

Multimedia Project Critique 1

Imagine Math Critique

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In recent years the use of adaptive technology and gamification in the classroom has exponentially increased. As the movement towards personalized learning in schools has emerged, product developers are moving in to create educational resources that are capable not only of immediate feedback for teachers and students, but also allow for differentiation based on individual student performance and outcome goals. One such product, Imagine Math (formerly known as Think Through Math) is the subject of this critique.

Imagine Math is a subscription based, web-hosted program focusing on grades 3 -8, and it is advertised as a supplementary, standards-aligned resource. Imagine Math is purposely scaffolded to provide personalized learning for each student, keeping them in their “proximal zone of development”. A major feature that separates Imagine Math from other similar programs is the fact that there is an on-call live teacher that students can access for support at any time, just by pressing a button during the lesson. This support feature includes bilingual teachers for English as a Second Language learners.

Once signed in, students will see their homescreen (see image below). This includes a history of all their lesson attempts and completed lessons, a progress tracker (if they are currently working on a lesson), and their personally designed avatar.

The screenshot displays the Imagine Math website interface. At the top, the logo "Imagine Math" is on the left, and the user's name "Spencer" with a profile picture and a balance of "2,147" is on the right. A navigation bar includes "HOME", "CONTESTS", "REDEEM", and "MESSAGES".

The main content area features a "Current Lesson" section for "Comparing Fractions and Decimals". It shows a progress bar with five stages: Pre-Quiz, Warm Up, Guided Learning, Practice, and Post-Quiz. The "Practice" stage is currently active. A "START" button is visible, along with a "THINK Points Earned in Lesson" of 80.

Below this, a "Lesson Progress" section shows "80 Lessons Attempted" and "41 Certificates Earned". A list of lessons includes "Classifying and Ordering Real Numbers" (marked with a red X), "Comparing Fractions and Decimals" (highlighted in yellow), and "Evaluating Simple Expressions".

On the right, a "THINK Points This Year" section shows a total of 80,347 points and 2,147 points to spend, with a "Redeem" button. Below that, a "Contests" section features a contest titled "Elephants, candy heart..." with a "Learn More" link.

All lessons follow along the same framework, consisting of a pre-quiz, warm-up, guided learning, practice, and post-quiz sections. If the pre-quiz is passed, students are not required to continue with the lesson, as they are considered to have already mastered the content. If the pre-quiz is not passed, the warm-up generally begins with a game that helps activate prior knowledge and skills needed to help support the lesson. The guided learning consists of several worked examples, sometimes with supplemental animations or videos. While problems are presented as text on screen, there also exists an option to press a button and have an audio recording of the questions being read out loud. Problems at this stage, whether answered incorrectly or correctly, are accompanied by explanations (see image below).

Example of feedback for incorrect answer:

Classifying and Ordering Real Numbers - Item 3479 Question 1 of 2

From their [location](#) in the [diagram](#), what are two possible [values](#) for n and m ?

Rational Numbers		Irrational Numbers
Integers	n	m

CLOSE

$n = -3\frac{2}{5}$ and $m = \sqrt{0}$ is not correct because $\sqrt{0}$ cannot be the value of m .

Real Numbers

Rational		Irrational
Integers	n	m
$\sqrt{0} = 0$		

0 is a **rational** number AND an integer.

But the value of m must be an irrational number.

Example of feedback for correct answer:

Classifying and Ordering Real Numbers - Item 3479 Question 1 of 2

From their [location](#) in the [diagram](#), what are two possible [values](#) for n and m ?

Rational Numbers		Irrational Numbers
Integers	n	m

CLOSE

Yes, $n = 0.5$ and $m = \frac{\pi}{2}$ can be the values of n and m .

Real Numbers

Rational		Irrational
Integers	n	m
$0.5 = \frac{1}{2}$		$\frac{\pi}{2} = 1.57079632 \dots = \frac{?}{?}$

0.5 can be expressed as a ratio of two integers, so it is **rational**.
0.5 is also not an integer.

$\frac{\pi}{2}$ cannot be expressed as a ratio of two integers, so it is **irrational**.

The practice section then follows, with several problems of different levels (procedural, conceptual, and application level). Finally, a post-quiz is administered. If the student scores at least an 80%, they pass the post-quiz and receive a certificate for passing the lesson. If a student does not score at least an 80%, then they do not receive the certificate and the lesson is moved into the “lesson attempted” category. Because Imagine Math is adaptive, it will then use that information to assign similar lesson topics and revisit the content to help build more student learning.

In terms of multimedia learning principles, Imagine Math successfully addresses several key ideas. The first clearly evident principle being adhered to is the segmenting principle, which Mayer & Pilegard (2014) defines as “breaking the lesson into manageable learner-controlled segments” (p. 318). Each lesson is learner paced, with students deciding how quickly to proceed through the material and the 5 stages of the lesson. The ticker at the top of the page shows students where they are in the progress on the entire lesson (and saves as they go), as does the lesson details checklist that is displayed as each section is completed (see image below):

The screenshot shows the Imagine Math interface for a lesson titled "Classifying and Ordering Real Numbers - Item 24306". At the top, a progress bar indicates the student is in the "Warm Up" stage (2) of a 6-step process: Pre-Quiz, Warm Up, Guided Learning, Practice, Post-Quiz, and Finish. The user is identified as "Spencer". A large blue banner displays "26 out of 91 points". Below this, a "Lesson Details" checklist shows the following items:

Step	Activity	Description
1	Pre-Quiz	26 out of 91 points
2	Warm Up	Review what you know.
3	Guided Learning	Explore new math.
4	Practice	Practice what you've learned.
5	Post-Quiz	Show what you know.

To the right of the checklist, a white box contains the handwritten text: "You already know a lot. Let's review."

Because Imagine Math is geared towards grades 3 – 8, using the segmenting principle in particular helps ensure the lesson “slows the pace of presentation to a level that enables learners to carry out essential processing” (Mayer & Pilegard, 2014, p. 318). Students are able to avoid cognitive overload by completing parts of the lesson and pausing or taking breaks, without having to proceed without breaks through one long, continuous unit of instruction.

Another multimedia principle closely adhered to is the split-attention principle. Ayres & Sweller (2014) cite a Sweller et al (1990) study stating “learners who studied an integrated worked example format where steps to the solution were written on the diagram at locations designed to reduce unnecessary search performed significantly better than learners solving problems or studying conventionally structured worked examples” (Ayres & Sweller, 2014, p. 210). Imagine Math designs its feedback to integrate the information on diagrams, as seen in the example below:

Classifying and Ordering Real Numbers - Item 3479 Question 1 of 2

From their location in the diagram, what are two possible values for n and m ?

Rational Numbers	n	Irrational Numbers	m
Integers			

Yes, $n = 0.5$ and $m = \frac{\pi}{2}$ can be the values of n and m .

Real Numbers

Rational	Irrational						
<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">Integers</td> <td style="padding: 5px;">n</td> </tr> <tr> <td></td> <td style="padding: 5px;">$0.5 = \frac{1}{2}$</td> </tr> </table>	Integers	n		$0.5 = \frac{1}{2}$	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">m</td> </tr> <tr> <td style="padding: 5px;">$\frac{\pi}{2} = 1.57079632 \dots = \frac{?}{?}$</td> </tr> </table>	m	$\frac{\pi}{2} = 1.57079632 \dots = \frac{?}{?}$
Integers	n						
	$0.5 = \frac{1}{2}$						
m							
$\frac{\pi}{2} = 1.57079632 \dots = \frac{?}{?}$							

0.5 can be expressed as a ratio of two integers, so it is **rational**.
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$\frac{\pi}{2}$ cannot be expressed as a ratio of two integers, so it is **irrational**.

CLOSE

Further, the image above helps illustrate Imagine Math's adherence to the feedback principle in multimedia learning. Johnson & Priest (2014) state "novice students learn better with explanatory feedback than with corrective feedback alone" (p. 450). Because Imagine Math goes beyond just informing the student of whether or not they are correct, but includes an explanation of why, it helps to reduce the amount of extraneous processing required from the learner (Johnson & Priest, 2014, p. 451).

Along with adherence to several multimedia principles, Imagine Math also displays several aspects psychology of learning. Driscoll (2005) states, "what learners bring to learning situation dictates to a large extent what they will take away from it in terms of new knowledge – concepts added to their cognitive structure or details elaborating schemata" (p. 137). Imagine Math observes this concept in two ways, first by giving a pre-test. If students are successful, and thus can gain no new knowledge from the lesson, they are not made to complete it and instead move onto more challenging material that can serve to expand their schemata. Secondly, if a student does not pass the pre-quiz, Imagine Math begins with a warm up game that's purpose is to activate prior knowledge related to the new topic. According to Ausubel's theory of meaningful reception learning, "the most important condition for meaningful learning is what learners already know and how that knowledge relates to what they are asked to learn". (Driscoll, 2005, p.116). By having students complete the warm up game and activating prior knowledge, the students are then primed to incorporate the new material and make connections with the old.

Another feature of Imagine Math which supports cognitive theory is its incorporation of conceptual and application problems - not just procedural skills, which is the focus of many programs - and generally involves only rote-memory skills. The varied problem types provided helps students to tune their schemas. As Kalyuga (2010) states, "as learners acquire more

knowledge and experience in the domain, their schemas evolve and become more refined” (p. 51). Managing all these different levels of understanding (procedural, conceptual, and application) means Imagine Math must pay particular attention to cognitive load. Along with the intrinsic cognitive load of the lessons themselves, the incorporation of the gamification aspect adds to the germane cognitive load – which Kalyuga (2010) defines as “activities designed to enhance learning outcomes or increase levels of learner motivation” (p. 53). Therefore, awarding “Think Points” for successful lessons should motivate students to learn more, and thus directly contributes to the learning. See image below for an example of why children may be motivated to accrue think points (to build their unique avatar).



Another feature of Imagine Math that relates to learning psychology is the inclusion of a reflection after the lesson, which prompts students to engage in metacognition by completing an end-of-lesson organizer, regardless of whether or not they passed the lesson in question (see image below).



Imagine Math

End of Lesson Organizer

Lesson _____ Passed Not Passed

Directions: Reflect on the lesson. Use linking words and phrases in your responses.

<p>1. Math Words and Phrases Write at least one important math vocabulary word or phrase that was used in this lesson. For each word or phrase, write the definition in your own words and draw a visual representation.</p>	<p>2. Problem-Solving Strategies Write at least one strategy that you used in this lesson and describe how you used it.</p>
<p>3. Growth Write about something mathematical that you learned, perhaps from a mistake you made, that you could apply to future problems.</p>	<p>4. Continued Learning Write about questions you still have or something you want to learn more about.</p>

As Driscoll (2005) states, “successful learners seem to acquire and refine these skills throughout their school and learning history” (p. 107). By making a reflection worksheet, with explicit questions prompting students to explore their own learning and look to the future, Imagine Math sets the stage for helping students become more critical thinkers who are aware of their own mental processes and how it affects their learning.

Overall, Imagine Math is a well thought out and well executed program that successfully adheres to several multimedia and learning principles. Indeed, online research shows that the only consistent complaint from educators is unrelated to the program itself, and comes from the expensive cost of the program. However, when weighed against the many positives of the program like available live teacher support, bilingual support, and purposefully designed, standards aligned instruction, Imagine Math is clearly one of the best personalized and adaptive programs for learning currently on the market.

References

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