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Digital Mathematics: Just How Widespread Are Math Apps?

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Abstract

Mathematics education in the digital age has brought about many changes, both for teachers and learners. In K-12 mathematics education, math apps have become increasingly used tools as 1:1 device initiatives continue to proliferate the number of digital devices in the classroom. While researchers have begun to uncover the impact of math apps on students' learning and well-being, what has remained unknown is how widespread math apps are in K-12 mathematics education. Using the PRISMA to systematically collect and analyze publicly available user data on K-12 math apps, this study found estimates of 608 million users on math apps devoted entirely to math and 683 million users on learning apps with math and additional content. Moreover, results indicated that the math apps in this study have, on average, increased by an estimated 427.3% over the last decade, with learning apps that include math seeing an estimated 345.7% increase in use over the last ten years. This study illuminates important math app user-count metrics that often remain in the shadows and calls for greater consistency and transparency in educational technology companies' user reports.

Keywords: math apps; mathematics; K-12 education; technology; digital learning

1. Introduction and Background

In recent years, technology has become commonplace in K-12 classrooms across the world. In fact, in the U.S., a national survey in March of 2021 found that 90% of high school and middle school districts had a 1-to-1 device policy, while 84% of elementary school districts were utilizing a 1-to-1 device policy (Bushweller, 2022). A 1-to-1 device policy, or 1:1 computing, means that each student gets their own device, often a laptop, tablet, or similar electronic device that has Internet capabilities and is used to complete classwork and communicate with others (Islam & Grönlund, 2016). Not only are personal devices becoming increasingly common in the classroom, but students are spending more time on screens outside of the classroom. A recent study by Common Sense Media found that the average 8–12-year-old and 13–18-year-old child in the U.S. spends 5.6 and 8.7 h of entertainment screen time each day (Rideout et al., 2022). The screen time statistics for both age groups went up a startling 17% in just two years following the global COVID pandemic. It is clear that students are spending lots of time on screens—both in and outside the classroom!

In an effort to make up for COVID learning losses that were illuminated with the recent release of the 2023 administration of TIMSS (Mullis et al., 2020; NCES, 2024; von Davier et al., 2024), and to combat teacher shortages (Nguyen et al., 2024; Tan et al., 2024) and growing class sizes (Darling-Hammond et al., 2023), many classrooms, schools, and districts have turned to mathematics applications, or math apps, as a solution. With limited funding, math apps have been used as a cost-effective solution to mitigate many of the

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problems K-12 schools across the U.S. and the world are facing post-COVID. Moreover, math apps have been utilized, in part, because of their purported potential to personalize learning and offer teachers the ability to work with small groups or individual students (Outhwaite et al., 2023). From 2018 to 2023 alone, Tafradzhiyski (2025) estimates a 129% increase in the number of educational app users, including math app users. And in the last few years, the increasingly common and widespread accessibility of AI has led to math tutoring chatbots (e.g., Khan Academy's Khanmigo) and even AI-powered math apps (e.g., DreamBox Math). This has further accelerated the growth of math app use and adoption. Math apps are now a normal part of classroom instruction. In this article, I seek to put an upper bound estimate on the number of K-12 math app users and estimate user count changes over the last decade by answering the following research questions:

RQ1: How many users currently use K-12 math apps across the world?
RQ2: How have K-12 math app user counts changed over the last decade?

Research on math apps is relatively new, with the first journal article on math apps published fifteen years ago (Hindin, 2010). In the fall of 2010, just over two years since Apple introduced the App Store in July of 2008, Hindin wrote about "Mathematics Software for the Apple iPhone" (p. 81), calling this software "iPhone Math Apps." Using math applications, mathematics applications, and math apps interchangeably, Hindin describes math apps like iPhone Alpha, PocketCAS, and Math Ref Free as apps students could download on their iPhones to "morph the iPhone into somewhat of a colleague" (p. 81). He argued that with the growing ubiquity of iPhone use among students, phones in classrooms were inevitable, and math apps offered a way teachers could leverage phones in schools for good. While Hindin described lots of different math apps that served different functions (e.g., a reference app with math formulas and examples vs. a mobile app for the site Wolfram Alpha), the commonality of all the apps Hindin described is that they all could be found on the iPhone App Store. Since 2010, math apps have come a long way and can be found on various app stores (e.g., Apple App Store, Google Play) as well as downloaded directly from educational technology websites. Research on math apps has also come a long way.

Research on math apps can be divided into several broad categories: research on achievement and cognition (Griffith et al., 2020; Outhwaite et al., 2019, 2022), research on affect-related factors (e.g., math identity, motivation, anxiety) (Calder & Campbell, 2016; Fadda et al., 2022; Swartz, 2024a), research on the design of math apps (Alam & Dubé, 2022; Cayton-Hodges et al., 2015; Dubé et al., 2020), and research related to the context, implementation, and teacher use of math apps (Gulliford et al., 2021; Montazami et al., 2022; Swartz, 2024b). Research on achievement-related outcomes has shown that math apps benefit learning and achievement-related outcomes (Griffith et al., 2020; Hallstedt et al., 2018; Kim et al., 2021), but what counts as "learning" is defined differently in these studies. Moreover, how achievement is measured varies. Kim et al. (2021) conducted a meta-analysis and found that math apps had a large effect on students' math skills. However, they also found a moderator variable to be whether the researchers used a researcher-designed or standardized outcome to measure math learning gains. In other words, when achievement was measured using a standardized outcome measure (e.g., state, national, or international math exam), they found math learning gains were moderate. However, when achievement was measured with a researcher-designed assessment, they found math learning gains from math apps to be significantly higher. In summary, while research has supported the claim that math apps benefit student learning, what counts as learning and how learning is measured have resulted in varying outcome measures and benefits to student learning.

Research on affect-related factors like motivation, math identity, and math anxiety has found that math apps have yielded mixed findings (Ersozlu, 2024). While some research has shown math apps as motivational (Calder & Campbell, 2016; Fadda et al., 2022; Sun-Lin & Chiou, 2019; Willacy & Calder, 2017), others have found that students were equally or even less motivated with math apps compared to paper-and-pencil options (Swartz, 2025; Swicegood, 2015). Moreover, math apps have been shown to reduce math anxiety (Schaeffer et al., 2018; Verkijika & De Wet, 2015) while having mixed results on math identity (Crossley et al., 2020; Swartz, 2024a). In summary, because research on math apps and affect-related constructs like motivation, math identity, and math anxiety are dependent on factors like which math app was used and how the construct was operationalized, findings across studies have varied widely.

Some research on learning analytics—using educational data to support the process of learning—related to technology in mathematics is starting to emerge (Hershkovitz et al., 2024; Ramli et al., 2019; Xia et al., 2019, 2020) that has addressed a wide variety of topics such as students' understanding of mathematics (Hershkovitz et al., 2024; Xia et al., 2020) as well as student behavior as a means to improve the design of learning material (Xia et al., 2019, 2020). Related to the analytics of usage, there is little research on the usage of technology in mathematics, and no recent work that has analyzed math app usage worldwide. Most of the current usage data has come from internal educational technology company reports and advertisements on educational technology websites, which often boast unverifiable statistics about the number of students who utilize their apps. One of the last math app articles that produced a quantifiable metric was over a decade ago, when Larkin (2013) found there were over 4000 math apps. More recently, Baker analyzed the usage of 135 educational apps, including math apps, from over 400,000 students and found that math apps were drastically underused by schools and that math apps had a stronger relationship to rising test scores than reading apps (Barshay, 2018). Given that little to no recent research has illuminated the trends in math app usage over the last decade, this article addresses the substantial knowledge gap regarding the extent to which math apps are being used worldwide.

2. Methods

2.1. Design

A systematic review of learning apps was performed to identify all K-12 math apps with at least one million current users. To carry out this systematic review of apps, the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021) were utilized (see Figure 1).

2.2. Search Strategy

Five databases were searched up to December 2025 to identify and compile a list of educational apps. These databases were Appfigures "https://appfigures.com/top-apps/ (accessed on 1 December 2025)", AppMagic "https://appmagic.rocks/top-charts/ (accessed on 1 December 2025)", the Apple App Store, the Google Play Store, and the EdTech Index "https://edtechindex.org/ (accessed on 1 December 2025)". On Appfigures, the Top Education App list was utilized to view the top free (by downloads), paid (by downloads), and grossing (by revenue) education apps, resulting in a total of n = 1775 education apps. On AppMagic, the Education filter was used to view the top free (by downloads), grossing (by revenue), and feature (by market interest), resulting in a total of n = 2579 education apps. On the Apple App Store and the Google Play Store, education apps were pulled from a variety of "Top Education" app lists, resulting in n = 394 and n = 1037 education apps, respectively. Finally, the EdTech Index is a list of "the most complete, reliable and up-to-

date information available on learning technology products, including quality indicators from trusted organizations and robust product profiles" (EdTech Index, n.d.). This list was created in collaboration with many top education technology organizations, including the International Society for Technology in Education, the State Educational Technology Directors Association, 1EdTech, and CoSN. This index resulted in n = 2041 education apps.

2.3. App Selection

After education apps were initially identified, duplicates were removed before screening. Following screening, education apps with no mathematical content, apps whose content was not in English, and apps whose focus was on content outside of K-12 education were excluded from this study. After the exclusion of these education apps, user counts for apps were sought. If no user count data could be retrieved, the education app was not included. Examples of sources that were used to collect app user count data include PR Newswire, Business Wire, and corporate press archives. All user data was publicly available and manually verified to ensure app user counts originated from official company statements rather than third-party estimates. In addition, education apps with fewer than one million users were excluded from this study. Now, I present the findings from this study.

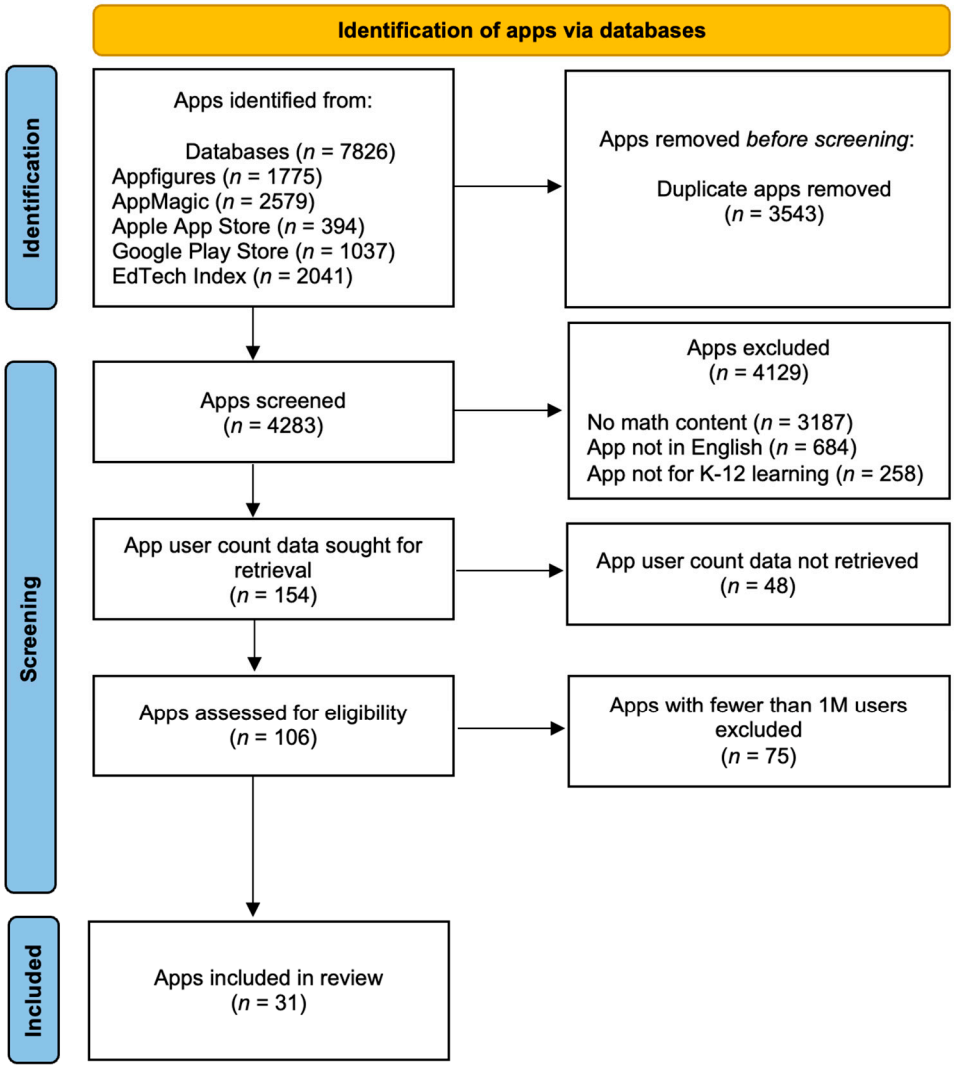


Figure 1. PRISMA flow diagram: math app user count search.

3. Results

3.1. Most Used K-12 Math Apps

Tables 1 and 2, which list math apps and learning apps with math by descending user count, include the classification of each app, the intended user grade band, and information about the user base. Utilizing Kay and Kwak's classification of math apps (Kay & Kwak, 2018), constructive apps are math apps that focus on understanding and exploring mathematics. Desmos (Table 1) is a math app that includes several math tools, such as a graphing calculator and geometry sketchpad, and is a tool that can be used to explore and make sense of mathematics. Kay and Kwak describe practice-based apps as math apps used to acquire targeted content and apply specific skills in math. Reflex (Table 1), a math app that focuses on addition, subtraction, multiplication, and division fact fluency, is a practice-based app, as the app's focus is on students becoming fluent with math facts. Additionally, Kay and Kwak describe game-based apps as practice-based apps that include gameplay and immersive narratives with structure such as rules, rewards, and a progression. Prodigy is a game-based app as it is a highly gamified app with many types of rewards, featuring a gameplay progression that ends with students battling the most advanced computer character, the Puppet Master. Finally, Kay and Kwak define productive math apps as apps that are used to produce and create artifacts. For example, Photomath (Table 1) uses a mobile device's camera to capture a math problem and solve that problem for a student or user. Photomath produces an explanation of the steps to solve a math problem, which serves as the artifact created by the app.

Table 1. The most used K-12 math apps (ordered by descending user count).

App Name	Number of Users	Classification	Grade Band	User Info
Photomath	300 M+	Productive	K–12	"Learners" worldwide
GeoGebra	100 M+	Constructive	K–12	Students and teachers worldwide
Desmos	75 M+	Constructive	K–12	People worldwide
Prodigy Math	50 M+	Game-based	1–8	Students worldwide
Math Kids—Add, Subtract, Count	30 M+	Practice-based	P–5	"Kids" worldwide
Zearn Math	~10.5 M+	Game-based	K–8	U.S students
Boddle	10 M+	Game-based	K–6	Students worldwide
Reflex	10 M+	Practice-based	2–6	Students worldwide
XtraMath	6.2 M+	Practice-based	K–8	Students worldwide
Mathletics	3.5 M+	Practice-based	K–12	Students worldwide
Eduten	3 M+	Practice-based	K–12	Students worldwide
ST Math	2.17 M+	Game-based	P–8	U.S. students
Happy Numbers	2 M+	Practice-based	P–5	Students worldwide
Creta Class Math	2 M+	Practice-based	P–3	Students worldwide
Matific	2 M+	Game-based	K–6	"Learners" worldwide
Imagine Math	1.5 M+	Practice-based	P–12	Students worldwide

Table 2. The most used K-12 learning apps that include math (ordered by descending user count).

App Name	Number of Users	Classification	Grade Band	User Info
CK-12	350 M+	Practice-based	K–12	People worldwide
Khan Academy	104.9 M+	Practice-based	K–12	People worldwide
ABCmouse	50 M+	Game-based	P–3	"Children" worldwide
SplashLearn	40 M+	Practice-based	P–5	Students worldwide
Savvas	40 M+	Practice-based	K–12	People worldwide
Kiddopia	20 M+	Game-based	P–2	Students worldwide
Amplify	18 M+	Constructive	K–8	Students worldwide
IXL	17 M+	Practice-based	K–12	Students worldwide
Curriculum Associates (i-Ready Math)	17 M+	Practice-based	K–8	People worldwide
Renaissance (Freckle Math)	10 M+	Practice-based	K–12	Students worldwide
DreamBox	6 M+	Practice-based	K–8	U.S. students
Carnegie Learning (MATHia)	5.5 M+	Practice-based	K–12	Students worldwide
PBS KIDS Games	~2.6 M+	Game-based	P–3	"Users" worldwide
DoodleLearning	1 M+	Practice-based	K–5	Students worldwide
DragonBox	1 M+	Game-based	P–12	"Parents, teachers, and children worldwide."

Examining Table 1, there are sixteen math apps in total that are estimated to have at least one million users. Summing the user counts of sixteen math apps in Table 1 produces an estimated 607.9 million users. Note, this total strictly accounts for math apps where user counts were solely tied to learning math. Table 1 also shows that eight of the sixteen math apps (50%) have more than ten million users. Of the sixteen math apps, two apps' user counts focus on U.S. students (12.5%), while the other fourteen apps' user counts describe users worldwide (87.5%). Moreover, practice-based is the most common app classification (n = 8), followed by game-based (n = 5), constructive (n = 2), and productive (n = 1). Additionally, while all sixteen math apps cover some or all of the elementary grades, ten apps span the entirety of middle grades (6–8), and seven math apps cover the entirety of high school grades (9–12). The most common focal content, grade band, and user information are practice-based elementary education math apps, with their users represented by students worldwide.

Examining Table 2, fifteen learning apps that include math content and at least one other subject area (e.g., science, literacy, social studies) account for an estimated 683.0 million users across the world. Ten of the fifteen learning apps (66.7%) have more than ten million users. Of the fifteen math apps, just one app's user counts focus on U.S. students (6.7%), while the other fourteen apps' user counts describe users worldwide (93.3%). Moreover, practice-based is the most common app classification (n = 8), followed by game-based (n = 5), constructive (n = 2), and productive (n = 1). Additionally, while all fifteen math apps cover some or all of the elementary grades, ten apps span the entirety of middle grades (6–8), and seven math apps cover the entirety of high school grades (9–12). The

most common focal content, grade band, and user information are practice-based K-12 learning apps, with their users represented by students worldwide.

In summary, an estimated 608 million users utilize math apps devoted entirely to math, while 683 million users utilize learning apps with math and other content. In total, there is an upper-bound estimate of 1.31 billion users worldwide who use math and learning apps. While most math apps devoted entirely to math focus on elementary students (K-5) and are practice-based with gamified elements, the majority of learning apps with math cover a wider range of students that spans all of K-12 education. Now, I will dive into specific user count trends across the math and learning apps in Tables 1 and 2.

3.2. Math App User Counts from 2016–2025

To examine math app user counts from 2016 to 2025, math apps and learning apps with math were separated into two tables, just like the previous section (Tables 1 and 2). Table 3, which displays math app user changes from 2016 to 2025, shows that the average user growth for the apps was 26.8 million users. Removing Photomath's substantial 200 million-user growth lowers the average user growth to 12.3 million users. The average gain of 26.8 million users equates to an average total growth of 427.3% across all math apps. Interestingly, the outlier in user growth, Photomath, is the only productive math app in Table 3. The rest of the math apps are constructive, practice-based, or game-based apps, which do not produce artifacts such as step-by-step solutions to pictures of problems. Removing the outlier in total growth (Eduten at 2500%), the average total growth across all math apps decreases to 254.6%. While two math apps experienced a loss in reported user growth, one math app shows no change in the total number of users, with the remaining ten math apps having positive growth in users. Both math apps with decreases in reported users are practice-based apps, while the lone math app that was stagnant in user growth is a game-based app. On average, each math app experienced an average annual growth of 35.6%. This means each math app, on average, doubled its user count in just over two years.

Table 3. Math App User Growth (math apps from Table 1; ordered by descending user growth).

App Name	Total User Growth (Users)	Interval (Years)	Total Growth (%)	Average Annual Growth (%)
Photomath	200 M	2018–2025	200.0%	25.0%
GeoGebra	50 M	2018–2025	100.0%	12.5%
Prodigy Math	43 M	2016–2025	614.3%	61.4%
Desmos	35 M	2016–2025	87.5%	8.8%
Zearn Math	9 M	2019–2025	600.0%	85.7%
Boddle	8.62 M	2021–2025	624.6%	124.9%
Eduten	3 M	2018–2025	2500.0%	312.5%
Happy Numbers	1.75 M	2019–2025	700.0%	100.0%
ST Math	1.17 M	2016–2025	117.0%	11.7%
Creta Class Math	1 M	2023–2025	100.0%	33.3%
Matific	0 M	2018–2025	0%	0%
Imagine Math	−0.2 M	2018–2025	−11.8%	−1.5%
Mathletics	−3.5 M	2016–2025	−76.1%	−7.6%

Figure 2 displays the year-by-year user counts of each math app with over twenty million users using all the available data points from 2016 to 2025. Examining Figure 2, all math apps showed an increase in their user count from before the data point preceding

2020 to the data point following 2020. Figure 3, which displays the year-by-year user counts of each math app with fewer than twenty million users, using all the available data points from 2016 to 2025, shows a similar trend. Of the seven math apps with user data before and after 2020, four show an increase from pre- to post-2020, while the other three show no change in their pre- and post-2020 user count data. Conducting a further analysis of which math apps experienced pre- and post-2020 user count gains, both constructive and the lone productive math apps had increases in users, while 75% of the game-based and 50% of the practice-based math apps showed increases in user counts.

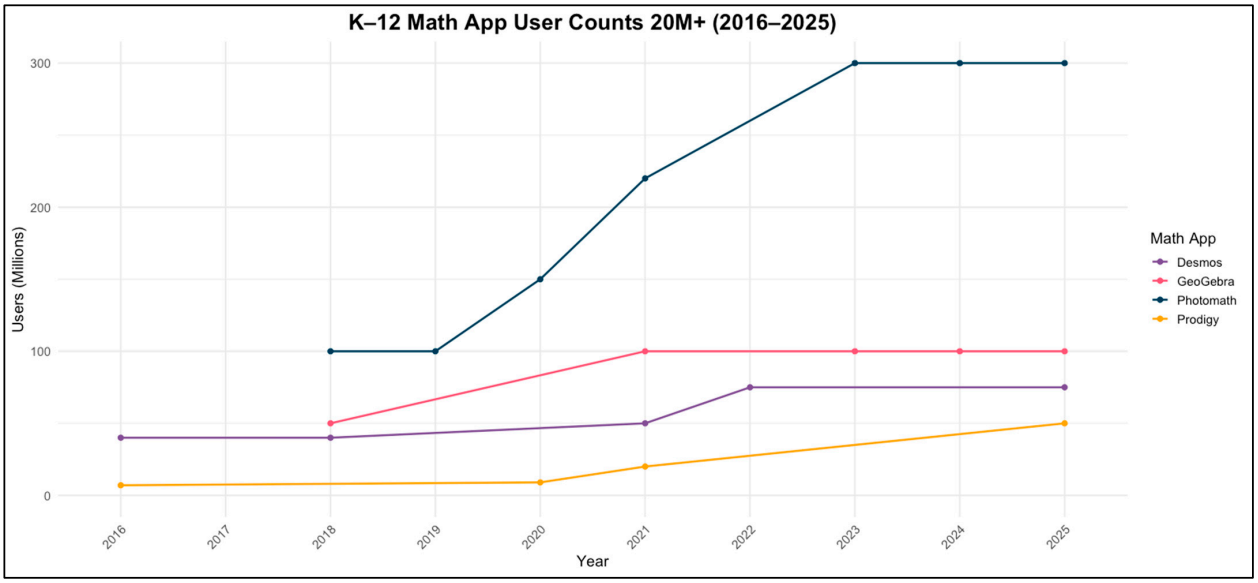


Figure 2. Math App User Counts from 2016–2025 (apps with more than 20 M users from Table 1).

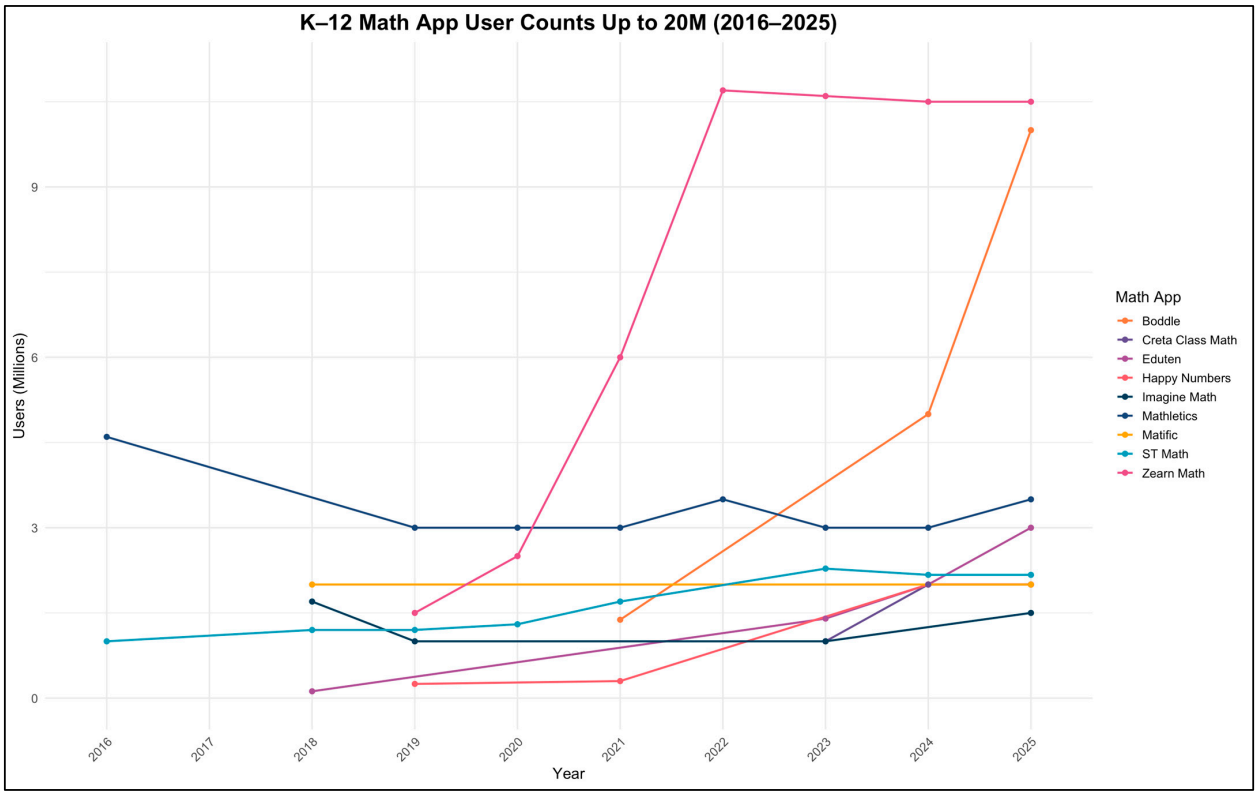


Figure 3. Math App User Counts from 2016–2025 (apps up to 20 M users from Table 1).

Table 4, which displays the user changes in learning apps that include math from 2016 to 2025, shows that the average user growth for the apps was 37.0 million users. This average gain of 37.0 million users equates to an average total growth of 345.7% across all learning apps. Removing CK-12, an outlier that had the highest total user growth of 250 million users, cuts the average gain by more than half, lowering it to 15.7 million users among all the remaining learning apps. The average gain of 37.0 million users equates to an average total growth of 345.7% across all learning apps. Among the three apps that showed no growth over their respective intervals of user count data, two apps are practice-based, while the other is a game-based app.

Table 4. Learning App User Growth (apps from Table 2; ordered by descending user growth).

App Name	Total User Growth (Users)	Interval (Years)	Total Growth (%)	Average Annual Growth (%)
CK-12	250 M	2020–2025	250.0%	41.7%
ABCmouse	40 M	2017–2025	400.0%	44.4%
Khan Academy	34.9 M	2018–2025	49.9%	6.2%
Kiddopia	18 M	2020–2025	900.0%	150.0%
Amplify	15 M	2016–2025	500.0%	50.0%
IXL	12 M	2016–2025	240.0%	24.0%
Curriculum Associates (i-Ready Math)	10.5 M	2016–2025	385.7%	38.6%
SplashLearn	10 M	2019–2025	33.3%	4.8%
Renaissance (Freckle Math)	8.7 M	2016–2025	669.2%	66.9%
DreamBox	4 M	2016–2025	200.0%	20.0%
Carnegie Learning (MATHia)	3.5 M	2023–2025	175.0%	58.3%
Savvas	0 M	2020–2025	0%	0%
DoodleLearning	0 M	2022–2025	0%	0%
DragonBox	0 M	2023–2025	0%	0%

Similarly to Figure 2, Figure 4 displays the year-by-year user counts of each learning app, with over twenty million users using all the available data points from 2016 to 2025. Examining Figure 4, all learning apps illustrate an increase in their user count from before the data point preceding 2020 to the data point following 2020. Two apps do not have data that precedes 2020. The three learnings that show an increase from pre- to post-2020 user counts, two apps are practice-based, while the other is a game-based app. Looking at Figure 5, among the five learning apps with data that precede and follow 2020, four of these apps have an increase in users, while one app showed no growth in pre- to post-2020 user count data. While the lone constructive app showed a gain in users, 75% of the practice-based apps had an increase in users from pre-2020 to 2021 and beyond. No game-based math apps had user count data that preceded 2020.

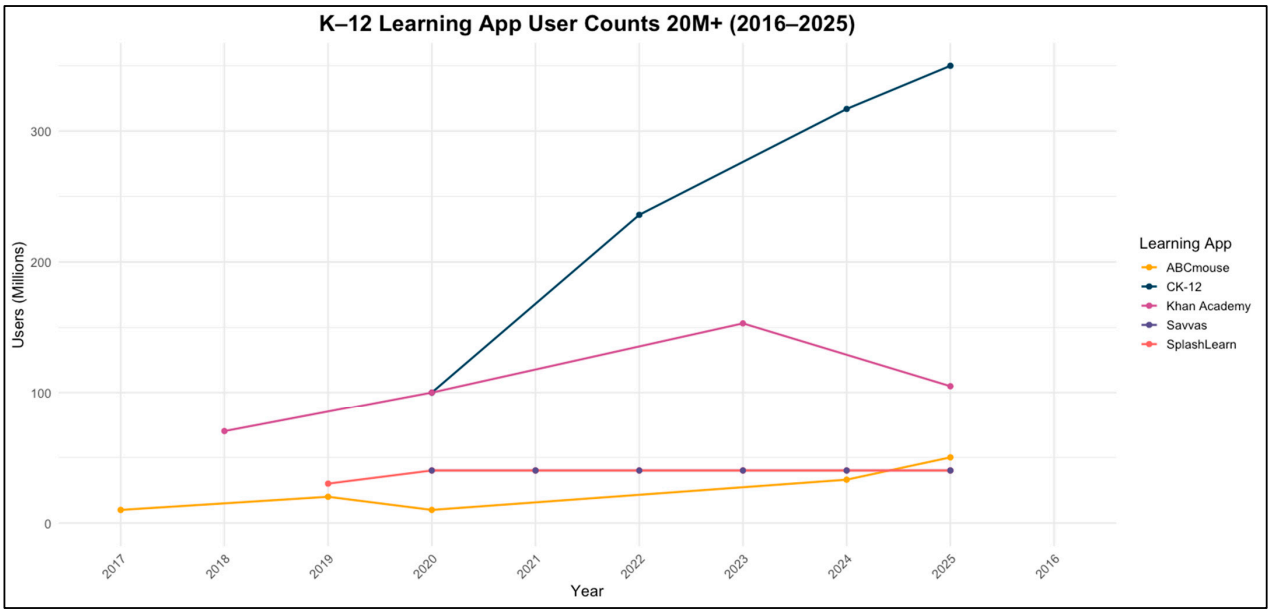


Figure 4. Learning App User Counts from 2016–2025 (apps with more than 20 M users from Table 2).

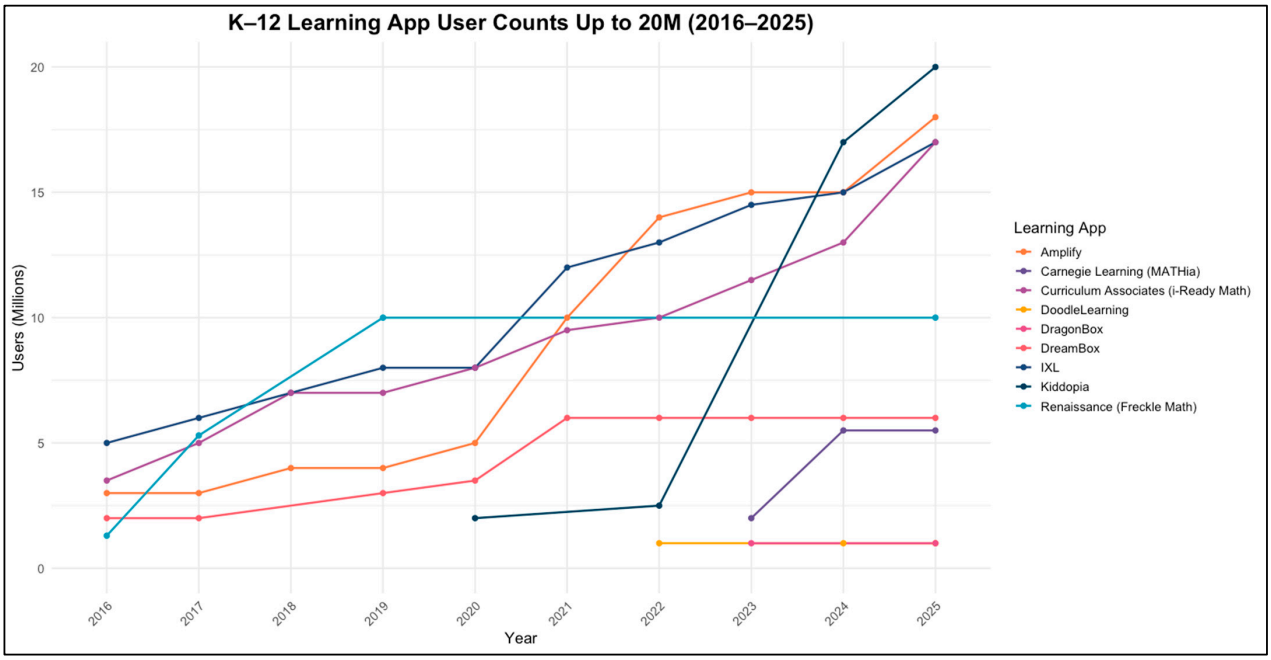


Figure 5. Learning App User Counts from 2016–2025 (apps up to 20 M users from Table 2).

4. Discussion & Implications

The results of this study showed that approximately 608 million users use math apps devoted entirely to math, while learning apps with math had an estimated 683 million users. In total, this produces an upper-bound estimate of 1.31 billion users worldwide who use math and learning apps with math. Not only are math apps and learning apps with math used extensively by users, primarily students—according to the reported user statistics—across the world, but results indicate that the math apps in this study have, on average, increased by 427.3% over the last decade, with learning apps that include math seeing a 345.7% increase in use over the last ten years. The results of this study indicate that K-12 math apps are widely used, given the upper-bound estimate of 1.31 billion users worldwide who use math and learning apps with math.

Importantly, Figures 2–5 illuminated important trends surrounding 2020, the start of the COVID-19 pandemic. Previous research has shown that the COVID-19 pandemic was a catalyst for technology use in education, with devices becoming more popular in efforts to continue to offer education as students learned in remote settings (Kaloostian et al., 2020; Mospan & Sysoieva, 2022; Slavin & Storey, 2020). Among math apps, 72.7% of apps showed an increase in their user count from before the data point preceding 2020 to the data point following 2020, while the other 27.3% showed no change in user count. Similarly, among learning apps, 87.5% of learning apps showed an increase in their user count from the pre- to post-2020 user count data point, while the other 12.5% showed no change in user count. This finding suggests that not only was COVID-19 a catalyst for technology use, namely personal devices such as Chromebooks and iPads, but the pandemic was also a catalyst for increased math app use.

Another interesting trend gathered from this study is that all productive and constructive math and learning apps saw an increase in their user count from the pre- to post-2020 user count data point. Moreover, the math app with the largest change in users from 2016 to 2025 was the productive math app Photomath, with 200 million users gained. Of that gain, 120 million users were gained from 2019 to 2021. For those unfamiliar with the app, Photomath is a mobile app that can be used to take pictures of math problems and receive step-by-step solutions. Several plausible reasons may help explain the rapid increase in users, especially the growth that came during COVID-19. One result of the pandemic was a drought of in-person instruction, leaving many students without their needed learning supports and accommodations (Hoofman & Secord, 2021). As such, Photomath could have been used as an at-home tool to support instruction and mathematics learning. Another result of the pandemic was a prevalence of cheating (Newton & Essex, 2024), as exams and homework were quickly shifted to online and other modalities. Photomath could have been used to cheat during at-home exams. Photomath is an app that researchers have previously linked to academic cheating (Larkins & Seaton, 2024).

Across all 31 apps in this study, practice-based were the most common app classification (n = 18), followed by game-based (n = 9), constructive (n = 3), and productive (n = 1). This distribution suggests that the current math app ecosystem remains heavily oriented toward procedural practice, with practice-based apps dominating and game-based apps largely extending this same focus through gamification rather than fundamentally reimagining mathematical learning, while constructive and productive apps, which more directly support conceptual understanding, exploration, modeling, and student-created artifacts, are notably scarce. This imbalance indicates a persistent emphasis on skill acquisition over sense-making and knowledge construction, reflecting a misalignment with reform-oriented visions of mathematics education that prioritize reasoning, representation, and agency. For teachers and teacher educators, this finding underscores the need for critical selection and pedagogical use of apps, as most readily available tools may not naturally foster deeper mathematical thinking without intentional instructional framing. At the same time, the result highlights a clear opportunity for designers and researchers to develop and study more constructive and productive applications that position students as active mathematical thinkers and creators, rather than primarily as recipients of practice.

While this study indicates that K-12 math apps are widely used and that their use has increased over the past decade, several important limitations must be addressed. First, given that the data sources relied on a thorough search of the deep web, focusing on official communications from educational technology companies such as press releases, investor reports, company "About" pages, archived websites, and app store listings to find user counts for math apps, there may be inaccuracies or even strategic misrepresentations in the press releases and reports of educational technology companies. With educational

technology companies like 3P Learning (owner of Mathletics) being publicly traded, you may wonder where these organizations' commitment lies. While 3P Learning claims that they want to help "inspire a love of learning by providing engaging, meaningful and personal learning experiences through exceptional education programs" (3P Learning, n.d.), researchers, educators, and parents alike may wonder if they are more responsive to shareholder value than inspiring a love of learning, and as a result, may be incentivized to misrepresent user data. Other privately traded educational technology companies, like Prodigy Education, have come under investigation for manipulative marketing, with the Campaign for a Commercial-Free Childhood saying Prodigy "lures schools with unsubstantiated claims, proclaims to be 'free' but cajoles kids to buy an expensive membership" (Monahan, 2021). Once again, readers may wonder whether privately traded educational technology companies are more responsive to shareholder value than to student learning and may therefore be incentivized to misrepresent user data.

Second, students who use one math app or learning app could use multiple apps. As such, the upper-bound estimate of 1.31 billion users worldwide who use math and learning apps is not likely the exact or true representation of math app users worldwide. However, given that I only included math or learning apps with a million or more users, the dataset likely underrepresents many math and learning apps and users worldwide, particularly in underrepresented regions such as Africa, the Middle East, and the Asia-Pacific. In these regions, educational technology companies may be less transparent and not market materials that are archived online. The search methods were conducted in English and focused on popular apps with at least 1 million users, which means smaller regional apps or those serving marginalized communities may be excluded from the analysis.

Third, educational technology companies do not report math and learning app usage in consistent ways. Various usage terms were reported, including registered users, active users, downloads, learners, and students. In the cases of learners and students, it was assumed these populations were actively using the apps. Given the complexity and nuance in reported app usage and the difficulty in finding publicly accessible data, not all the apps had user data for each year in the past decade (see Figures 2–5).

In summary, while this study speaks to trends and the estimated use of math and learning apps worldwide, it does not provide conclusive evidence on how widespread the use of math apps is in K-12 education worldwide, as this conclusive data is not freely available for public viewing. Tables, figures, and statistics in this study should be viewed as a starting point for understanding the size of the K-12 math app ecosystem, not as an objective truth about exactly how many students use math apps worldwide. Given these limitations, this study has shown that math apps are used widely across the world, and their use has increased in the last decade. Math apps have become commonplace in many K-12 schools across the world.

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