far, and how well they did in each subtopic. However, as observed with the teacher dashboard, the actionable aspect is missing. A possibility for the same could be to have actionable buttons based on the learner’s performance on different topics.

**Tools to support Problem-solving (T6) is rated Valuable:** Mathematical tools are present in some of the topics which aid in problem-solving, Graph-based, a graph paper and the means to draw on it are available in the geometric representation of factors and multiples. A weighing balance is present in the unit of Mass and Capacity. However, a good percentage of topics do lack problem-solving tools. Some places where they would be needed and helpful are Measuring Angles (Protractor), Symmetry (a mirror), Graphs, and Data Handling (Graph paper to draw).
**Meaningful Interactivity (T7) is rated Valuable:** The overall product has most of the basic interactivity features which are used appropriately to help the learner move forward with the learning in a meaningful manner. For example, radio buttons and input boxes are the most common ways observed by which the user responds to the questions.

The concept-specific features needed for some topics are present, while other topics lack certain interactions which would help the learner to understand the concept much better. Some units do have excellent interactivity features.

**Illustrative examples: Factors & Multiples, Grade 5**

- Drag and drop to sort the multiples and factors in 2 different groups, helping the learner clearly distinguish between the two.
- A graph-based drawing interactivity where a learner can create rectangles of different dimensions containing a fixed number of small squares, thereby highlighting the sides of the drawn rectangles as the factors.
- A ‘Click and drop’ interactive activity is present where the learner needs to make a chain of factors and multiples starting from any number. This allows for multiple possibilities and is very effective for playfully building a deep understanding.

Other good examples are observed in **Comparing numbers** (where learners sort numbers by drag and drop) and **Mass and Capacity** (where learners drag and drop objects on the weighing scale and observe the effects).

On the other hand, there are some topics especially in Geometry where some features would be helpful but are missing.

Some topics like **Angles, Symmetry, Area, and Tiling** lack sufficient interactivity affordance.

**Illustrative examples:**

As an example, some questions involve the child in figuring out which shapes (or combinations of shapes) could be used to tile another given shape. Interactivity is much-needed to drag, place and rotate smaller shapes and try to fit them together to be able to visualize the idea. Another example is where some interaction would be helpful in finding the lines of mirror and rotational symmetry.

All in all, the basic interactivity is good which helps the learners respond to the questions and move ahead. Concept-specific interactions are present in some topics and missing in others.
Appendix

How does the EdTech Tulna evaluation work?

FRAMEWORKS

EdTech Tulna frameworks define a set of standards for quality design of EdTech products. A rigorous and research backed process is established and applied for the creation of various nuanced frameworks. These frameworks are use-case specific to enable transparent and precise, high stakes decision making. The process includes considering existing research literature, feedback from the ground on multiple stakeholder needs and an appreciation for the quality of solutions currently supplied in the ecosystem.

The frameworks are categorized along the three dimensions of Content Quality, Pedagogical Alignment, and Technology & Design to capture a holistic view of the quality of the product design. The frameworks are also made available at varying levels of depth for varying stakeholder needs and range from supporting governments and institutions in making high stakes, rank based, adoption decisions, to providing a brief overview of the key criteria to be considered while designing a product.

TOOLS

Each Tulna framework is accompanied by a toolkit that is specifically designed to guide experts to evaluate EdTech products. These toolkits are customized to the type of EdTech solution, grades, subjects, to drive meaningful and nuanced evaluations. The tools are informed by research as well as iterative empirical study and tested for inter-rater reliability and validity. A typical toolkit consists of rubrics and reviewer guidelines to enable evaluators to interpret the framework and conduct unbiased evaluations. Each criterion within the framework is rated along a three-point rating scale - ‘Exemplary’, ‘Valuable’, and ‘Potential to Improve’ - indicating the level of alignment with expectations laid out in the framework. Toolkits include supporting materials - videos, templates, and example illustrations - to guide experts while conducting evaluations.

PROCESS

Each product goes through a rigorous review process that takes approximately 160 hours for four grade ranges K-2, 3-5, 6-8, and 9-10. Each review team is designed to be independent and neutral. A typical expert review team consists of 3-4 members who are subject matter experts, instructional designers, user-interaction experts, user-experience design experts, and professionals with experience in teaching and implementing EdTech in field settings. Each review team has an anchor of at least one experienced evaluator.

Each member of the expert review team undertakes a two-week long intensive training on understanding the frameworks and the subsequent application of its toolkits to conduct evaluations. For each product, the review team applies a systematic sampling strategy and decides the representative learning units that will be reviewed. The team collectively reviews a subset of the learning units to check for convergence and establish inter-rater reliability. Team members then individually review the remaining learning units. The team finally meets to synthesize key points and takeaways of each review and elaborates their reviews into an in-depth report, which is overseen by the experienced evaluator.

The role of the product company is limited to an initial demo which supports the review team to deepen their appreciation of the intended use of the product, and its scope. The product company is then provided the final reviews and their unedited responses are published alongside the expert evaluations on the Tulna evaluation center.