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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

Khan Academy offers instructional videos, practice exercises, and a personalized learning dashboard for learners to study at their pace in school or at home. The platform also has teacher tools and a ‘coach’ dashboard that empowers teachers to identify the learning requirements of each student, based on which they can tailor remediation for each student. The product contains elements of personalization and adaptivity for learners.
3. Executive Summary

Khan Academy | Mathematics | Grades 6-8

Content Quality Exemplary
Pedagogical Alignment Exemplary
Technology and Design Exemplary

Overall, the product is aligned with national standards and includes excellent content and pedagogical strategies. This product is strong in adaptivity and might be very useful for learning and applying concepts in Mathematics for grades 6-8. The product might serve as an effective supplementary tool for teachers to support learners’ learning and monitor their progress.

Potential benefits of this product

Learners will likely be able to:
- Interpret various mathematical topics effectively since factually correct content is presented engagingly.
- Solve complex mathematical problems as the product provides stepwise hints to address misconceptions.
- Engage with the product effectively due to personalized conversational style and efficient scaffolding.
- Infer the meaning of complex concepts at a comfortable pace since the product provides them exemplary control over their learning pace and navigation.

Teachers will likely be able to:
- Integrate the product in class since it is aligned with national standards, most of the units/topics/chapters are as per NCERT books, and it covers Maths skills recommended by NEP 2020.
- Track class performance and individual learners’ learning progress. Thus they can use the product to create and assign relevant homework for each learner.

Potential limitations of this product

Learners will likely face the following issues:
- Feel disconnected with the content as inclusivity of content is valuable and sufficient context is not used in the product.
- Get frustrated as adaptivity is only performance-based and does not map to the profile of students.
### Khan Academy (Grades 6-8): Summary of Review Ratings by Criteria

**Content Quality:** **Exemplary**

<table>
<thead>
<tr>
<th>C1</th>
<th>Content accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>All content is accurate and explained clearly.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C2</th>
<th>Correctness and clarity in assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>All assessment questions in practice tests or associated activities and their solutions are correct and unambiguous.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C3</th>
<th>Language comprehensibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>The language used can be understood by the intended learners with some effort. The accent might be difficult to follow.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C4</th>
<th>Mathematics skill coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills recommended by the NEP are covered.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C5</th>
<th>Curriculum alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The content is aligned to NCERT and logically sequenced.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C6</th>
<th>Inclusivity in representation of learners</th>
</tr>
</thead>
<tbody>
<tr>
<td>No consideration is given to include diversity in gender, caste, look, and socio-economic class.</td>
<td></td>
</tr>
</tbody>
</table>

**Pedagogical Alignment:** **Exemplary**

<table>
<thead>
<tr>
<th>P1</th>
<th>Constructivist approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some elements of constructivist approach are present such as, pausing video to allow learners to reflect and experiment. But overall, those efforts are inconsistent across learning units.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P2</th>
<th>Addressing learning gaps/ alternate conceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning gaps have been addressed thoroughly through the videos and practice questions. Stepwise hints provide effective redressal of these gaps.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P3</th>
<th>Content in context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient content in context has been provided.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P4</th>
<th>Learner scaffolding</th>
</tr>
</thead>
<tbody>
<tr>
<td>The product included sufficient scaffolds like hints to help the learner form the correct mental model of the concept being taught.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>P5</th>
<th>Cognitive engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highlighting of essential concepts is provided for signaling and tone is conversational.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>P6</th>
<th>Motivational Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>The product includes a comprehensive set of motivational features that are well integrated and prompt the learners to interact further with the content. E.g., the presence of stars, motivational statements, and badges.</td>
<td></td>
</tr>
</tbody>
</table>
Executive Summary

Summary of Review Ratings by Criteria

EdTech Tulna Evaluation Report: Khan Academy, Mathematics Grades 6-8, February 2021
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P7 Logical Chunking and Connectedness
The videos are small and are logically chunked to enhance understanding. Practice questions followed the videos.

P8 Learning objective – assessment alignment
The learning objective and cognitive levels of the assessments are aligned to the content and the National curriculum.

P9 Pedagogy – assessment method alignment
There was inconsistent alignment between pedagogical strategies and assessment as per NEP recommendations.

P10 Cognitive levels covered
Questions and activities engaging learners in Higher Order Thinking Skills (HOTS) are insufficient.

P11 Feedback Quality
Detailed explanations are present for assessment questions, and there is an opportunity to revisit the related content.

P13 Adaptivity
The product is assessment adaptive, and the adaptivity is determined only based on learner performance.

P14 Teacher support
Adequate teacher support is provided, where they can customize and assign students relevant material.

Technology and Design: Exemplary

T1 Interface design: Enable intuitive use
The interface is intuitive, all elements are clearly visible, and actions are mapped to their expected response.

T2 Interface design: Assess consequences of an action
The interface provides an appropriate response to the learner’s action.

T3 Learner navigation & pace
The interface provides complete control to learners over their learning path.

T4 Universal Design
Features of universal design are present to ensure a low entry barrier to diverse learners.

T5 Analytics for learners’ progress
The dashboard provides easily interpretable progress of the learners to both teachers and learners.

T6 Tools to support problem solving
Except for the calculator, no other supporting tool is available in the product.

T7 Meaningful interactivity
Appropriate interactivity like text inputs, drag and drop interfaces, radio buttons were used. No superfluous interactivity feature is present.

T8 Content type - Technology alignment
Visualization type matched to the content type.
4. Detailed Review

4.1 Content Quality

Content Accuracy and Clarity ................................................................. 8
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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. The criteria in this dimension focus on content accuracy and clarity, alignment to national standards, and inclusivity in content representations.

4.1.1 Content Accuracy and Clarity

Content Accuracy (C1) is rated Exemplary: The reviewers observed that all the content was accurate. The video content included accurate definitions, diagrams, facts as per the topic requirement.

Illustrative example Learning Unit: Estimating sum, difference, or product (Grade 6):

The given video explained the solution for addition and subtraction of three-digit numbers by approximation method, i.e., 398+251 done by approximating the numbers to the nearest 100, i.e. 400 and 250. Subtraction of two numbers 678-273 is done by approximating them to 700- 300. The results were close to the actual results (Fig. 1).

Illustrative example Learning Unit: Congruence of triangle (Grade 7):

The concept of congruence of the triangle was explained using appropriate diagrams and equations, as shown in Fig. 2.

Correctness and clarity in assessment (C2) is rated Exemplary. The wording of the assessment questions conveyed the intended meaning and clearly stated what was expected from the learner. The solutions provided were complete with appropriate explanations.
Language Comprehensibility (C3) was rated Valuable: The language and vocabulary used in the videos and practice questions were simple, and the sentences were short and easy to comprehend. The reviewers observed that an American accent had been used, thus making it challenging for Indian learners to understand.

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: Major topics were chunked appropriately into small subtopics. Shorter videos were presented to learners, which covered the single concept at a time. The conceptual understanding was progressively built through videos and assessed via a series of test questions. Reviewers observed that all the topics and subtopics covered were aligned with the NCERT textbooks for grades 6-8. The subtopics were scaffolded as per their difficulty levels and prerequisite knowledge required within each topic.

Illustrative example: Learning Unit Fraction: Grade 6:

The content included in the product were fractions on a number line, Mixed and improper fractions, equivalent fractions, comparison of fractions, addition and subtraction of like and unlike fractions. Those topics were covered in NCERT books as well. Word-problems in fractions and visualization of fraction were merged in previous topics while they were treated as separate units in the product.

Similarly, reviewers observed that the content covered all the Mathematics skills recommended by NEP 2020 and NCF specifically for the upper primary stage (Grades 6-8), such as understanding abstract concepts like algebraic expressions, triangles, and decimals. It also used graphical representations to explain topics like data handling.

Illustrative example: Learning Unit Data handling Grade 6:

The video explained the concept of representation of data through picture graphs, bar graphs. There were problem-solving exercises based on drawing bar graphs for the given data. The topic covered data handling and representation skills.
4.1.3 Inclusivity in Content Representation

Inclusivity in the representation of learners (C6) is rated Potential to Improve: The product did not include content relatable to diverse learners. Diversity in gender, caste, geography, or socio-economic status from an Indian context was missing. Based on the names, sports, activities, and food, the target users seemed to be American students. The product did not include Indian learners. Some of the examples shown below illustrate the problem.

- **Illustrative example: Learning Unit: Fraction word problems: Grade 6**
  Fractional subtraction examples include a variety of tomatoes like beefsteak, Roma, and Cherry to calculate their heights.

- **Illustrative example: Learning Unit: Interpretation of Histogram: Grade 8**
  For explaining the histogram, an example of Cherries on Pie was given. Indian students might find difficulty relating to such examples. It may hinder their learning process.

4.2 Pedagogical Alignment

Pedagogical Alignment includes criteria focused on adaptivity, learner-centred 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 / alternate conceptions (P2)**

Constructivist approach in pedagogy design (P1) is rated Valuable: The product’s design provided few opportunities for learners to construct their understanding. But the reviewers observed that there was inconsistency in the use of the constructivist approach. The concepts were explained well in the videos, But the opportunity for learner interaction was available only in a few videos. The speaker rarely asked the learner to pause and reflect. Most of the learning units contained drill and practice type of questions. Very few assessment questions provided an opportunity for learners to experiment and apply their knowledge.
Illustrative example: Learning Unit: Area and perimeter of circle: Grade 7

Video included problem-solving exercises (fig. 3) as shown. The complete solution was explained without any pause points for learners to think, apply, or at least draw what they understood by the area of the circle. So the design appeared to be following an information transmission model. Most of the questions were of substitution type. No opportunity was given to the learners to think, reflect, or experiment. The problems were not diverse either.

![Fig.3. Problem-solving based on the area of a circle](image)

While in some examples, the reviewer team observed the use of a constructivist approach. For instance,

Illustrative example: Learning Unit: Expression with variable: Grade 6

This video explained the evaluation of expressions by substituting values. There were diverse examples given and learners were asked to pause the video to evaluate the expression. The problem was diverse as well as at a higher difficulty level than the previous one (Fig. 4).

![Fig.4. Video for explaining evaluation of expression (pause suggested)](image)
There were drill and practice types of questions present in some of the learning units.

Illustrative example: Learning Unit: Area and perimeter of circle: Grade 7

The practice questions were
1. Find the area of circle if circumference is 18.84 units
2. Find area of circle with radius 8 units
3. Find area of circle with diameter of 16
4. Find area of circle with circumference of 31.4 units

While some learning units allowed learners to experiment and answer the questions, as shown below.

Illustrative example: Learning Unit: Fraction on number line: Grade 6

In this question, the learner was allowed to move a point on the number line and find the number of divisions (fig. 5)

Addressing learning gaps/ alternate conceptions (P2) is rated Exemplary: Reviewers found that the product’s pedagogy design addressed the learning gaps in most learning units, wherever there was a possibility. The gaps were addressed using a variety of examples in the video during practice assessment questions.

Illustrative example: Topic: Idea of variable, Grade 6

In this example, the instructor covered the use of multiplication signs, how it might be confused with the ‘x’ alphabet, and how variables could be represented in different manners. Also, the instructor clarified how the problem should be thought about at each point, which addressed learning gaps.
Illustrative example: Topic: Related Angles, Grade 7

Assessment questions were presented (Fig. 6) to test the misconceptions in which learners were given questions to find the value of the angle. Out of the two intersecting lines, one is not a straight line.

![Vertical angles](image)

Fig. 6. Identification of learning gaps for vertical angle

There were stepwise hints provided for redressal of misconception, as shown in Fig. 7

![Vertical angles](image)

Fig. 7. Redressal of misconceptions

4.2.2. Enhancing learner experience

Content in Context (P3) is rated **Valuable**: Reviewers noted an effort to add good real-life examples in videos and assessment questions. But inconsistency was observed across learning units. Only a few learning units had good real-life examples to motivate learners to care for the topic.
Illustrative example: Topic: Idea of Variable, Grade 6

The example shown in Fig. 8 was used to explain the concept of a variable. It showed how the value of tip changed hourly and thus how the total amount changed, and how the learners can replace the hotel tip value by a variable ‘t.’

![Fig.8. Example of hotel tip](image)

However, for topics like ‘Lines, line segments and rays,’ no context was provided. The context referring to various diagrams might have been valuable and applicable in such topics.

Illustrative example: Topic: Lines, line segments and rays, Grade 6

The video explained the definitions directly with diagrams without providing any reference with real-life context.

![Fig.** No real-life context](image)

Learner Scaffolding (P4) is rated Exemplary: Reviewers observed that videos were organized by breaking content into small conceptual units with progressively increasing difficulty levels. There were stepwise hints presented in the assessment.

There were patterns seen in the presentation of video content. The context of concept was formed using everyday life examples and simple definitions of concepts were followed by simple repetitive examples after which some application of concepts were explained. These would likely simplify the learning task and bring it within reach of learners.

Illustrative example: Topic: Introduction of Coordinates, Grade 8

The video explained the coordinate system and how to locate points on the coordinate axis. There were examples shown on how to locate points on the coordinate axis. There were points situated on the axis and explanations regarding how to find its coordinate were provided. Thus, examples were varied and presented in increasing order of difficulty (Fig.9).

![Fig.9. Learning unit structured in higher order of difficulty](image)
Reviewers observed another scaffold in the assessment. The multistep hint approach would potentially help learners overcome impasses during the problem-solving process. Learners were supposed to select steps of hint as per their requirement.

Illustrative example: Topic: Introduction of Coordinates, Grade 8

The question is to identify the coordinates of a given point on the graph. In order to find the solution, there are four hints provided to learners and a choice was given to the learners to select several of those hints (Fig. 10).

| 1 / 4 | The ordered pair of a point tells us how to get to it from the origin. (distance right, distance up) 
       | -coordinate    y-coordinate 
       | We are asked to find the x-coordinate. |
| 2 / 4 | The x-coordinate tells us how far we move right from the origin. |

Thus, both types of scaffolds were potentially valuable to form the correct mental model of the concept being taught.

Cognitive Engagement (P5) is rated Exemplary: Product’s design included both conversational style of presentation and excellent signaling required for exemplary cognitive engagement.

In the video content, the instructor used a conversational style of presentations. Words like ‘we’ and ‘us’ were frequently used by the instructors. If the instructors made any mistake, they acknowledged the mistake immediately. This model created a feeling of conversation between instructor and learners.

Illustrative example: Topic: Kinds of quadrilaterals, Grade 8

While explaining the shape rhombus, the kite was shown and the instructor used sentences like “we can see two pairs of congruent sides.”

Instructors highlighted essential concepts or principles using different colors, boxes, and circles. Thus, visual cues were used to highlight crucial points on the screen. Verbal cues were also observed as the instructor stressed certain points in the voice-over.
Motivational Features (P6) is rated Exemplary: The product’s design incorporated noteworthy motivational features for the learners. Reviewers observed the presence of many motivational features at various steps in the learning path.

Illustrative example: Topic: Introduction to quadrilaterals, Grade 8

Boxes and circles were used to highlight and explain square and rectangle shapes. The instructor used arrows to mark congruent sides. Also, the phrase ‘quadri’ was highlighted (Fig.11) and the instructor stressed it during voice-over to explain what it meant.

Illustrative example: Topic: Understanding Quadrilaterals: Grade 8

Learners were given energy points for watching the video or completing the exercise (Fig. 12). Energy points motivated learners to complete the current learning unit.

Illustrative example: Topic: The idea of variables: Grade 6

If learners complete an exercise, a course challenge, or a unit test accurately, they get mastery points. A topic is categorized as familiar or proficient, based on how well one has done with the practice exercises (Fig.13).
These proficiency levels were also supplemented by messages like “Nice, ready to move on,” “Try again,” or "Mastered." The product used a personalized motivation tone within units. Where the messages crafted are on the lines of “Keep trying, keep going,” or “You’re almost there, you can do it.” Such messages motivate low achievers to continue and explore the content. The motivational features were a combination of messages, star, and sound. Students will get a star, sound, and message for correct answers like “good work.”

There were badges for the learner modeled after moon, earth, and meteorite. Tags like “Nice Listener,” and “Mad Scientist” were also available. Such additional tags are an interesting addition for students who are motivated by rewards.

Logical chunking and connectedness (P7) is rated Exemplary: Khan Academy consisted of a set of multimedia (videos and questions) organized into distinct segments. The product has designed the user interface with Learn (video content) and Practice (Assessments) sections parked side by side. Such a design would enable learners to assess themselves anytime while viewing the content. Hence, the videos were segmented at the sub-topic level. These segments are available as individual units and there is at least one assessment mapped to every sub-topic. At a course level, it’s easy to navigate through an entire grade, where both chapters and topics are listed in the same order as per NCERT.
4.2.3 Assessment of Learning

<table>
<thead>
<tr>
<th>Learning objective - assessment alignment (P8)</th>
<th>Pedagogy-assessment method alignment (P9)</th>
<th>Cognitive levels covered (P10)</th>
<th>Feedback Quality (P11)</th>
</tr>
</thead>
</table>

**Learning objective – assessment alignment (P8) is rated Exemplary:** The questions in each topic and concept were very well aligned with the stated learning objectives. The illustrative example below (Fig. 16) demonstrates such an alignment.

**Illustrative example: Topic: Related angles, Grade 7**

Learning objective:-Learners will be able to calculate supplementary and complementary angles. Questions:-What is the measure of ∠x?

**Pedagogy-assessment method alignment (P9) is rated Valuable:** Product attempted pedagogy and assessment alignment inconsistently. Reviewers observed alignment between the pedagogy and assessment in only some of the topics. In some topics, although the pedagogy used real-world scenarios to introduce these topics, the assessment questions emphasized simple application of formula-based questions instead of problems based on real-world experiences.

**Illustrative example: Topic: Mean, mode, and median, Grade 7**

The topic was explained using real-life examples like finding the mean for heights of plants, but in the assessment, students had to just calculate the mean of a set of numerical values. Not a single question was provided with real-life examples.

While there were some learning units in which the pedagogy and assessment was aligned as both contained the application of concept through real-world context.

**Illustrative example: Topic: Creating Histogram, Grade 8**

The video explained histograms with real-life examples like going to a restaurant and noting down the ages of all people in the restaurant and then grouping and representing them through histograms. The questions given in the assessment were also based on real-life examples. One such question was- “Below is the number of pages in six books that Pedro read this summer 584,201,255,44,312,334. Using data create a histogram”

This also addressed the skill of data handling, representation, and visualization skills recommended by NEP.

EdTech Tulna Evaluation Report: Khan Academy, Mathematics Grades 6-8, February 2021
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Cognitive levels covered (P10) is rated Valuable: Product attempted to address HOT level assessment questions but these were insufficient. Moreover, HOTS questions were missing in many important topics. For example, reviewers found HOTS questions lacking for the following key topics - linear equations, mensuration, and direct and inverse proportion. Overall, the HOTS questions covered in the practice set were very few and insufficient to cover the wide variety of questions present in the NCERT.

Feedback Quality (P11) is rated Exemplary: Feedback was provided to learners using multiple steps which broke down big solutions into easily understandable steps. Feedback contained correct responses with explanations in the form of appropriate diagrams/illustrations wherever required.

Illustrative example: Topic: Introduction to coordinates, Grade 8
Feedback is given not only for correct answers but for wrong answers as well (Fig.17).

For each practice or assessment question, the corresponding remedial videos were also shown. Thus feedback also directed learners to revisit the content (Fig.18)
4.2.4. Adaptivity

Adaptivity (P13) is rated Valuable: Reviewers found that the product’s adaptivity was linked to the learners’ performance only. There was no consideration of learners’ profiles or learners’ interactions with the content.

The product showed content adaptivity to a limited extent, where it adapted according to the performance of the learner. There was no evidence of adaptivity based on learners’ profiles or interactions. However, the product collected basic information such as grade and focus topics from the student and showed relevant content for that grade. There was an option of a diagnostic test - Course Challenge - that was available to the students but this was dependent completely on whether the learner chooses to invoke it or not. Furthermore, the content or assessment questions did not change based on the result of this diagnostic test. However, the scores in the diagnostic test increased the learner's mastery points for specific topics and sub-topics.

Based on the results from the practice exercises and unit tests, the product nudged the learner to revisit certain topics by recommending videos to watch. Practice questions, videos, or the user interface did not change much based on individual learners and their responses. There was no evidence of adaptivity based on the learner’s interaction with the system. For example, the product did not check or provide prompts if questions were answered at an unreasonable pace. Reviewers did not find the product adapting to user interaction patterns such as always selecting a particular option.

Thus, while there were some instances of adaptivity in the product, these were limited to the learners’ performance in assessment questions.

4.2.5. Teacher Support

Teacher Support (P14) is rated Exemplary Teachers were provided with content on various topics that they could use in the classroom. For instance, teachers had access to assessment questions, quizzes, and unit tests which could be used in their classrooms. Teachers could monitor the progress of students and assign units based on students’ performance. Thus teacher support is such that they could select questions and customize the homework or practice sessions for the students.
4.3 Technology and Design

Technology & Design measures how well the technological affordances and the user interface design integrate with the pedagogy and context to promote a meaningful learning experience for all learners. The criteria in this dimension focus 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 user interface followed Norman's design principles for visibility, affordance, consistency, and mapping. The interface clearly conveyed how learners needed to perform actions. The visual elements on the screen are easy to find and their functions are intuitive. The element provides appropriate guidelines for its functionality. Similar elements were doing the same task, thus adhering to consistency.

Illustrative example for showing natural mapping
For “Match the following” type of assessment questions, learners needed to click on boxes and move them to match the content. The interface exploited natural mapping like vertical scroll bars moving the content in the vertical direction. Play-pause buttons in videos performed the natural function of playing or pausing the video.

Interface design: Assess consequences of an action (T2) is rated Exemplary: The interface provided feedback or responded to the learner's actions through appropriate text or visuals. The product’s interface design facilitated recovery from errors if any.

Illustrative example for showing feedback on learner’s action
Visual feedback was provided to learners about their actions such as for correct answers there was a motivating text which prompted learners to move ahead. In the case of incorrect answers, textual feedback like “get help” or “skip for now” was shown on the screen and the learner had the option of going back and rectifying the solution. This allowed learners to accomplish tasks without getting stuck with the interface.

Illustrative example for showing error handling
If learners close a window by mistake, they could start from the same unit after resuming the work.

Learner Navigation and pace (T3) is rated Exemplary: Product’s interface design provided adequate control for learners over their learning path. Learners were able to navigate within and across the learning unit at the pace that they preferred.
Learners could skip the videos or practice questions and move ahead to the next level. They could also revisit the content as per their requirement. Both backward and forward movements were allowed for the learners. Thus navigation and pace through content were based on the learner’s requirement.

**Universal Design (T4) is rated Exemplary:** Several Web Content Accessibility Guidelines (WCAG) principles had been followed in the product. The product ensured low entry barriers for diverse learners with varying ability, special needs, or other characteristics. For example, content was presented in multiple ways using text, diagrams, and videos. The content was allowed to appear and be operated in predictable ways. However, non-keyboard alternatives enabling different ways of data input were missing. While such alternatives might not be essential for the purposes of this product, they are desirable from an inclusivity perspective.

### 4.3.2 Affordances that Facilitate Learning

<table>
<thead>
<tr>
<th>Analytics for learners’ progress (T5)</th>
<th>Tools to support problem-solving (T6)</th>
<th>Meaningful Interactivity (T7)</th>
<th>Content type – Technology alignment (T8)</th>
</tr>
</thead>
</table>

**Analytics for learners’ progress (T5) is rated Exemplary:** The reviewers found that the teacher dashboard was robust. The teacher could track individual learner’s learning paths like topics completed, questions attempted, and responses submitted. Teachers also could allot topics or questions to each learner as needed. The learner could view all the activities they had undertaken, their progress through various levels such as familiar, mastery, and proficiency. Learners also could check how many problems they could solve correctly and the time spent on each activity. A separate tab to track their assignments was also provided.

**Tools to support Problem-solving (T6) is rated Valuable:** In this product, the calculator was the only tool available. Tools like protractors or animated scales were missing.

**Illustrative examples: Topic: Circles, Grade 7**

For the question of calculation of area of a circle or perimeter, calculator was available as an online tool (Fig.19)

![Fig.19. Online calculator](Image)

**Meaningful Interactivity (T7) is rated Exemplary:** The product was rated as exemplary on interactivity affordance of the interface. In many places, whenever required interactivity such as selecting input boxes for multiple options, drag and drop buttons for matching options, etc. were provided in the product.

**Content type - Technology alignment (T8) is rated Exemplary:** The visualizations used in the product mapped suitably to the content type. The product included videos to explain the process of problem-solving and images were drawn within the video to explain facts.
EdTech Tulna Evaluation Report: Khan Academy, Mathematics Grades 6-8, February 2021

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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.