

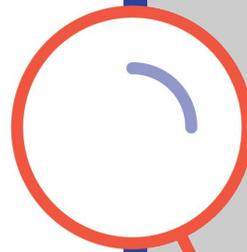


EdTech  
**Tulna**

EVALUATION REPORT

**MATIFIC**

MATHEMATICS  
GRADES 3-5



Evaluated in  
September 2021

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# 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

Matific is a personalized and adaptive Math learning platform for grades K-6. It presents learners with play-based activities aligned to the National Curriculum. It can be used independently by children as the learning activities adapt according to the level and the performance of the learner. The product also has features that make it suitable for use by schools and teachers to supplement their classroom teaching. This report evaluates Mathematics for Grades 3-5.



## 3. Executive Summary

### Matific | Mathematics | Grades 3-5

Content Quality  
Exemplary



Pedagogical Alignment  
Exemplary



Technology and Design  
Exemplary



### Potential benefits of this product

Learners will likely be able to-

- Engage with the content deeply due to exemplary cognitive engagement and motivational features.
- Solve difficult mathematical problems due to exemplary constructivist pedagogy approach and learning scaffolding in the product.
- Use the content for practice activities as the content is accurate and aligned with the NCERT curriculum.

Teachers will likely be able to-

- Use game-like activities as assignments to support classroom teaching or use it as an out-of-class component in a flipped-classroom mode.
- Assign game activities to learners based on their performance since the product has an exemplary dashboard.

### Potential limitations of this product

Learners will likely face the following issues-

- Get frustrated with the learning activity since for some of the activities the interface design is not intuitive and the learner has limited control over the learning path
- Learners may make mistakes in solving problems as alternative concepts are not addressed in the content



# Matific (Grades 3-5): Summary of Review Ratings by Criteria

Content Quality: **Exemplary**

## C1 Content accuracy

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.

## C2 Correctness and clarity in assessment

The assessment questions are clear and solutions contain accurate explanations for all the topics



## C3 Language comprehensibility

The language, accent, and vocabulary are easy to follow



## C4 Mathematics skill coverage

Mathematics mindset and skills required for grades 3-5 (recommended by NEP 2020 and NCF 2005) are covered.



## C5 Curriculum alignment

The content is aligned to NCERT and logically sequenced.



## C6 Inclusivity in representation of learners

No consideration is given to include diversity in terms of gender, socio-economic class, religion, etc.



Pedagogical Alignment: **Exemplary**

## P1 Constructivist approach

The learner has sufficient opportunities for problem-solving and to make sense of the concepts.



## P2 Addressing learning gaps/ alternate conceptions

All the learning gaps are identified and addressed.



## P3 Content in context

All of the topics have some real-world context and it is sufficient as well as relevant.



## P4 Learner scaffolding

Sufficient scaffolds are provided to learners to help them form mental models of the concepts



## P5 Cognitive engagement

The content presentation style is conversational and important points are highlighted.





<b>P6. Motivational features</b> Features like the points system, mastery level, and challenge questions keep a learner motivated.	
<b>P8 Learning objective – assessment alignment</b> The assessment questions are aligned to the learning objective of the learning unit.	
<b>P9 Pedagogy – assessment method alignment</b> The pedagogical strategies used in the product and the assessment methods used are aligned to each other across all the topics.	
<b>P10 Cognitive levels covered</b> Sufficient questions covering Higher Order Thinking Skills are present.	
<b>P11 Feedback Quality</b> Feedback is inconsistent across learning units	
<b>P13 Adaptivity</b> The system adapts to the learner’s performance and profile.	
<b>P14 Teacher support</b> Robust supports for creating homework, worksheets, and dashboards to track student progress are available.	

**Technology and Design: Exemplary**

<b>T1 Interface design: Enable intuitive use</b> The product interface enables intuitive use. However, there's inconsistent guidance for learners on how to use the interface.	
<b>T2 Interface design: Assess consequences of an action</b> User Interface provides appropriate feedback to learner’s actions and facilitates recovery from error.	
<b>T3 Learner navigation &amp; pace</b> The learners have complete control over the selection of topics and activities, but within some activities, the learning path is decided by the system and learners cannot go back to the previous question.	
<b>T4 Universal Design</b> Several Web Content Accessibility Guidelines principles had been followed. However, the product did not have low entry barriers for diverse learners such as learners with varying abilities, learners with special needs, or other characteristics.	
<b>T5 Analytics for learners' progress</b> The dashboard has useful information for the teachers and learners	
<b>T6 Tools to support problem solving</b> The product provides tools to support problem-solving.	
<b>T7 Meaningful interactivity</b> All necessary interactivity features are included in the activities of the product. They are meaningful for learning the content.	

## 4. Detailed Review

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Content Quality  
Exemplary

## 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)

Language  
comprehensibility (C3)

**Correctness and clarity in assessment (C2) is rated Exemplary.** Most of the content is completely correct and clear. The questions clearly state and demonstrate the response or the action which is expected from the learner. Simple animation is usually present at the beginning of an activity which helps the learner understand and get familiar with the ways they need to respond and interact for the task. The solutions are accurate and accommodate multiple possibilities for the correct response.

For example, in an activity for *Grade 5, Mapping your way*, directions need to be given to reach a particular destination. All correct routes to reach the destination are accepted. This is observed in each activity where multiple correct responses are possible.

The review team observed a few instances where clarity was lacking.



#### Illustrative example:

- In Grade 5, Factors: "Place the number tags correctly on the number line". The meaning of 'correctly' is not clear. What does the learner need to?
- In Grade 3, Shapes and design: In the activity of covering a large shape with multiple smaller shapes, it's not clearly stated whether overlapping of figures is allowed. It doesn't intuitively seem so but one of the questions can only be solved with overlapping.
- Another example: "Place more than half of the shape in Zone A". The product accepts a response as correct only if it is clearly large. Close to correct answers are not accepted.

However, the above instances were rare and are not expected to hamper the learning process.



**Language comprehensibility (C3) is rated Exemplary.** Most of the learning units have a simple and minimal sentence structure and use simple vocabulary appropriate for the grade range. The presence of a lot of visuals in the form of images and animated visualizations make the content further easier to comprehend.

There is a voice-over to listen to the written text for learners who might find it difficult to read. The voice-over can be played and repeated multiple times. Some types of sentences used are described below:



#### Illustrative example:

- “How many cherries are left on the table?”
- “How much taller is the tree as compared to the house?”
- "Make a necklace so that at least one-fourth of the beads are striped, spotted."
- "Drag the X mark to the line plot to record the length of the crayon".
- “Pour the contents into the cauldron.”

However, some unfamiliar vocabulary is observed (like hedgehogs, cauldron), but these are not expected to cause a major hindrance in understanding the task, due to proper signaling and visuals.

### 4.1.2 Alignment to National Standards

**Mathematics Skill coverage**  
(C4)

**Curriculum alignment**  
(C5)

**Mathematics skill coverage (C4) and curriculum alignment (C5) are rated Exemplary.** It is observed that, broadly, all the topics and activities covered were aligned with the content present in NCERT textbooks for Grade 3-5. Important skills like understanding shapes & patterns, data handling, measurement, money, and number systems have been covered. There is strong evidence of scenario-based teaching and real-life examples used across the product. For instance, for teaching maps and navigation, the learner has to deliver pizza to different locations like houses, parks, hospitals, etc. Another excellent example of real-life scenarios is while teaching angles, the learner is the captain of the ship who has to guide the ship to the island by selecting the right angle which involves additional skills like estimation and sense of direction as well.



The chapters are chunked into smaller topics that are logically sequenced and aligned to the curriculum. Each topic consists of several activities and worksheets which are supplemented with a detailed and scripted lesson plan which can be used by the teacher at school. Most of these activities and worksheets are in alignment with the corresponding NCERT curriculum and help create deeper understanding within these topics. There are, however, a few topics that are not in complete alignment with the NCERT book. For instance, in grade 4, the chapter 'Jugs and Mugs', in the activities related to volume, the focus is more on understanding the volume of a cuboid and filling solid cubes within the cuboid, whereas NCERT focuses more on understanding units like liters, ml, and the concept of volume in real-life.

The overall Mathematics mindset and skills required for grades 3-5 (recommended by NEP 2020 and NCF) like developing a liking towards Math through interactive activities, games, and worksheets, 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)

**Inclusivity in the representation of learners (C6) is rated Potential to Improve.**

The product is quite indifferent to the idea of inclusivity. No specific attempt or effort has been made to represent different genders, religions, and skin colors. The Indian context is also overall lacking. Some examples are listed below.



#### Illustrative example:

- In Grade 3: Who is heavier? A 'grow wings' potion has to be made. The recipe to be made has ingredients like unicorn tears, magic beans, rainbow seeds. Even though these are fictional, they are not common in the Indian context.
- Animals like Meerkat and Hedgehogs are used. Beverages like 'Sorbet' are also mentioned.
- Indian currency is not used in the chapter on Rupee and Paise.

A few signs of inclusivity have been observed in some places. Some of these are using both male and female characters in the form of explorers on a mission. Reviewers also observed usage of some common fruits and vegetables relatable to everyone. However, these are not enough to represent different sections of the Indian society.



Pedagogical  
Alignment  
Exemplary



## 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- centered Approach

Constructivist approach  
(P1)

Addressing learning gaps  
(P2)

**Constructivist approach in pedagogy design (P1) is rated Exemplary.** The product follows a constructivist approach, with a high element of interactivity, experimentation, and visualization. In many activities, the learner is required to perform some actions to achieve a particular goal. The learners understand and form an intuitive understanding of the concept during the process, without explicitly being taught about it.



**Illustrative example:** Topic: Measuring Angles, Grade 5

The learner is required to adjust the angles of the canon to aim and hit at the given target. There are multiple attempts allowed to try to get the perfect angle and shoot. Then, the learner measures the angle with the help of a protractor.

In another activity following the same, it is required to navigate a ship to the right destination, by estimating the angle of navigation to be set.



**Illustrative example:** Topic: Representing 3-digit Numbers, Grade 3

There is an excellent activity for constructing an understanding of 100's, 10's, 1's. The learner needs to mix 100 or 10 or 1 litres of any of the 3 given colors to get the given total quantity. The actual color keeps forming in the tank while keeping the focus is on the problem of getting the right quantity. This clearly helps the child experiment and realize that there are multiple ways of reaching the same number.



In many activities, there are immense possibilities for the learner to respond in different ways. The system takes the learner's response and shows the feedback showing how the different aspects of the submitted response are correct or wrong. So, the learner centricity is very high.



**Illustrative example:** Topic: Rotational Symmetry, Grade 5

The learners need to paint a Mandala art picture with a lot of smaller sections, in order to obtain some degree of rotational symmetry. The system rotates the user's colored picture and demonstrates clearly which parts of the painting are either correct or disturbing the rotational symmetry.

Apart from the above examples, a lot of such interactivities are observed in almost every learning unit. Overall, the activities are designed to address different aspects of a concept, with enough opportunities for active problem solving, which also helps address some potential learning gaps.

**Addressing learning gaps / alternate conceptions (P2) is rated Exemplary.** The common learning gaps have been identified as well as addressed very well in most of the topics. The proper visualizations in the feedback also help the learner realize their alternate conceptions and understand their possible learning gaps. Certain outcomes that may be impossible to achieve mathematically are also brought to the user's attention.



**Illustrative example:** Topic: Different faces of 3D figures, Grade 4

Proper options in the worksheet help identify learning gaps in the worksheet. For Example: Top view of the cylinder has one option as an oval shape, which its visibility looks like, but is not true. Actually a circle. Another example is the interconversion of solid shapes (with faces of different colors) and their 2D nets. The learner is required to color the 2D nets appropriately, after which the system folds the submitted response trying to match it to the given 3D shape. The whole process of folding, rotating, and comparing the 2D nets to the given shapes helps resolve any learning gaps the user might have,



**Illustrative example:** Topic: Equivalent Fractions, Grade 5

It is clearly shown that it may be impossible to achieve certain fractions by using the given set of initial smaller parts. For example,  $\frac{3}{4}$ th of bread cannot be covered by cheese slices of size  $\frac{1}{6}$ th of a bread. Another idea shown is that the Whole numbers can all be written as equivalent fractions.



However, there are a few learning units, where some potential learning gaps have not been addressed sufficiently.



#### Illustrative example:

- In Money, the conversion between different currencies is not clearly explained. Also, unrelatable currencies can cause confusion.
- Measuring from different starting points of a ruler and comparing the length of objects which are not vertically aligned is missing.
- Some possible alternate conceptions are not addressed like "Bigger is heavier". "More objects are heavier".

However, reviewers do not expect these shortcomings to hamper the learning process.

### 4.2.2. Enhancing learner experience

Content in context

(P3)

Learner scaffolding

(P4)

Cognitive Engagement

(P5)

Motivational Features

(P6)

**Content in Context (P3) is rated Exemplary.** The product introduces the content to the learner through a gamified virtual context in the world of monsters. As soon as the learner logs in, they are presented with a challenge to help the monster families to unite by solving various mathematics challenges and riddles on the map. Throughout the learning journey across grades 3-5, the context of monsters has been very well utilized in designing the learning activities i.e a relevant and sufficient context is included in the content, wherever required. The real-world objects have been used in the activity scenarios within the monster world such as - Fruits, Vegetables, Pens, Animals, Toys, etc. Routine activities such as grocery shopping, the movies, school, factories, etc have been blended into mathematical scenarios. The product very well identifies the real-world application of the mathematical concept in each case.



#### Illustrative example: Topic: Counting Numbers, Grade 3

The activity involves the learner in packing the toys as per the order in boxes before shipping them to various countries, for example, Ship 200 pinwheels to Canada.



The context presented in every topic is very relevant and helps the learner to understand its application and also care about the topic. In the learning unit of *Shapes and Sizes (Grade 3)*, the relevance of learning about the basic shapes like triangles, rectangles, circle,s etc is brought out in the activity, as the learners use simple shapes to build complex shapes like that of a *ship, fish, house, etc.* Real-world experiences such as going to the movies have been embedded in the learning context. Overall, the product caters to various aspects of contextualizing the content, and the virtual world created within the product is highlighting various applications of Mathematics in the real world. Some noteworthy examples are below.



#### Illustrative example:

- Pizza delivery for the learning unit of Maps and Navigation.
- The area as multiple and side lengths of rectangles as factors
- Fractions with the help of cheese covering the bread
- Symmetry using Mandalas
- Angles - Cannon shots and using angles to navigate as the captain of the ship

**Learner Scaffolding (P4) is rated Exemplary.** The product provides learners with scaffolds to help the learner form the correct mental model of the concept. Activities are supported with visuals, animations, and pointed feedback that scaffold the learner to visualize and understand the concept better. The activities within a learning unit progress from simple to complex and concrete to abstract allowing the learner to gradually learn. Complex concepts are broken down into simpler components to help the learners,



#### Illustrative examples: Simple to complex graduation of topics

Grade 4: First, it starts with counting balls, (as they can be physically seen and counted), and then it moves on to more abstract concepts like money (shopping).

Grade 3: In the learning unit of addition/subtraction the operations with 2 digit numbers followed by 3 digit numbers

Grade 4 - In the learning unit of playing with patterns the concept progressed from 'Extend the pattern' to 'complete the pattern' to 'circular patterns'.



#### Illustrative example: Grade 3 - Writing the numbers in words

The number of words has been broken down and placed as options among others, and the learners pick the relevant words. They help learners pick and try different combinations.



The learner is provided with three attempts to answer any question or perform an activity. In some cases, the system adapts with some scaffolds with the learner's response. If the learner doesn't answer it correctly the first time, the system prompts the learner with a hint or highlights objects/numbers that need some part of the activity to help the learner come out of the stuck situation to give another attempt. There is a repetition in progression if the learner doesn't answer it correctly in the second attempt. With the third wrong attempt, the system presents the correct step-by-step solution, in most cases using an animation. Hints are presented in intermediate attempts. In some cases, the system partially solves the steps to enable the learner to reach the answer, for example, helps identify the dimensions of the rectangle so that the learner is able to calculate the area.



### Illustrative example of Hint: Topic: Factors and Multiples, Grade 5

The Activity required the learner to draw different combinations of dimensions of possible rectangular areas - if the learner doesn't attempt or attempts it wrong the first time the system prompts "**Need any help?**" and if you click on it the hint is presented i.e. "Start by drawing the simplest rectangles possible using all the tiles in one row"

Some activities have some advanced level scaffolds such as reflective scaffolds which prompt the learner to reflect and build an understanding of their topic.



### Illustrative examples: Reflective Scaffolds

In the activity introducing *Rotational symmetry* (Grade 5), the learner is asked to color a mandala as per their choice and made to reflect by comparing their design with the rotationally symmetric design.

In the learning unit of *Maps and Navigation* (Grade 5), the input directions given by the learner are simulated even if the learner is wrong - that helps learners to reflect on why they went wrong and how they should approach the problem in the next attempt.

In the learning unit of 3D objects, *Cast your Net Wide Activity* (Grade 4), the student's color 3D net is folded to help them reflect where they went wrong. Such scaffolds help elicit a learner's understanding of the topic.

While all the learning activities have good scaffolding, All the worksheets are presented in the set pattern of multiple-choice questions without any scaffolds and just binary feedback and hence there is a potential to improve the scaffolds in the worksheet and overall some more reflective nudges for the learners will help figure out how to solve the questions on their own.



**Cognitive Engagement (P5) is rated Exemplary.** The product has paid careful attention to cognitively engage the learners throughout their learning journey. The content presentation style is conversational and the important points in the content explanation are highlighted for the learners to enhance their cognitive engagement with the content. The consistent conversational style is maintained through the virtual context of monsters, in every activity, the monster (avatar) is engaging with the learner to explain various aspects of the activity. Most activities involve the learners in doing the activity, as as they are a part of the story it keeps them engaged. There are many visual cues provided such as highlighting the important text in the question using a different color, important elements or objects under consideration have been highlighted consistently. For example, if the activity requires the learner to count the number of marbles in a jar, the appropriate marbles have been highlighted which makes it easier for the learner to grasp the information. Activities are supplemented with voice-overs as verbal cues. The graphics used to simulate the monster world are very realistic and would be highly engaging for the learners.



#### **Illustrative example:** Topic Representing 3-digit number, Grade 3

Filling the tub with colors in progressions of 1L, 10L, 100L is very engaging. The options of using different colors from RGB also cognitively engage the kids to watch the color change in addition to the number.

**Motivational features (P6) is rated Exemplary.** The product includes various intrinsic and extrinsic motivational features that are well integrated and hence have the potential to prompt learners to further explore the content. The overall virtual context set to engage the learners is motivating for the learners, the learners are given a responsibility to solve various mathematics challenges to bring the monster families together, the learner is intrinsically motivated by posing questions like "Are you brave enough to solve the match challenges? Can you bring the family back together?". This instills a sense of responsibility to finish the challenges and explore the content further.

The system has points that are collected in the form of 'stars'. If you get the perfect result in the activity the learner receives 5 stars. In an animation at the end of the activity, there is a treasure box that opens and collects the stars. As the learners advance further they collect various monster cards such as 'Medu', 'Jam', 'Shalpi' on completing the activities perfectly. Every time the learner gets an answer correct, there is a star confetti feedback along with a nice motivating sound. On the other hand, if the learner gets the answer wrong there is a 'stuck' sound and is given 3 attempts which motivate the learner to try again and again. The context provided also adds to motivating the student intrinsically, since the learner relates to the topic and understands the relevance and application of the topic. Also, at various instances, the learners are provided with a lot of options to choose from while performing an activity, for example, Picking a Mandala design to color, Choosing a color palette, or in other cases - choosing the movie, size of the popcorn bucket, etc. This intrinsically motivates the learner.



### 4.2.3 Assessment of Learning

**Learning objective - assessment alignment (P8)**

**Pedagogy-assessment method alignment (P9)**

**Coverage of cognitive levels (P10)**

**Feedback quality (P11)**

**Learning objective - assessment alignment (P8) is rated Exemplary.** The activities, worksheets, and corresponding lesson plans provided are aligned completely to the learning objective of the topic and its corresponding cognitive levels. The lesson plan also explicitly states the learning objective for each activity, along with an activity overview, description, and behind-the-scenes which describe the purpose of the activity and what it intends to achieve.

**Pedagogy-assessment method alignment (P9) is rated Exemplary.** The pedagogical strategy used in the product is as recommended for each grade group in NEP, 2020. According to 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), Activity method, and Observation.* The pedagogical strategies (e.g. activities, examples) used in the product are aligned to the assessment methods used. The activities follow a scenario-based teaching methodology based on the virtual gamified context of monsters, where the objective of the learner is to unite the monsters by solving math riddles and challenges. Most of the activities follow real-life examples like going to the movies, helping buy groceries, delivering pizza, buying toys and this helps the learner stay engaged in the learning process throughout the journey of the product.

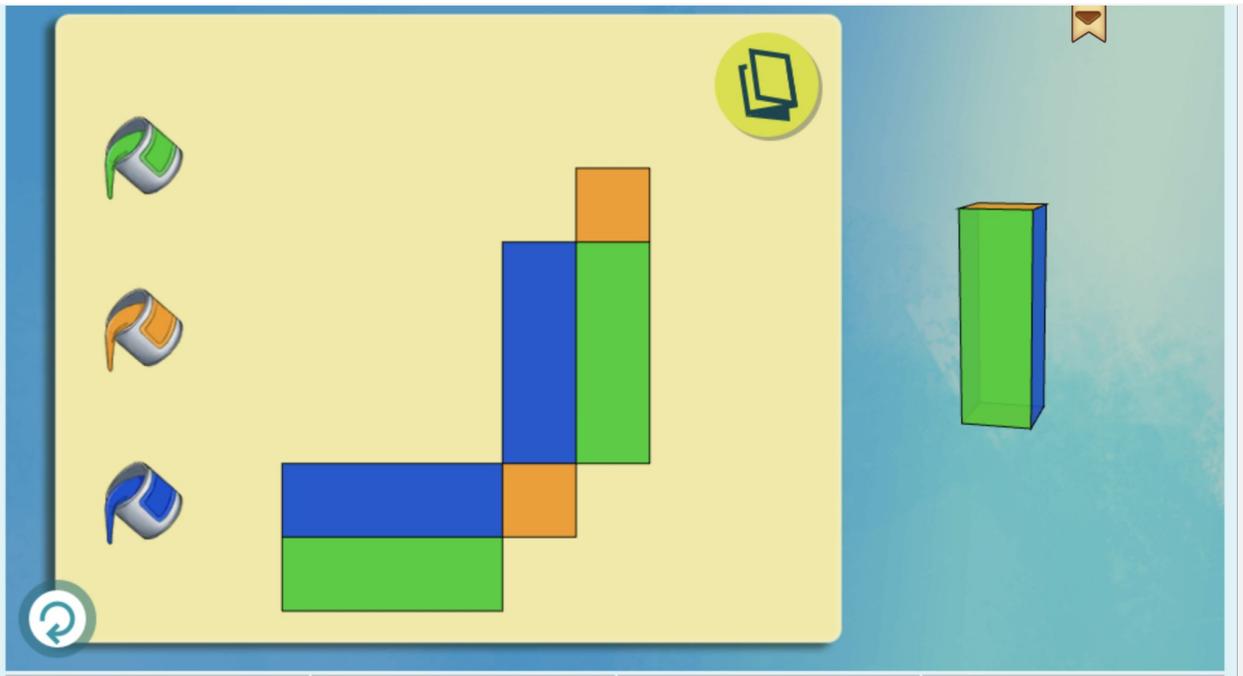
**Cognitive levels covered (P10) is rated Exemplary.** The questions are present at various cognitive levels as required, ranging from understanding and identifying, to application, analysis, and creation.

Throughout the entire product, there is a higher focus on helping students apply new concepts in different contexts. There is great coverage of Higher Order Thinking Skills (HOTS) questions in a lot of topics, going much beyond just recalling or identifying. Most topics have real-life scenarios and contexts, where learners need to apply the concept and solve problems through constant experimentation.



#### **Illustrative example:** Topic: Difference faces of a 3-D figure

In the activity 'Toy Factory', learners are shown toys made of cubes from many angles. They are asked to find the total cubes used to make each toy. The skill involved is analyzing shapes from different perspectives. In the activity 'Cast Your Net Wide', the learners match the faces of a given cuboid to the congruent faces of its corresponding net. These are higher-order thinking skills, as the learners have to analyze the corresponding 3-D figure and be able to visualize them appropriately.



Color the net to match the shape.

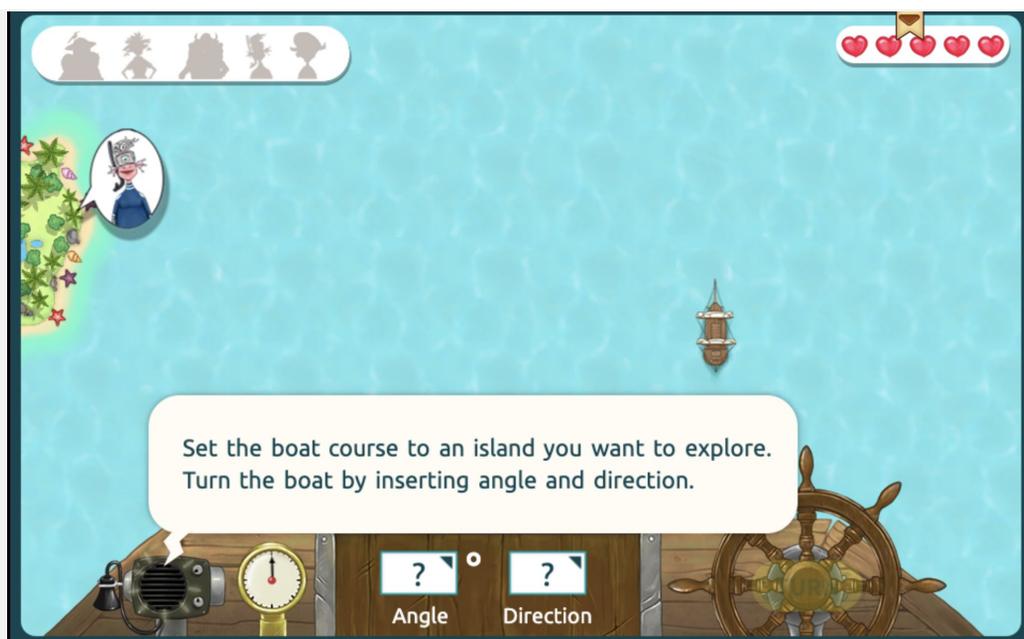
**DONE**



**Illustrative example:** Topic: Measuring Angles - Shapes of Angles

In the activities 'A Loose Cannon', learners create angles by hitting a target with a ball at a tank. The angles, all of which are multiples of 10, are then measured with a protractor, and learners read and record the measurement. In the activity 'Island Expedition', learners create angles by hitting a target with a ball at a tank. The angles, all of which are multiples of 10, are then measured with a protractor, and learners read and record the measurement. In both these activities, higher-order thinking skills like 'apply' and 'evaluate' are used while learning concepts like measuring angles using a protractor and problem-solving, in diverse real-life scenarios.





**Feedback quality (P11) is rated Valuable.** While most topics provide feedback that is both visually appealing and intuitive, in many cases the why of the solution is not explained. There is a lot of variation observed in the quality of feedback provided, especially in the explanations of questions. In cases where quantities or measurements are involved, the feedback provided is personalized based on the input. For instance, in the activity Flying Colors, the feedback also is personalized based on the response given. If the color paint entered is too low in quantity, it says "It's not enough", where it says "It's too much" in case it's higher than required. Also in case of wrong answers multiple times, the correct distribution is shown by filling the colors step by step, and the units are represented beside.

In the topic 'Symmetry', the activity 'Making Mandalas', each learner has to fill different colors in the mandala. The feedback provided is excellent, as it is intuitive, visual, and helps the learner compare their answers with the correct ones. The mandala colored by them is rotated and compared with a rotational symmetrical pattern, and different parts of their own mandala. This allows the learner to identify errors and address them correctly.

However, there are still a significant number of topics where the feedback is only binary, or the explanation provided is not sufficient. In such topics, although the feedback provides the right answer, the explanation is not provided.



### **Illustrative example:** Topic: Making Charts, Grade 3

In all the activities on this topic, the feedback provided is binary. Only the correct answer is shown, and the 'why' isn't mentioned. In the case of the activity, 'Plotting Pencils' they could have highlighted, or shown how the pencil/crayon is measured, and why the answer is incorrect. In the case of understanding the data, they could have shown how to plot using data, which they didn't. In this case, the feedback provided doesn't help the learner progress toward correct conceptual understanding.



1 UNIT

Pencil's Length Line Plot

2 3 4 5 6 7

Number of Units

Drag the X mark to the line plot to record the length of the pencil.

DONE



**Illustrative example:** Topic: Shapes and Designs, Grade 3

The feedback directly shows the final filled shape, without showing how individual pieces are dragged to form the corresponding larger shape. This might cause confusion amongst learners. The remedial help is not sufficient for the learner to understand the concept.

Fill the empty shape with pattern blocks.

DONE

Fill the empty shape with pattern blocks.

NEXT

The feedback provided in the case of the worksheets is binary, and there is no explanation provided with the right solution. The aspect of providing remedial content based on performance in weak topics is missing on an overall level. Overall, the feedback quality is valuable. Improvement is needed in these aspects to make this product exemplary.



## 4.2.4. Adaptivity

### Adaptivity (P13)

**Adaptivity (P13) is rated Exemplary.** The product adapts dynamically to the learner's profile as well as the learner's performance. A customized learning path with a set of activities is initially laid out for a learner based on their grade. This path keeps updating dynamically based on a learner's performance in the activities. If the activities are done with high accuracy, the following ones are at a higher difficulty level. On the other hand, if the learner makes a lot of mistakes, easier concepts are introduced in the subsequent activities.



**Illustrative example:** Grade 3: Learning Path of 2 different students looks like the following:

The 1st 3 activities for different kinds of learners are the same, after which the activities were adapted as per the learner's performance.

- Activity 1: Skip counting by 2 by completing missing numbers in a sequence
- Activity 2: Counting moving objects(birds) in groups of 2
- Activity 3: Counting objects in groups in groups of 2

Student 1: Answering all questions with high accuracy

- Activity 4: Multiples of 5 and 6
- Activity 5: Skip counting by 5 on a number line
- Activity 6 : Sorting of numbers upto 1000

Student 2: Making a lot of mistakes

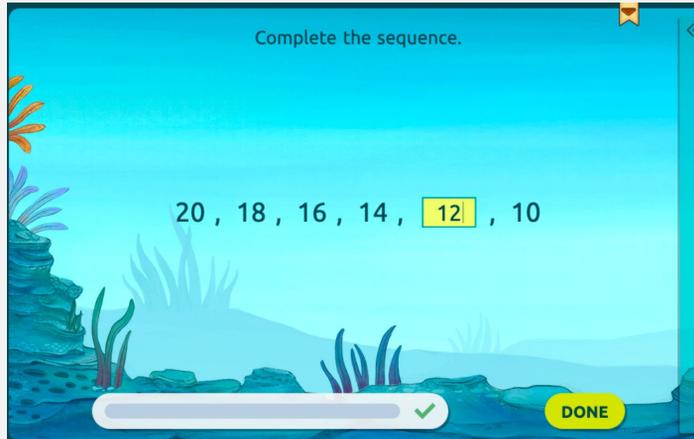
- Activity 4: Identifying odd and even numbers
- Activity 5: Arranging numbers between 1-20 in an ascending order.
- Activity 6: Counting and comparing numbers upto 20.
- Activity 7: Arranging numbers between 1-10 in an ascending order.



## Illustrative example of two trajectories based on learner's profile and performance

### A. (Student 1)

- Activity 1: Doing all questions correctly.



- Activity 2: Counting flying birds in groups of 2  
Performed 4/5 correctly.



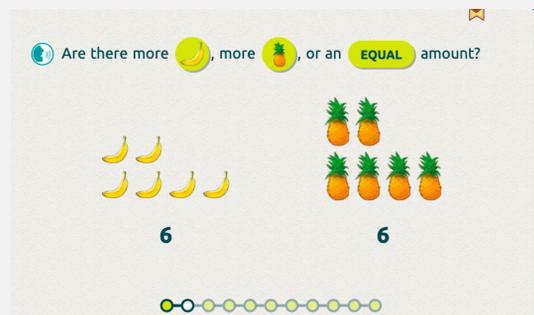
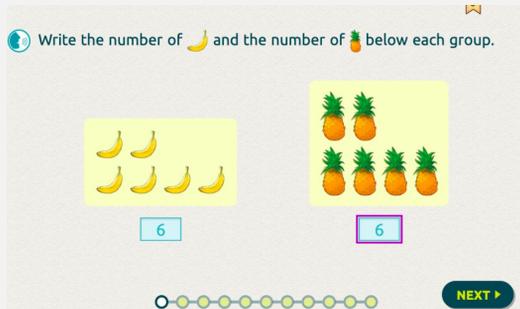
- Activity 3: Counting Meerkats
- Activity 4: Multiples of 5 and multiples of 6

### Level up: Rank 2

- Activity 5: Skip counting by 5 on a number line
- Activity 6: Sorting numbers up to 1000

**A. (Student 2) - Doing everything wrong!**

- Activity 1 was the same. All attempts were made wrong.
- Activity 2 was also the same. All attempts were made wrong.
- Activity 3 was also the same. (Counting Meerkats)
- Activity 4: Identifying Odd and even numbers.
- Activity 5: Arranging numbers between 1-20 in ascending order.
- Activity 6: Counting and comparing numbers up to 20.



- Activity 7: Arranging numbers between 1-10 in ascending order

### 4.2.5. Teacher Support

#### Teacher Support (P14)

**Teacher Support (P14) is rated Exemplary.** Detailed guidance and lesson plans are provided for the teachers explaining how to integrate any of the activities in their teaching. There is also support for the teacher to create groups of students and assign various activities to different learners, hence creating a customized learning experience for the learners.

**Technology and Design**  
**Exemplary**

## 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**  
(T1 and T2)

**Learner navigation and pace**  
(T3)

**Universal design**  
(T4)

**Interface design: Enable intuitive use (T1) is rated at Valuable**

The Matific activity interface enables intuitive use via the provision of help animations before a learner begins an activity aiding in understanding the usage of affordances provided by the interface. There are some activities in which a video demo shows what to click for continuing with the activity.

However, there are instances in which learners have to figure out which button to press since no guidance is provided for initiating an activity. Thus inconsistency is observed in the design.



**Illustrative example:** Topic: Measuring Angles - Shapes of Angles, Grade 5

Animation and visual cues that show how to turn a geometrical figure to align to the grid lines for measurement are often provided. In the game of measurement of angle through protractor, the demo visuals show how to measure the angle using a protractor.



**Illustrative example:** Topic: Long and short - Length, Grade 5

The instruction to drag X mark is given (figure below) but not intuitive for grade 5 learners to play with the activity. This is not a self-explanatory activity and no demo visuals are available to guide the learners to play with the activity.



No help video available

### Interface design: Assess consequences of an action (T2) is rated as Exemplary

Scenarios that cause an error during usage for the Matific interface both at the activity interface, as well as the overall platform level interface, are minimal.



**Illustrative examples:** A confirmation message is displayed if the user logs out by mistake.

The product's interface provides appropriate feedback using visual cues -the entire question text shakes when a wrong answer is submitted along with a sound - to enable the learner to work through the activities.

### Learner navigation and pace (T3) is rated as Valuable

Learners are free to navigate across LU's and start from any point. Even within a learning unit, the learner can navigate between activities. However, the learning path within an activity is preset and cannot be changed. There is no scope to ignore feedback and proceed. Navigation back to attempted questions or activities is not possible unless the learner retries.



## Universal Design of Information Technology (T4) is rated as Valuable

Product is robust in several criteria for universal design like provision of audio and visual content, some key actions can be performed from the keyboard (without needing a mouse), and availability of voiceover option for reading questions. Many expected and important aspects are missing which would help the content accessible to a diverse set of learners. These include a provision to pause animated content (like counting games with birds flying), assistive technology like an NVDA screen reader not recognizing content in activities and the menus on the homepage, cross-browser issues (e.g., with Microsoft Edge), and cross-device compatibility (e.g., iPad logins).

### 4.3.2 Affordances that Facilitate Learning

**Analytics for learners' progress**  
(T5)

**Tools to support problem-solving**  
(T6)

**Meaningful interactivity**  
(T7)

**Analytics for learners' progress (T5) is rated Exemplary.** The dashboard provided by the product is very useful and usable for the intended users (Teachers, Students, Parents). The Teacher's login allows the teacher to assign activities at the class level as well as at a student level. The information provided by the interface is easy to interpret. It provides information about the assigned work progress, it gives student-wise data about the completion of work-in-progress. It is noteworthy that the dashboard also provides pointed segregated data about 'Students needing help' and the 'Students that are excelling'. This will allow the teacher to give personalized attention as per the need and also assign higher-level activities for the excelling students to cater to their advanced skill development. The dashboard also provides the teacher with daily critical insights at various levels. Overall, the teacher dashboard provides sufficient guidance on identifying where the learner needs to put in the effort or where additional support should be provided to make progress. Similarly, there is a parent dashboard that provides them with the basic progress about their learners' progress and highlights some actionable insights. Learners' progress is visible as they solve the challenges - the 'Training zone' shows their result along with the class average for that particular topic which allows the learners to reflect on their progress and attempt it at their pace.



**Tools to support Problem solving (T6) is rated Exemplary.** The product provides tools in every activity that learners/teachers would need to solve the given problem, thus contributing to the learning process. The learning activities have embedded tools relevant to the topic to enhance the learning experience. In activities requiring the learner to measure dimensions, the activity provided a *Grid* as a reference to allow the learner to align and measure the dimensions. A *Protractor* is provided in the learning unit of *Angles* to measure the angle. There is a *marking tool* provided to allow the learners to mark as they count the number of objects under consideration. These tools are beyond the generic tools like pencil, eraser, etc.

**Meaningful Interactivity (T7) is rated Exemplary.** 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. All necessary interactivity features are included in the activities of the product. They are all very meaningful for learning the content. No superfluous interactivities have been included. Basic interactivities such as radio buttons, input boxes, drag and drop are the most common ways by which the user performs an action. Most activities in the product include interactivities of different variations to understand the concept by doing.



### Illustrative examples

- **Grade 3, Fractions** - Drag and Drop interactivity where the learner is supposed to place the fraction of the shape in an area.
- **Grade 4, Perimeter**- Rotate and Align The learner can click and rotate, align the objects to the grid to measure the side lengths of the shapes and calculate the perimeter of the object.
- **Grade 4, 3D objects** - The learner can rotate the 3D object around its axis and also in some cases click to open the 3D objects to 2D nets and vice versa.



# 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.

