



# METAARI

Advanced Learning Technology Research

## **The 2017-2022 Global Game-based Learning Market**

*Serious Game Revenues Spike to \$8.1 Billion by 2022*

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### **About Metaari**

*Metaari (formerly Ambient Insight) is an ethics-based quantitative market research firm that identifies revenue opportunities for advanced learning technology suppliers. Metaari publishes quantitative syndicated reports that break out revenues by customer segment (demand-side analysis) and by product category (supply-side analysis). Our forecasts are based on our industry-leading learning technology taxonomy and our educational game framework.*

*We track the learning technology markets in 122 countries. We have the most complete view of the international learning technology market in the industry. Metaari focusses solely on advanced learning technology research on products that utilize psychometrics, neuroscience, game mechanics, robotics, cognitive computing, artificial intelligence, virtual reality, and augmented reality.*

### **About the Analyst**

*Sam S. Adkins is the CEO and Chief Researcher at Metaari. Sam has been providing market research on the learning technology industries for over twenty years and has been involved with digital training technology for over thirty-five years. Sam is an expert at identifying revenue opportunities for global learning technology suppliers.*



Dubai, United Arab Emirates, 2013 (Photography by Tyson Greer)

*Sam was the co-founder and Chief Research Officer for Ambient Insight between 2004 and 2016 before rebranding the company to Metaari in early 2017.*

*Sam was a business development manager for Microsoft's Training and Certification group. During his eight years at Microsoft, he managed the Advanced Knowledge Engineering team that built the world's first commercial online learning business (The Microsoft Online Learning Institute). Prior to that, he was a Senior Instructional Designer at United Airlines.*

*Before United Airlines, Sam was the manager of the Instructional Animation and Graphics Lab at AT&T's central computer-based training (CBT) facility for four years.*

*Sam Adkins and Tyson Greer founded Ambient Insight in 2004. Ambient Insight ceased operations in late 2016 and rebranded as a new company named Metaari that launched in January 2017.*

*"Ambient Insight has been in operation for twelve years and we have a well-respected brand and a very successful company," comments Adkins. "The global learning technology market has changed dramatically in the last few years and the new advanced learning products coming on the market essentially represent a 'brave new world' in education. We want to be an active part of this new world and launched our new company to focus on these incredible innovations."*

Over 300 suppliers operating across the globe are cited in this report to help companies identify partners, distributors, and resellers.

## **Executive Overview: Global Revenues for Serious Games Will Surge to \$8.1 Billion by 2022**

The five-year compound annual growth rate (CAGR) for Game-based Learning products on the planet is 20.2% and revenues will more than double to \$8.1 billion by 2022, up from the \$3.2 billion reached in 2017.

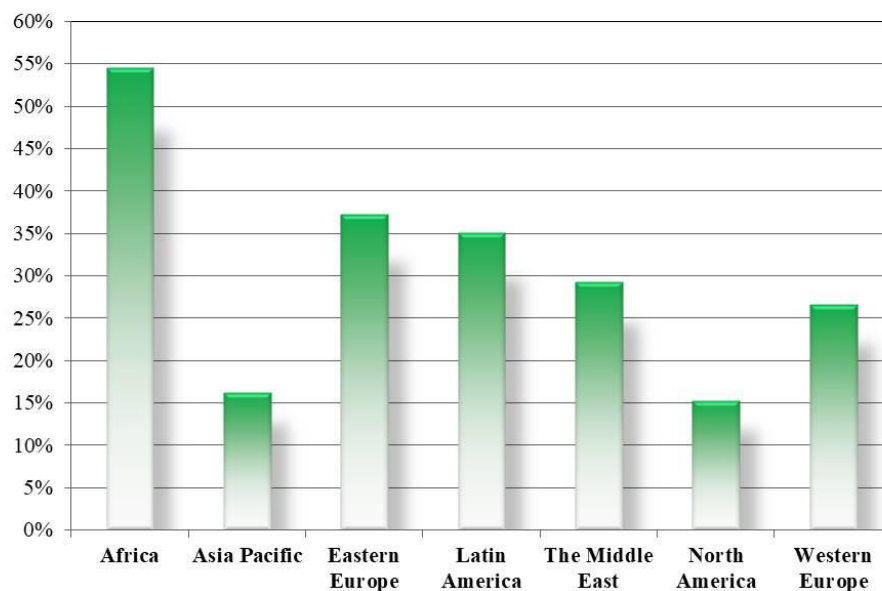
There are two sections in this report: a demand-side analysis and a supply-side analysis. The demand-side analysis provides revenue forecasts for seven regions, thirty-nine countries, and eight buying segments.



The supply-side analysis provides five-year revenue breakouts for eleven educational game categories as defined by Metaari's pedagogical game framework.

A detailed demand-side analysis by eight buying segments and supply-side analysis by eleven serious game categories is provided for the United States in this report because the US will regain its position as the top buying country by the end of the forecast period. The US analysis identifies very distinct revenue opportunities for developers.

**Figure 1 – 2017-2022 Game-based Learning Growth Rates by Seven Regions**



Asia Pacific (despite the negative conditions in China), North America, and Western Europe are the largest buying regions in terms of expenditures throughout the forecast period.

This report includes an analysis of seven regions: Africa, Asia Pacific, Eastern Europe, Latin America, the Middle East, North America, and Western Europe. Africa has the highest growth rate of all the regions at a breathtaking 54.4%, followed by Eastern Europe and Latin America at 37.3% and 35.1%, respectively.

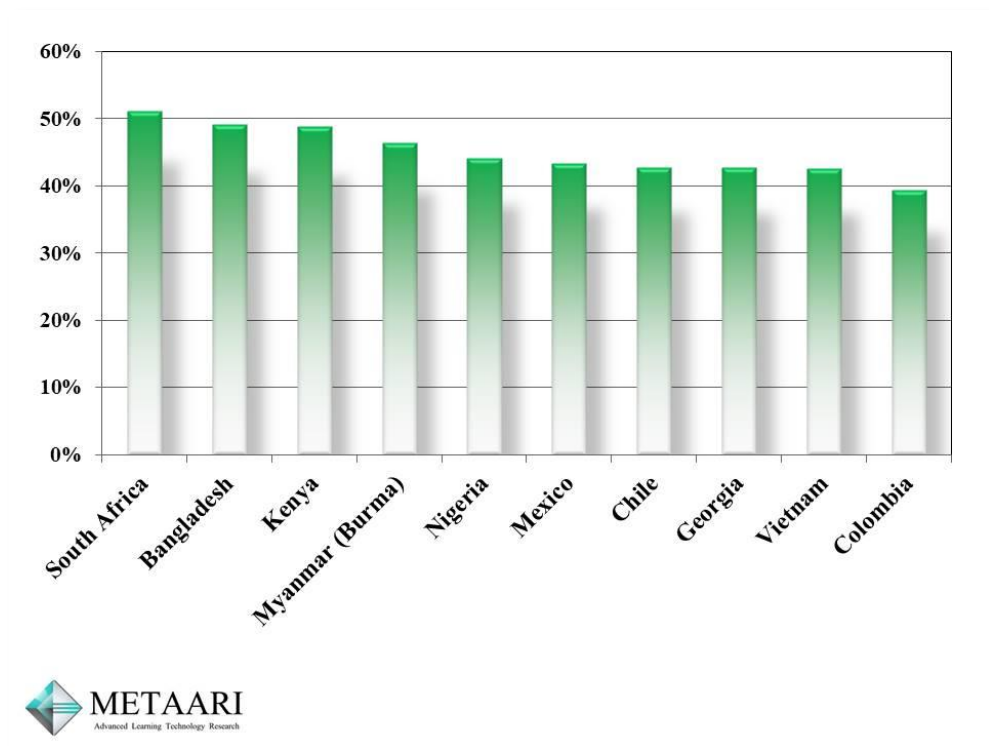
The top buying countries are identified in each region and five-year revenue forecasts are provided for thirty nine countries including three in Africa, nine in Asia Pacific, six in Eastern Europe, six in Latin America, four in the Middle East, two in North America, and nine in Western Europe.



The three countries with the highest revenues for serious games in 2017 are China, the US, and India, respectively. In the 2017 market, China was the largest buyer of serious games having overtaken the US in 2014, but market conditions have changed (dramatically) for the worse in that country due to newly imposed restrictive regulations on game development.

The growth rate is now negative-to-flat for educational games at -2.7% in China, and by 2022, the US (with a five-year compound annual growth rate of 17.2%) will be the top buying country again, followed by India. China will drop to third.

**Figure 2 – Top Ten Highest Growth Rate Countries for Game-based Learning in the 2017-2022 Market**



South Africa has the highest growth rate for Game-based Learning in the world at 51.1%, followed by Bangladesh at 49.2%, Kenya at 48.8%, Myanmar (Burma) at 46.4%, and Nigeria at 44.1%. Other high-growth countries include Mexico, Chile, Georgia, Vietnam, and Colombia.

There are eight Game-based Learning buying segments analyzed in this report: consumers, preschools, primary schools, secondary schools, tertiary & higher education institutions, federal government agencies,

provincial/state & local government agencies, and corporations & businesses. This report breaks out the global revenues for each of these segments.

Figure 3 – 2017-2022 Comparison of Global Buyer Growth Rates and US Buyer Growth Rates

The granular breakouts of the PreK-12 segment by the three sub-segments provide visibility into the demographics and revenue opportunities in specific grade brackets.

Revenues Concentrated in:	Game-based Learning by Buying Segment***	Global Five Year CAGR 2017-2022	US Five Year CAGR 2017-2022
Mobile early childhood learning games and brain trainers	Consumer	16.3%	15.6%
	Preschool	30.7%	26.6%
	Primary Education	24.1%	18.7%
STEM-based serious games on PCs/laptops	Secondary Education	23.5%	27.9%
	Tertiary Education	26.5%	29.4%
Immersive MR role playing games for security & public safety	Federal Government Agencies	21.8%	13.7%
	State & Local Government Agencies	16.0%	8.2%
Assessment games	Corporate	35.7%	21.5%
	<b>Total</b>	<b>20.2%</b>	<b>17.2%</b>

\*\*\* Mobile and Non-mobile Edugames Combined



In the 2017 global market, consumers were the top buyers, followed by primary school buyers, and corporations, respectively. The three buying segments with the highest growth rates are corporations, preschools, and higher education institutions at 35.7%, 30.7%, and 26.3%, respectively. By 2022, corporations will be the second-largest buyers after consumers.

The growth rates in the US buying segments are relatively consistent with global growth with the exception of the growth rates in the two government segments and the corporate segment.

Government agencies primarily buy educational games for military, first responder, security, emergency medical technicians, and public safety personnel. In the US, these agencies were early adopters of high-end simulator hardware built with custom software.

Until recently, the agencies also built physical replicas of environments used to train personnel. In the current market, the agencies are moving rapidly to commercial game engines and virtual environments.

This report only includes revenues for retail Game-based Learning content and does not include revenues for hardware, devices, platforms, tools, or custom content services.

For example, NASA built a detailed virtual International Space Station using the Unreal Engine. The agencies are now adopting commercial VR headsets as well. NASA uses the Microsoft HoloLens headset. Rockwell Collins' new mixed reality platform called Coalescence uses commercial game engines and VR headsets to train personnel on the operation and maintenance of military equipment.

This report maps product revenue forecasts to Metaari's Game-based Learning pedagogical framework. The framework identifies eleven unique types of educational games. ***The educational game framework provides suppliers with a precise method of tapping specific revenue streams and a concise instructional design specification for the development of effective educational games.***

The highest revenue generating educational games throughout the forecast period are early childhood learning games, brain trainers, and language learning games, respectively. Yet, the serious games with the highest growth rates are virtual reality educational games at a breathtaking 47.9%.

This report includes the combined revenues for both mobile and non-mobile educational games. It also includes a description of Metaari's Mixed Reality Spectrum. Mixed Reality (MR) is defined as an integration of Augmented Reality (AR), Virtual Reality (VR), and the biophysical environment along an immersion spectrum.

### ***Primary Catalysts Driving the Global Educational Games Market***

There are six primary convergent catalysts driving the global educational game market:

- The growing global demand for early childhood learning games
- The organizational resistance to Game-based Learning is fading fast
- The growing availability of easy-to-use development tools
- Exponential innovation in Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR)
- An upsurge of new next-generation brain training games coming on the market based on neuroscience, cognitive therapy, and biosensors
- The impending rollouts of very fast 5G networks and the Internet of Things (IoT)

Combined, these catalysts have created highly favorable market conditions for Game-based Learning developers across all seven regions analyzed in this report.

**Figure 4 - Primary Catalysts Driving the 2017-2022 Global Game-based Learning Market**

Until recently, Game-based Learning was perceived to be incompatible with the corporate culture and very time consuming and expensive to develop. This has changed dramatically in just the last two years.



Perhaps the most significant catalyst driving the current demand for Game-based Learning products is the rapid innovation in early childhood learning games. Startups continue to come on the market at a steady pace and are now attracting significant amounts of venture capital.

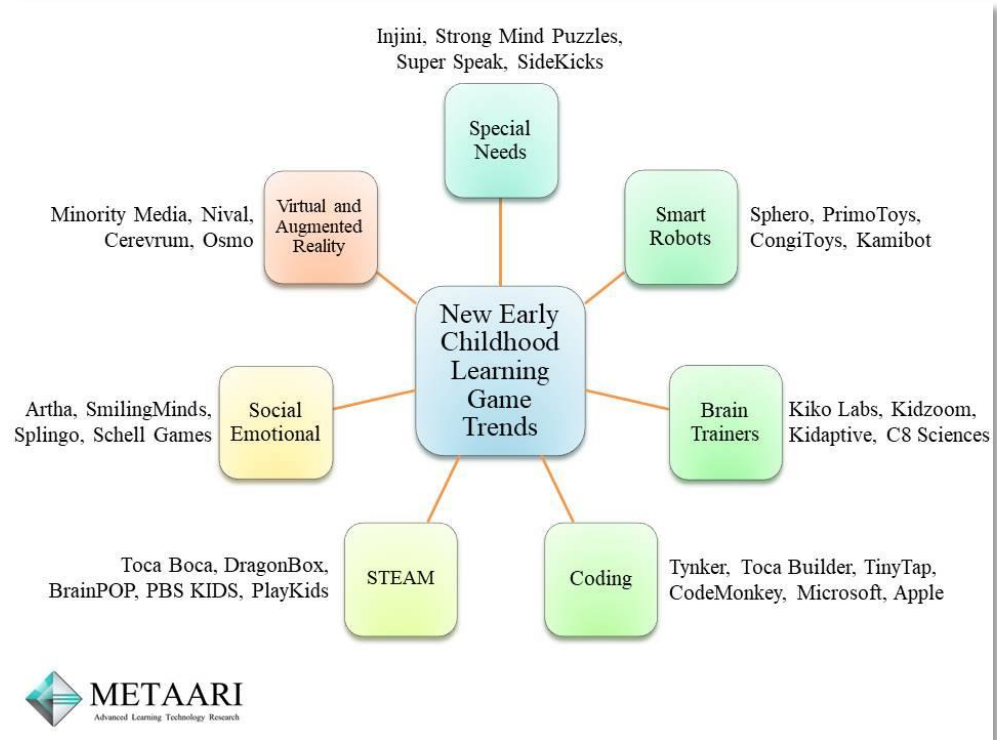
### ***Growing Global Demand for Early Childhood Learning Games: Startups Attracting the Attention of Investors***

Learning games designed for early childhood education have a robust growth rate of 21.6% and global revenues will nearly triple by 2022. They are the top revenue opportunity for serious game developers throughout the forecast period.

Educational games for young children under are unique. They focus on shapes, sounds, music, colors, numbers, letters, hand-eye coordination,

movement, and spatial awareness. Most of them use cartoon characters that interact with the children.

**Figure 5 – Global Early Childhood Learning Game Trends**



In May 2017, Microsoft launched their Code Builder for Minecraft: Education Edition.

There are seven recent global trends creating a high demand for early childhood learning games:

- Games for children with special needs gaining traction and commanding high price points
- The growing number of inexpensive robot tutors that play learning games with young children
- Brain trainers for kids continue to come on the market creating a new demographic for this kind of game
- New game development companies continue to hit the market with coding games for young children and they are attracting investment capital.
- The addition of art games in an expanded genre called STEAM (science, technology, engineering, art, and math)
- A brand new type of early childhood learning game based on social and emotional learning (SEL) pedagogies
- The availability of sophisticated (and visually stunning) augmented and virtual reality games designed for young children

Games for children with special needs are gaining traction and developers can command high prices for the products. These games usually are developed in collaboration with healthcare specialist including phycologists, pathologists, and therapists.

- Injini sells for \$29.99. It is "Play-based learning exercises and games that are well suited for children with cognitive, language and fine motor delays."
- Voice4u is a "simple application that consists numerous of fun and memorable images that can help assist and improve language." The app costs \$99.
- The Mobile Education Store (MES) sells individual apps from \$5.99 to \$19.99 and bundles for \$74.99.

A smart toy company called Sphero raised \$45 million in 2015 and an additional \$3.2 million in 2016.

Several new educational robots designed to teach kids programming and related skills have entered the market including the Vortex, the Kamibot, the Fisher-Price's Code-a-Pillar, WowWee's Coji, Primo Toys' Cubetto, Makeblock's Codeybot, Aisoy, Scansorial's Root, and Ozobot. The one thing they have in common is relatively low price points.

Wonder Workshop raised \$20 million in funding in July 2016. They have obtained \$35.9 million so far. They sell two educational robots designed to teach children coding: Dash and Dot.

Games designed to teach young children to code continue to come on the market being driven by the new education plicies that are being implanted to increase computer science programs in the schools. New companies are still coming on the market to meet the demand and they are attracting investment capital.

- Tynker raised \$7.1 million in May 2016. "Kids begin experimenting with visual blocks, then progress to text-based coding as they design games."
- A company called codeSpark obtained \$4.1 million in funding in late 2016 on top of the \$1.35 million raised in 2015. "This fully self-directed game places kids in a Mariostyle setting and gives them friendly characters to control through visual prompts and commands illustrating the fundamentals of how coding works."
- Israel-based CodeMonkey raised \$1.5 million in February 2017 and launched their Game Builder Platform in June 2017.

A unique (and visually stunning) VR educational game is Time Machine VR developed by Minority Media. The game involves time travel back to



Game-based job candidate assessment products are rapidly gaining traction in the corporate segment and are further eroding the resistance to Game-based Learning in the corporate segment.

the Jurassic era and an exploration of undersea animals. "You are a time-travelling cadet tasked with exploring the Jurassic era and the ancient creatures that once ruled the prehistoric oceans. Use an array of advanced tech tools to track, examine, and discover scientifically accurate creatures like mosasaurs, livyatans, and megalodons."

### *Organizational Resistance Fading Fast*

The use of learning games has long been a staple in first responder and military organizations and spread relatively quickly to civilian agencies. Yet, there has been a history of resistance to education and training games in the corporate segment and to a lesser extent in the academic segments.

However, the major inhibitors that previously dampened the widespread adoption of Game-based Learning are now fading fast. The corporate segment now has the highest growth rate for serious games at 35.7%.

The adoption of game-based assessment is growing rapidly in the corporate segments across the planet. It is now a major catalyst driving the uptake of educational games in the corporate segment. Startups that develop these games continue to come on the market and are attracting the attention of private investment firms.

Until recently, these games were primarily being adopted in the HR departments of companies. They are now being used as assessment methods in the other so-called "horizontal" departments such as sales, marketing, training, and finance.

### *Learning in the Bright Air: 5G Networks are Game Changers*

Commercial fifth-generation (5G) wireless broadband networks will be operational in the 2018-2020 timeframe. These new networks will have a profound impact on the Game-based Learning market and will enable extraordinary innovations in location-based, VR, AR, and AI-based learning games.

To illustrate the breathtaking speed of 5G, consider the time it takes to download a two-hour high definition movie. With 3G, it would take 26 hours to download a two-hour movie. With 4G, it takes six minutes. The download will take 3.6 seconds with 5G.



All four of the major US carriers are running 5G pilots in selected cities. South Korea, Japan, and Sweden will be the first countries with national 5G networks as early as 2018.

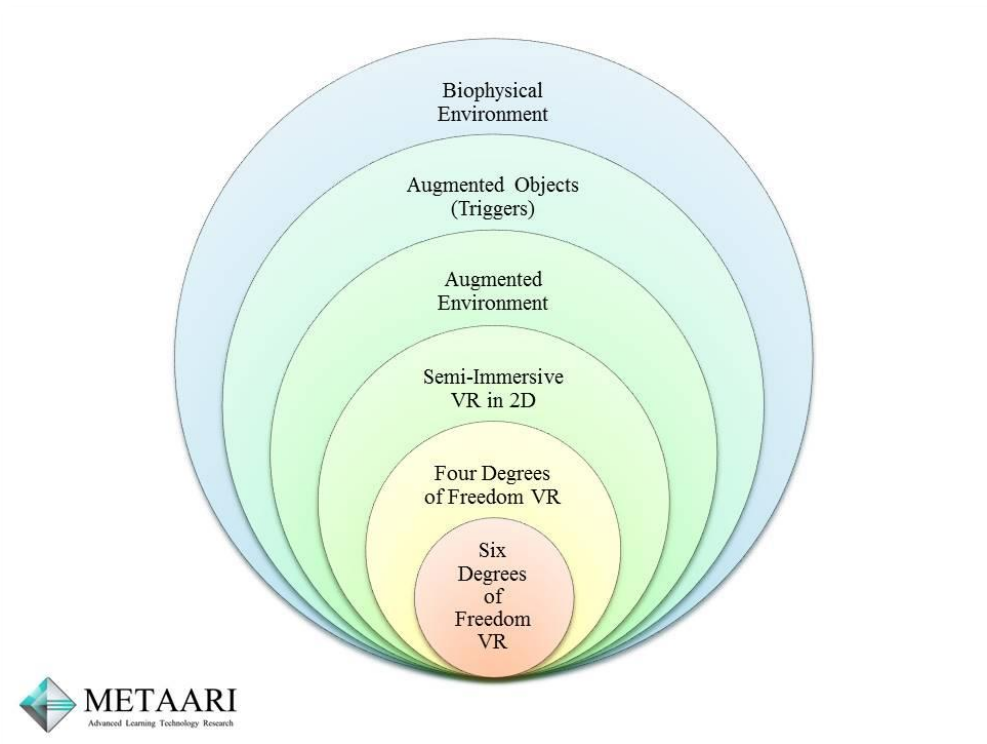
The new 5G networks also have low latency rates. Latency is the time it takes for a device to send a signal to a server and get a response. A 3G phone has a 100-millisecond latency rate. A 4G phone has a 50-millisecond latency rate. A 5G device has an ultra-low latency rate of one millisecond.

### ***Reality is Relative: Metaari's Mixed Reality Spectrum***

Mixed Reality (MR) is defined as an integration of Augmented Reality (AR), Virtual Reality (VR), and the biophysical environment along an immersion spectrum. In AR, the user is still fully aware of the physical environment.

Even in fully immersive VR experiences, there is a sense of physical presence, sometimes referred to as embodied cognition. Headset controls are in the physical world. Users interact with VR environments with body movements, eye movements, hand gestures, and voice.

**Figure 6 – Metaari's Mixed Reality Spectrum**



There are two types of augmented reality: AR triggered by objects and AR projected into the actual environment. Location-based Learning found in exhibitions and tourist attractions are almost all triggered by objects via object recognition, geotags, print-based markers, beacons,

The Microsoft HoloLens platform is a technology that overlays augmented content onto the actual environment. The educational content developed for the HoloLens inserts objects into the real world.

RFID chips, barcodes, and sensors, collectively known as triggers. The location of the object triggers the experience; the user finds the object and intentionally activates the trigger.

New technology now focusses on the location of the user and takes full advantage of the range of smartphone GPS chips and sensors including the gyroscope, compass, altimeter, and the accelerometer. Essentially, *the object finds the user* and automatically triggers the augmented content.

Semi-immersive VR still makes up the majority of virtual educational products on the market. These include educational virtual worlds like MathBlaster and simulated training products for the corporate and government segments. They are experienced on a 2D screen and only approximate virtual reality.

VR-based learning products are by definition a type of Simulation-based Learning and the latest innovations utilize mobile devices placed inside viewer headsets. Many education suppliers define their products as virtual, despite the fact that they are not technically virtual.

For example, screen-based virtual worlds are semi-immersive. Essentially all of the virtual worlds for young children include educational games. Whyville, Math Blaster, and Mingoville are good examples. Mingoville is a "virtual" world that teaches English to children. Metaari defines these products as Simulation-based products since they are not immersive.

True virtual reality is experienced in immersive 3D with the aid of a headset and other peripherals. There are two types of products: those with four degrees of freedom (4DoF) and those with six degrees of freedom (6DoF). The four degrees are up, down, left, and right and they can be simulations or actual 3D videos. Google's Cardboard Expeditions is a good example of a 4DoF educational product.

The six degrees of freedom include the addition of forward and backward to the four degrees. Developing 6DoF VR products is still very expensive to develop requiring a high-end modeling platform (or gaming engine) and/or automatic spatial tracking hardware and software tools. The prices for 6DoF cameras and automatic spatial mapping tools are dropping fast and products will start hitting the market during the forecast period.

### ***Democratizing Development: The User Friendly Reality Modeling Trend***

A significant catalyst is the availability of easy-to-use and cost-efficient authoring tools. The suppliers of the tools are marketing them to non-specialists and pricing the products at relatively low price points.

Sixsense's MakeVR is "designed to open the doors to 3D content creation for just about anyone with accessible design that can get even inexperienced CAD modelers or random Vive users up and running with it in a short amount of time." Developers design VR content while inside a VR environment.

Austria-based Wikitude is a pioneer in education-related augmented reality. The company was founded in 2009 and they launched their first augmented "tour guides" using geotags that overlaid geographic and educational information about objects, historical sites, and tourist areas. They now license a cloud-based augmented reality authoring tool called Wikitude Studio and claim that no programming skills are needed.

All of the new products designed for augmented decision support have authoring tools. NGRain claims their Producer Pro authoring tool "is the fastest, easiest way to make 3D virtual maintenance training and virtual task trainers (VTTs). ***Go from instructional design to deployment without expensive programmers, 3D artists, or game developers.*** Train maintainers in removal and replacement for the installation, repair, and maintenance of equipment."

Blippar provides the Blippar for Education for free to schools and teachers but charges third-party content providers to use the tool. In November 2016, Blippar opened their platform to third-party developers. "Users will have access to the best-in-class augmented reality and computer vision capabilities on the market, ***allowing developers and marketers without coding experience to tap into the potential of the AR market.***"

The Muzzy Lane Author platform is designed specifically to enable educators to create their own serious games; the tool is gaining traction in universities across the US. In November 2016, Muzzy Lane announced that Western Governors University had licensed the tool. As of May 2017, WGU had just under 82,000 enrolled higher education students across all fifty states.

In early 2017, EON Reality released a new version of their Creator tool "that will enable non-technical users to create Augmented Reality (AR) Knowledge Injections by attaching AR 3D Annotations to physical objects and environments in the real world supported by EON IoT sensor data, EON Geo positional tracking, and EON AI. Users can instantly select from thousands of 3D models from the EON Experience portal annotate them and begin teaching right away, ***with no coding required.***"

In June 2016, WakingApp launched a new version of their cloud-based ENTiTi Creator platform for PC and Mac that "allows users to create VR/AR content without technical skills. ENTiTi features an easy-to-navigate, drag-and-drop interface that makes designing content relatively simple. Content can be easily and quickly updated anytime, anywhere."

In December 2016, GuidiGo released their cloud-based GuidiGo AR Composer tool designed for museums and tourist exhibitions. The new tool includes native Google Tango technology.

"GuidiGO AR Composer makes full use of Tango capabilities, including motion tracking, which enables virtual objects to behave as if they were real. ***AR Composer is extremely user-friendly and doesn't require special skills or training.***"

Another trend is the growing number of marketplaces that sell (or give away) premade virtual objects and even virtual worlds. Suppliers include Lifelique, EON Reality, Voxelus, WEARVR, and Odeum.

In August 2016, Immersive VR Education launched their dedicated VR education platform called Engage. "The big idea behind Engage is that educators can bring existing teaching materials into the software as the basis for a lesson, or entire course, built in VR. The teacher can then lead a class through a guided tour aided by photos, videos, and presentations — even animated 3D models — while also answering questions from students located anywhere in the world."

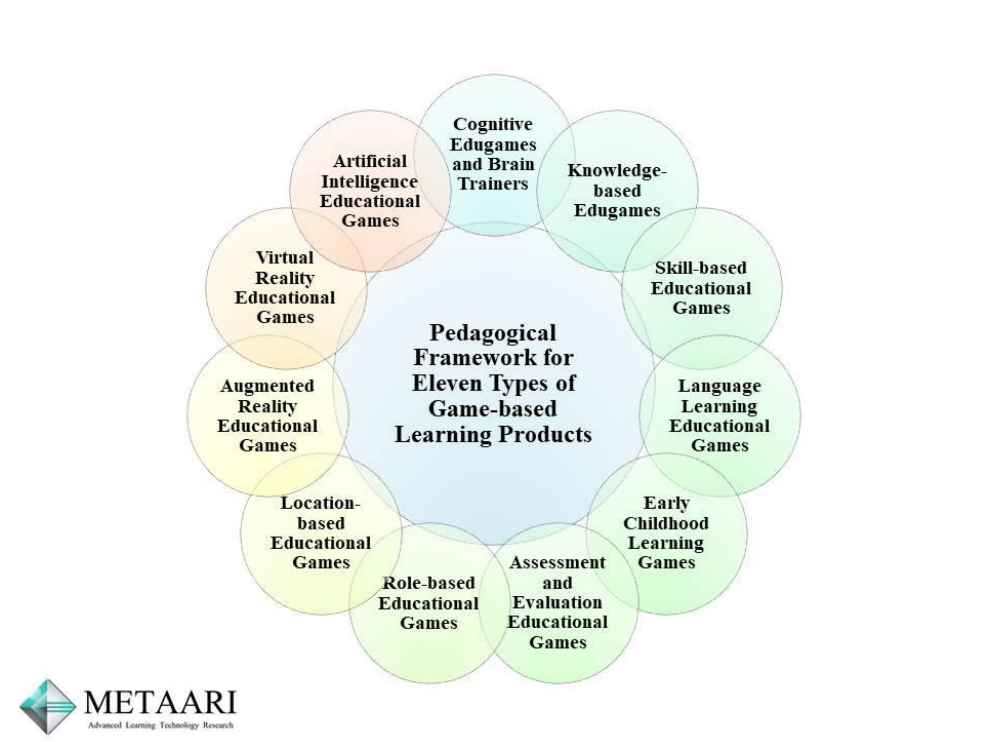
In March 2017, Unity announced a new toolset called the XR Foundation Toolkit (XRFT). "It's a framework for XR developers that allows anyone, not just programmers, but artists and directors, to start making experiences without needing to start from scratch."

### *Quantifying the Revenue Opportunities: Metaari's Education Game Framework*

The forecasts in this report break out revenues by eleven distinct educational game types based on Metaari's pedagogical framework. Revenues for these eleven game types are provided for all the regions combined and a separate breakout is provided for the United States.

**Figure 7 - Metaari's Pedagogical Framework for Game-based Learning Products**

The educational game framework is a quantitative method to identify clear revenue opportunities for suppliers.



The educational game framework provides suppliers with a precise method of tapping specific revenue streams and a concise instructional design specification for the development of pedagogically sound effective educational games.

Early childhood learning games are the top revenue generating educational game throughout the forecast period, followed by brain trainers, language learning games, and knowledge-based educational games.