The 2016-2021 Global Game-based Learning Market

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Published: July 26, 2016 at the Serious Play Conference
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About Ambient Insight

Ambient Insight is an ethics-based market research firm that identifies revenue opportunities for learning technology suppliers. We track the learning technology markets in 122 countries. Ambient Insight publishes quantitative syndicated reports that break out revenues by customer segment (demand-side) and by product category (supply-side) based on our industry-leading learning technology taxonomy and our proprietary Evidence-based Research Methodology (ERM). We have the most complete view of the international learning technology market in the industry. Ambient Insight has two lines of business: publishing quantitative syndicated reports and providing proprietary custom research to suppliers and private investment firms.

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Founded in 2004, Ambient Insight has attracted an impressive list of international clients including academic institutions, government trade organizations, investment banks, equity firms, small innovative startups, and global companies.

Clients include Adobe, Amazon, Apple, the Australian Broadcasting Corporation, Berlitz, Blackboard, the Cambridge University Press (UK), the Consulate General of Canada, Chungdahm Learning (South Korea), Cisco, Dell, DeVry, Disney, DuPont, Hasbro, Houghton Mifflin Harcourt, IBM, John Wiley & Sons, the Korea Trade Center, McGraw-Hill, Macmillan, Microsoft, Mitsui (Japan), NIIT (India), the Oxford University Press (UK), Pearson, the Queen Rania Foundation (Jordan), Rosetta Stone, Sanoma Learning (the Netherlands), TOPICA (Vietnam), and U&I Learning (Belgium).
About the Author
Sam S. Adkins is the Chief Research Officer at Ambient Insight. Sam has been providing market research on the IT Training and eLearning industries for over twenty years and has been involved with electronic training technology for over thirty-five years. Sam is an expert at identifying revenue opportunities for global learning technology suppliers. Sam specializes in learning technology research across several technologies including mobile, augmented reality, virtual reality, cognitive systems, collaboration platforms, simulation platforms, and game engines.

Sam provides clients with technology feasibility studies, strategic consulting on new product development, product revenue forecasts, emerging market analyses, and competitive intelligence. Sam is the only analyst in the industry that focuses exclusively on learning technology trends across all the major customer segments including businesses, government agencies, academic institutions, and consumers.

Dubai, United Arab Emirates, 2013

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.
Executive Overview

Worldwide revenues for Game-based Learning products reached $2.6 billion in 2016. The global five-year compound annual growth rate (CAGR) is a robust 22.4%. Revenues will surge to $7.3 billion by 2021.

This whitepaper breaks out global revenues for Game-based Learning products for seven regions, eight buying segments, and ten types of edugames. A breakout for the US is also provided for eight buying segments and ten edugame types.

We have also included an overview of private investments made to Game-based Learning companies through the first half of 2016. A total of $322.6 million has been invested in thirty-six Game-based Learning companies in just the first half of 2016, nearly double the amount for the entire year of 2015.

This whitepaper uses Ambient Insight's Game-based Learning pedagogical framework that identifies ten unique types of edugames. The revenue forecasts in the whitepaper are mapped to those ten types of edugames giving suppliers precise instructional design specifications and visibility into addressable revenue opportunities.

Figure 1 - 2016-2021 Global Forecasts for Game-based Learning and Simulation-based Learning

| 2016-2021 Global Market Forecasts for Game-based Learning and Simulation-based Learning |
|---------------------------------|-----------------|-----------------|-----------------|
| **Global Revenues by Learning Product Type** | **2016 Revenues in US$ Millions** | **2021 Revenues in US$ Millions** | **Five-Year CAGR 2016-2021** |
| Simulation-based Learning | $5,167.87 | $11,310.43 | 17.0% |
| Game-based Learning | $2,661.96 | $7,324.84 | 22.4% |
| Total | $7,829.83 | $18,635.27 | 18.9% |

**Does not include hardware, tools, or custom services**

Ambient Insight 2016
In our Research Taxonomy, Ambient Insight defines Game-based Learning and Simulation-based Learning as two different types of learning technology products. The global revenues for Simulation-based Learning are provided here to provide context.

The worldwide Simulation-based Learning market has a 17.0% growth rate and revenues will climb to $11.3 billion by 2021. Combined, the two products will generate $18.6 billion for suppliers by 2021. While the combined total is interesting, it is not addressable as there are very few suppliers that develop both Simulation-based Learning and Game-based Learning. This whitepaper provides highly addressable Game-based Learning revenues.

We have included an analysis of the global edugame market by seven regions: North America, Latin America, Western Europe, Eastern Europe, Africa, Asia Pacific, and the Middle East. We also break out the global revenues by eight buying segments: consumer, preschool, primary education, secondary education, tertiary education (post-secondary & higher education), corporations & businesses, federal government agencies, and state/provincial/local government agencies.

Figure 2 - 2016-2021 Global Five-year Growth Rates by Learning Technology Type

As of 2016, learning technology innovation is heavily concentrated in four learning product types: Simulation-based Learning, Game-based Learning, Cognitive Learning, and Mobile Learning. Highly-advanced, low-cost products are flooding the market.

- The 2016-2021 worldwide growth rates for Simulation-based Learning, Game-based Learning, Cognitive Learning, and Mobile Learning in the US are 17.0%, 22.4%, 11.0%, and 7.5%, respectively.
In stark contrast, the 2016-2021 global growth rates for Self-paced eLearning, Digital Reference-ware, and Collaboration-based Learning are -6.4%, -3.0%, and -5.3%, respectively.

Clearly, the demand for legacy learning technology types is declining. The primary factors causing the weakness in legacy learning technology sales are the extraordinary innovations in the newer product types and a significant amount of product substitution.

**Global Growth Rates for Game-based Learning are Accelerating**

There is now clear longitudinal evidence that Game-based Learning is gaining traction across the planet. The five-year compound annual growth rates (CAGRs) have been climbing for the last six forecast periods.

**Figure 3 - Longitudinal Analysis: Global Five-Year (CAGRs) Are Accelerating**

This is a relatively unusual trend for a learning technology that has been on the market for decades and indicates a new phase of market demand. As of 2016, Game-based Learning has the highest five-year growth rate of the seven learning technology products tracked by Ambient Insight.

The growth rate for Game-based Learning products in the 2016-2021 forecast period is 22.4%, up from 15.4% in the 2011-2016 forecast period. The current growth rate for Game-based Learning products as of 2016 is more than double the growth rate of 9.7% in the 2006-2011 forecast period.
The spike in growth rates in the 2006 to 2013 timeframe was driven in large part by the success of the extensive catalog of new edugames running for the Nintendo DS. A spurt of new types of edugames became best-selling across the globe including brain trainers, cooking games, language learning games, and test prep games.

The demand for these Nintendo edugames began to wane in 2009 and 2010. The recent growth is due to the massive popularity of mobile edugames for smartphones. Educational games for the Nintendo devices still sell well, but the sales are dwarfed by the sales made in the commercial app stores across the planet.

As of June 2016, only a handful of countries do not have operational commercial app stores. Telecoms operate their own app stores in countries where Apple and Google have yet to launch app stores.

Ambient Insight has identified the twenty ten best-selling mobile education apps and edugames in 122 countries. We did not find a single country that did not have at least one edugame in the top twenty.

We found distinct differences in the demand for edugames from country to country. In general, but not always, the three most common edugames in the top ten were early childhood learning apps, brain trainers, and language learning games in 2016.

Test prep games were in high demand in so-called exam cultures, which are countries (like China, India, South Korea, and Japan) that place a great emphasis on high stakes testing. Edugames to help students prepare standardized English exams are also popular across the planet. Most of the test prep edugames were in the form of knowledge-based quiz games.

The Primary Catalysts in the Game-based Learning Market

There are six primary convergent catalysts driving the worldwide Game-based Learning market:

- The rapidly fading resistance to learning games in the corporate and academic segments
- The growing body of empirical evidence on the effectiveness of Game-based Learning
- A high degree of product substitution as buyers migrate away from legacy learning technologies to serious games
- The growing international popularity of brain trainer games
- The spike in demand for early childhood learning apps
- The strong demand for language learning apps (particularly English and Chinese)

In educational psychology, the two phases of the learning process are knowledge transfer and learning transfer. Knowledge transfer is the transmission of information and skills to the learner. Learning transfer is the ability of the learner to demonstrate mastery in a real world setting.

New learning technology products on the market now essentially merge these two phases. Augmented reality-based decision support is a good example of a worker learning to do tasks as he or she actually does the work on site in the real world, essentially merging the two transfer phases.
Despite the recent advances in learning research and technology in general, no significant innovations have been introduced in the last decade for Self-paced eLearning, Digital Reference-ware, or Collaboration-based Learning.

Some legacy learning technology suppliers claim to offer new advanced "personalization" and "adaptive learning", but these features have been integral features in Self-paced Learning products for decades.

**Figure 4 - Primary Catalysts Driving the 2016-2021 Worldwide Game-based Learning Market**

Buyers are moving away from these legacy products and new suppliers are entering the market to meet the demand for the more advanced products. And the new products are game changers relative to knowledge transfer and learning transfer. The learning technology industry has entered a new phase characterized by innovation and effective knowledge transfer. *(Source: Ambient Insight’s 2016 Crossing the Rubicon: The Reinvention of Learning Technology)*

**The Inhibitors to Learning Games are 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 edugames 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.

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. Game-based recruiting and job application assessments are rapidly gaining traction in the corporate segment and creating the breakthrough moment for the uptake of Game-based Learning by corporations and businesses.

Several of these new learning products utilize sophisticated psychometrics that yield statistically-sound quantitative learning results. The science of psychometrics is the core measurement method used in all the major professional certifications and this is the game type that has overcome the corporate resistance.

- Proof of the growing corporate demand for Game-based Learning can be found in the success of corporate-facing companies. A company called Gamelearn was founded in 2008 in Spain. In July 2016, the CEO reported that "Our results were spectacular. We increased our website traffic tenfold, developed a new product launch plan, collaborated with HR directors of multinational companies, and positioned Gamelearn as an industry leader. Now Gamelearn boasts thousands of clients from Burger King to Hyundai, and hundreds of thousands of satisfied users." One factor the company cites for their success is a 90% completion rate among their clients. This is extraordinary considering the notoriously high dropout rates (50-70%) for legacy learning technology products like Self-paced eLearning.

- A corporate-facing Game-based Learning company called mLevel obtained $5 million in funding in July 2015. GamEffective also serves the corporate segment and garnered $7 million in private investment in June 2016. Between them, they have dozens of high-profile clients including Microsoft and Yahoo! that use their product for product rollouts, sales training, employee alignment, and customer service. This is more evidence pointing to the uptake of edugames in the corporate segment. Investment interest in corporate-facing edugame developers is very new in the industry. And an indication that they expect returns on their investments.

In the academic segments, the use of Game-based Learning is still heavily concentrated in the early grades in the PreK-12 segment and gaining traction in the higher grades in secondary schools (particularly for STEM edugames). In July 2016, Project Tomorrow released the results of a study that stated "In 2015, 48 percent of teachers said they use games in their lessons. In 2012, that number was 30 percent. In 2010, it was only 23 percent. What's surprising about those findings is that, according to another survey we run with technology leaders, more CIOs and CTOs believe game-based learning will be an area of high growth compared to technologies that may receive more attention."

The use for edugames is just beginning to gain traction in the higher education segment. Like simulation products, Game-based Learning products were also prohibitively expensive and time intensive to create until recently. This has changed dramatically since 2015, with several new easy-to-use gaming engines hitting the market. Many of these require no coding reducing the barriers-to-entry and instructional designers in the higher education segment can now implement rapid development methods to develop games. Unity also launched their Unity Educator Toolkit in a bundle of free training content and discounted platform licenses for post-secondary institutions in June 2016.

One interesting trend is the uptake of digital edugames in the preschool sub-segments across the globe. Preschools were late adopters of learning technology. This has changed quickly in the last 3-5 years. The strong demand for early childhood learning apps in the consumer segments across the globe is directly related to the reduced the resistance to using learning technology in the preschools. Almost all educational content designed for preschoolers includes gameplay.
The use of technology in preschools is particularly prevalent in China. The preschool sub-segment in China is heavily commercialized and the schools are often called "Preschool Education Storefronts". According to ChinaVenture Investment Consulting Group, 32% of all online education companies in China are preschool education providers. In October 2014, US-based Kids ‘R’ Kids, a preschool chain with 157 preschools in the US, announced their expansion into China.

Their first two Kids ‘R’ Kids, preschools opened in Shanghai and Beijing in September 2015. Kids ‘R’ Kids makes extensive use of learning technology in their classrooms and provides individual Computer Learning Centers in every school, which are equipped with "the latest multi-touch screen technology and educational software for development in a safe, child-directed learning environment." Kids ‘R’ Kids licenses digital content from Age of Learning (ABCmouse), arguably one the most successful early childhood learning companies on the planet.

A Chinese online edugame company called Beiliao garnered $15 million in venture capital in January 2016. They market their platform as a 'Home Kindergarten." They stated in the press that "Beiliao will continue focusing on the cloud platform of personalized family education solution."

Finally, one major inhibitor for Mobile Learning in general and mobile edugames was the presence of multiple operating systems. As of June 2016, all the major commercial game engines output to multiple systems (including VR formats). The few specialized edugame authoring tools on the market are now also cross platform.

**Edugames Empirically Proven Prove to be Effective Knowledge-Transfer Products**

One major inhibitor for the Game-based Learning market was the lingering debate over the effectiveness of the product. That tide has turned as well. A string of empirical meta-analysis research results have found that Game-based Learning is a more effective knowledge transfer method than conventional methods. Meta-analysis is defined as "a method for systematically combining pertinent qualitative and quantitative study data from several selected studies to develop a single conclusion that has greater statistical power."

In 2011, the results of study by Traci Sitzmann were released in a paper called "A Meta-Analytic Examination of the Instructional Effectiveness of Computer-based Simulation Games". She found that "Interactive cognitive complexity theory suggests that simulation games are more effective than other instructional methods because they simultaneously engage trainees’ affective and cognitive processes. Meta-analytic techniques were used to examine the instructional effectiveness of computer-based simulation games relative to a comparison group. Consistent with theory, post training self-efficacy was 20% higher, declarative knowledge was 11% higher, procedural knowledge was 14% higher, and retention was 9% higher for trainees taught with simulation games, relative to a comparison group."

In 2012, Thomas M. Connolly and his team published a paper called "A systematic literature review of empirical evidence on computer games and serious games". "This paper examines the literature on computer games and serious games in regard to the potential positive impacts of gaming on users aged 14 years or above, especially with respect to learning, skill enhancement, and engagement. Search terms identified 129 papers reporting empirical evidence about the impacts and outcomes of computer games and serious games with respect to learning and engagement and a multidimensional approach to categorizing games
was developed. The findings revealed that playing computer games is linked to a range of perceptual, cognitive, behavioral, affective, and motivational impacts and outcomes. The most frequently occurring outcomes and impacts were knowledge acquisition/content understanding and affective and motivational outcomes."

In a seminal study called "A Meta-Analysis of the Cognitive and Motivational Effects of Serious Games" released in 2013 in the *Journal of Educational Psychology*, Pieter Wouters and his Utrecht research team reported that, "It is assumed that serious games influences learning in two ways, by changing cognitive processes and by affecting motivation. However, until now research has shown little evidence for these assumptions. We used meta-analytic techniques to investigate whether serious games are more effective in terms of learning and more motivating than conventional instruction methods. Consistent with our hypotheses, serious games were found to be more effective in terms of learning and retention."

In March 2014, SRI International, an international R&D company, released the results of their meta-analysis of research papers on the effectiveness of simulation and games on learning. Both Simulation-based Learning and Game-based Learning were found to be significantly more effective knowledge transfer methods than learning products that did not include simulation or game play. "When digital games were compared to other instruction conditions without digital games, there was a moderate to strong effect in favor of digital games in terms of broad cognitive competencies."

In a 2015 Stanford study on the effectiveness of edugames for third grade math it was found that third graders that played the Wuzzit Trouble math edugame for ten minutes a day on 3 days a week over a four week period (a mere two hours of total game play) had a 20.5% improvement rate over the control group that were given the same material in traditional formats.

The industry is on the verge of extraordinary innovations in knowledge transfer using games. In April 2016, Sesame Street announced a three-year partnership with IBM to develop educational products using IBM's artificial intelligence platform Watson. In the press, IBM stated "As part of a three-year agreement, Sesame Workshop and IBM will collaborate to develop educational platforms and products that will be designed to adapt to the learning preferences and aptitude levels of individual preschoolers. Research shows that a significant extent of brain development occurs in the first five years of a child’s life, making this window critical for learning and development. Working together with Sesame Workshop, we aim to transform the way in which children learn and teachers teach, and envision having an impact on the lives and education of millions of children."

"Over the next three years, the pair will create mobile apps, games, smart toys, and a range of products offering adaptive, individualized education. Using Watson's cognitive capabilities, the app will analyze a child’s response in real-time and then intervene with content just for that child because each of us learns in a very, very different way."

Perhaps the most effective knowledge transfer products in the current market are the new assessment and evaluation edugames based on psychometrics. Psychometrics is the science that focuses on statistical measurement of psychological states. Psychometric instruments measure knowledge, abilities, skills, attitudes, and personality traits.

Several new companies that specialize in this type of edugame have come on the market in just the last 2-3 years including Pymetrics, Revelian, Knack, Scoutible, SHFuse, RoundPeg, Arctic Shores, and High Voltage Software. All of them are seeing rapid uptake in the
corporate segments across the planet. Psychometrics can be complex and very few people outside of the psychometrician profession understand the science, but psychometrics are the foundation of all the major certification exams. It is not a hard sell to convince corporations to buy products based on psychometrics. They may not understand the science, but they recognize the clear benefits of using it.

"Pymetrics is reinventing the recruiting process by using big data, neuroscience, and machine learning to identify optimal career paths for job seekers and ideal employees for organizations. Pymetrics assesses cognitive and personality traits using a series of fun and quick neuroscience games, making it easier than ever to understand where inherent characteristics can lead to success."

Artic Shores was founded in 2013 and has developed a job recruitment edugame based on psychometrics called Cosmic Cadet that places a job candidate on a virtual spaceship where they must complete six levels of "interstellar challenges" in 30 minutes. "Measuring cognitive processes such as resilience and problem-solving, the game collects data on how job candidates instinctively respond to given situations, thereby helping employers gain a better understanding of how they would perform in the role and whether they are a good fit for the company."

In July 2016, Arctic Shores announced a distribution agreement with the talent measurement and assessment company Cut-e. Cut-e is now a global distributor of Arctic Shores' edugames and is collaborating with Arctic Shores on new learning games. "Cut-e provides ability, personality, motivation, values, creativity and integrity assessments in 70 countries."

A company called Simcoach has worked with dozens of businesses in healthcare, retail, manufacturing, government. They have developed games for numerous companies such as Alcoa, Honeywell, Lowe’s, and Wegmans and organizations like the 3 Rivers Workforce Investment Board, OSHA, and other agencies. "Measurable and sustainable behavior change is at the core of what we do. Our team of experienced game developers is committed to making every learning experience fun. Our Simcoach Method combines superior game design with proven learning science to develop industry leading workforce training that is both engaging and effective."

**Product Substitution: Leapfrogging Legacy Learning Technology**

The term *product substitution* is used in the product market analysis industry to describe the demise of one product due to the preference of substitute products. The most cited examples are the replacement of print-based encyclopedias with digital repositories and the decline of the film-based camera industry in favor of digital cameras.

Three factors that contribute to product substitution are lower-cost substitutes, higher quality in the substitutes, and low "barriers-of-switching" to the substitute. In the global learning technology industry, all three of these factors are now present and a pronounced degree of product substitution is underway, particularly in mobile-only countries.

Low-cost learning technologies with highly-effective knowledge transfer methods are now flooding the market. A range of studies can now quantify the effectiveness of the knowledge transfer process measured in terms of performance improvement and behavior modification.
In stark contrast, mastery methods used in Self-paced eLearning products are almost all text-based exams and assessments. While these are adequate for demonstrating the retention of information, they are not very good at measuring skills. Being able to pass a test on procedural skills does not guarantee learning transfer to the real world. A good example of this is found in non-immersive language learning methods. Students can pass a written test on foreign languages, but are often quite incapable of speaking the language with any degree of fluency.

The deployment of tablets in digitization initiatives is a factor contributing to product substitution. So far, the largest national deployments of tablets in the schools in Asia are in South Korea, China, Malaysia, and Singapore. Each of these countries are deploying the tablets differently, usually starting the process at specific grade levels. The educational content used on tablets is Mobile Learning and it is rare to find self-paced courseware used on the devices.

The uptake of Mobile Learning and mobile educational apps in the mobile-only countries cannot technically be called product substitution since the adoption of the other learning technologies was practically non-existent. School systems in developing economies have been rolling out learning technology in the last five years (usually with funding from NGOs) but they are more likely to deploy tablets and mobile content rather than PCs and PC-based products.

In March 2016, William Bao Bean, the managing director of MOX (a mobile software accelerator), stated that "In the US and Europe, you have one billion people who started using the internet on PCs. In China, one billion people will soon be online, first on mobile – the largest mobile-only population in the world. That's the next billion."

Clearly, the learning technology industry has entered a new phase characterized by products that are more effective than legacy products. These products are far more advanced and significantly more effective than traditional courseware, textbooks (digital or otherwise), or web conferencing. The current phase of product substitution will continue unabated for the near future.

The Growing International Popularity of Brain Trainer Games

Nintendo's Brain Age was first released in Japan in 2005 and was an instant hit. The popularity of Brain Age and a new crop of brain trainers spread like wildfire, but the demand was concentrated in developed economies. Brain Age was the top-selling game in the UK by 2008, outselling all other games.

Nintendo’s Brain Age series of games have sold over 60 million copies worldwide since the initial launch. The popularity of the early brain trainers started to wane in 2010. This began to change dramatically in 2011 and 2012 as suppliers started porting their brain trainers to mobile formats. A wave of new suppliers launched mobile products in the app stores. The new mobile version of the edugames became popular very quickly in the developed economies.

For example, in December 2012, Vancouver-based Vivity Labs (now owned by Rosetta Stone) launched their brain trainer mobile app in the Apple store and sold one million copies in the first 60 days.
A change in the demand for brain trainers started in the 2013 to 2015 time frame as app stores were launched in mobile-only countries across Africa and Asia. Brain trainers are now popular in developing economies.

Product substitution is particularly acute in Africa and Asia, the two regions with the highest percentage of mobile-only countries. Eleven countries in Africa can be categorized as mobile-only: Benin, Botswana, Burkina Faso, Ghana, Mali, Mozambique, Namibia, Rwanda, Senegal, Tanzania, and Uganda. All of these countries had mobile penetration rates above 120% by mid-2016.

Nine countries in Asia are now considered mobile-only: Bangladesh, Cambodia, China, Indonesia, Myanmar (Burma), Mongolia, Laos, Nepal, Sri Lanka, and Vietnam. By the end of 2015:

- Cambodia had a mobile penetration rate of 167%.
- Mongolia had a mobile penetration rate of 152%.
- Vietnam had a population of 93.5 million people and a breathtaking mobile penetration rate of 177% by the end of 2015, one of the highest in Asia (and indeed the world).

In mobile-only countries, the mobile device is the dominant device used to access the Internet; people are introduced to digital learning content on a mobile device. As of June 2016, mobile brain trainers consistently ranked in the top twenty best-selling educational apps in the app stores in 97 of the 122 countries tracked by Ambient Insight. (Source: The Worldwide 2016-2021 Worldwide Mobile Edugame Market, Ambient Insight, LLC)

This trend is effectively a third wave of demand with brain trainers popular in both developed and developing economies. The growth rates for mobile brain trainers is slowing globally, yet still healthy at 8.5% for all regions combined. The growth rate for mobile brain trainers is now negative in the US at -2.1%, but this is not due to lack of demand. Unit sales are still high but price points are falling due to commoditization pressures.

The Spike in Consumer Demand for Early Childhood Learning Apps

Essentially all early childhood learning apps are game-based and incorporate play into the experience. Like brain trainers and language learning apps, early childhood learning apps consistently rank in the top twenty best-selling educational apps in almost every one of the 122 countries tracked by Ambient Insight. As of July 2016, twelve of the top twenty best-selling educational apps in the US Apple store were early childhood learning apps.

In the 2016 market, early childhood learning edugames generated the second-highest revenues after brain trainers. The five-year growth rate for early childhood learning edugames across the globe is 30.5% and revenues will more than triple to $1.7 billion displacing brain trainers by a wide margin to become the top revenue-generating edugame product.

This trend is similar in the US. Brain trainers were the top selling type of edugame in the US in 2016. The five-year growth rate for early childhood learning edugames is 23.4% in the US and revenues will more than triple to $297.7 million by 2021; this edugame type will displace brain trainers in the US as the top revenue-generating product.
The demand is now global and particularly evident in mobile-only countries. Consumers in many countries will be outspending preschools and PreK-3 schools by the end of the forecast period due to the rapid rollout of mobile broadband across the world, the availability of very low-cost smartphones and tablets, and the boom in demand for educational apps for children.

For example, the largest buyers of early childhood learning products in China in 2016 were the commercial preschools and the government-run schools. By 2021, consumers will be the top mobile early childhood learning app buyers in China.

Consumers are already the top Mobile Learning buying segment in Azerbaijan, Bosnia, Bulgaria, Croatia, the Czech Republic, Greece, Hungary, Italy, Lithuania, India, Indonesia, Japan, Mongolia, Nepal, New Zealand, Singapore, South Korea, and in the United States.

Compelling evidence for the sustainability of early childhood learning products is the investment capital going to companies that develop early childhood learning games. Age of Learning (the developer of the enormously popular ABCmouse) garnered a breathtaking $150 million in investment in May 2016. This is the highest investment ever made to a Game-based Learning company in the history of the learning technology industry.

Brazil-based Movile's mobile education division called PlayKids obtained $15 million in June 2015 and another $40 million in June 2016. PlayKids consistently ranks in the top best-selling educational apps in app stores across the planet.

Another trend that provides evidence for the strong demand for early childhood learning products is the recent acquisitions of companies that sell products that are quite popular with buyers. Toca Boca and Sago Mini, developers of some of the most popular edugames for young children, were acquired by Canada-based Spin Master in April 2016.

**The Strong Demand for Language Learning Apps (particularly English and Chinese)**

The global growth rate for language learning edugame is a robust 23.2% and revenues will surge to $896.2 million by 2021, up from $315.7 million in 2016. The growth rate in the US is higher at 31.1% for this type of educational game and revenues will nearly quadruple by 2021 to reach $246.4 million.

The top language in demand is English by a large margin, even in English-speaking countries including the US, Australia, the UK, New Zealand, Canada, and Ireland. The primary catalysts driving the language learning market across the planet are:

- Consumer demand for mobile digital English language learning products
- New national language educational policies designed to increase English proficiency
- Increase in funding for government ESL programs

In January 2016, *every one of the top ten selling educational apps in the Apple store in Laos were language learning apps.* Seven of them were English language learning apps. Two of them were for the Lao language and one was for Chinese.

Consumers in Australia are avid buyers of English language learning mobile edugames for children. As of June 2016, three of the top ten selling apps in Google's Play Store in Australia were English language learning edugames for young children. The top selling educational app in
the Apple app store in Japan in June 2016 was an English language learning app for the TOEIC exam. Eight of the top ten best-selling apps in the store in Japan were language learning apps and all of them were for English.

While English is generally in high demand in most countries, Chinese is also gathering steam. This is particularly evident in the US consumer segment and in countries that share borders with China. The growth rate for digital English language learning in the US consumer segment is anemic at 2.5%, but the demand for Chinese is a healthy 14.8%. Language learning edugame developers should also take note of the language with negative growth rates (French and German).

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>$156.20</td>
<td>$167.25</td>
<td>$185.66</td>
<td>$193.54</td>
<td>$189.95</td>
<td>$176.62</td>
<td>2.5%</td>
</tr>
<tr>
<td>Spanish</td>
<td>$129.45</td>
<td>$133.20</td>
<td>$136.09</td>
<td>$137.99</td>
<td>$135.10</td>
<td>$132.93</td>
<td>0.5%</td>
</tr>
<tr>
<td>French</td>
<td>$19.07</td>
<td>$18.77</td>
<td>$18.32</td>
<td>$18.05</td>
<td>$17.83</td>
<td>$17.24</td>
<td>-2.0%</td>
</tr>
<tr>
<td>German</td>
<td>$10.52</td>
<td>$10.32</td>
<td>$10.11</td>
<td>$9.84</td>
<td>$9.34</td>
<td>$8.78</td>
<td>-3.6%</td>
</tr>
<tr>
<td>Chinese</td>
<td>$31.76</td>
<td>$38.54</td>
<td>$43.68</td>
<td>$47.37</td>
<td>$58.09</td>
<td>$63.26</td>
<td>14.8%</td>
</tr>
<tr>
<td>All Others</td>
<td>$23.49</td>
<td>$26.80</td>
<td>$28.74</td>
<td>$30.81</td>
<td>$32.77</td>
<td>$33.12</td>
<td>7.1%</td>
</tr>
<tr>
<td>Totals</td>
<td>$370.49</td>
<td>$394.88</td>
<td>$422.60</td>
<td>$437.60</td>
<td>$443.08</td>
<td>$431.95</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

(Source: The 2015-2020 Worldwide Digital English Language Learning Market, Ambient Insight, LLC)

Recent educational policies on languages learning is also contributing to the demand for language learning products. In December 2013, the President of Kazakhstan called on all Kazakhs to learn three languages: Kazakh, Russian, and English. He stated in the press that, "We need the English language to enter the global arena." The Kazakhstan government has a formal Trinity of Languages program, "which envisages all school graduates able to communicate equally well in Kazakh, Russian, and English."

It should come as no surprise that the largest government expenditures on English as a Second Language (ESL) programs are in the English-speaking countries including Australia, Canada, Ireland, the UK, and the US. As they migrate to online formats, the governments in these countries hire commercial suppliers to develop the new digital programs.

The US Department of Education (ED), the Office of Vocational and Adult Education, and the Division of Adult Education and Literacy (DAEL) funded a site with digital ESL courses and apps called U.S.A. Learns. The content is now managed by the Sacramento County Office of Education. Interestingly and while the online courses are free, the mobile edugame apps are sold for 99 cents each.

The US State Department hired a commercial supplier to develop their Trace Word English language learning game. The edugame was developed by the US Department of State’s Bureau of Educational and Cultural Affairs (ECA) and the SuperGroup Creative Omnimedia, a multimedia company based in Atlanta. The digital edugame was formally launched in November 2012. It is distributed in countries across the world but is also designed to help ESL learners in the US.
**Definitions: Game-based Learning and Simulation-based Learning are Different**

Ambient Insight defines Game-based Learning as one of the seven distinct types of learning technology products in our Research Taxonomy. Simulation-based Learning is also one of the seven learning technology products we track. We do not approach Game-based Learning as a subset of the global videogame industry, but rather as a subset of the global learning technology market.

In the context of the global learning technology market, isolating Game-based Learning products is relatively straightforward. Isolating the Game-based Learning market in the context of the global videogame industry is a daunting task and rarely attempted in the industry.

**Definition of Game-based Learning**

In Ambient Insight's Research Taxonomy, Game-based Learning is defined as a knowledge transfer method that utilizes "game play" comprised of some form of competition (against oneself or others), increasing levels of complexity, and a reward/penalty system that essentially functions as an assessment method. Game-based Learning is often linked to the constructivism theory of education, defined as the process of Experiential Learning, Discovery Learning, and Situated Learning.

The instructional concept of scaffolding is an inherent component of Game-based Learning. "Scaffolding refers to a variety of instructional techniques used to move students progressively toward stronger understanding and, ultimately, greater independence in the learning process." In Game-based Learning, learners are introduced to greater levels of complexity once they master the current level, which is by definition a scaffold.

Ambient Insight categorizes ten types of edugames mapped to the domains in *Bloom’s Taxonomy* and *Gagné’s Conditions of Learning Theory*; the most widely used educational taxonomies in the education and training industry. The taxonomies are used by the majority of academic, government, and corporate instructional designers.

Bloom identified three learning domains: Cognitive, Affective, and Psychomotor. Most classroom-based instruction is based on the six processes in the Cognitive Domain: remembering, understanding, applying, analyzing, evaluating, and creating (formerly called synthesizing). The Affective Domain deals with the emotional processes involved with learning. The more sophisticated brain trainers and behavior modification products map to the Affective Domain.

Bloom's Psychomotor Domains deals with physical mind-body learning an motor skills. Sports training is a good example. Until the advent of Location-based Learning and virtual reality edugames, edugames based on the Psychomotor Domain were non-existent.

*Gagné’s Conditions of Learning Theory* identifies five categories of learning: intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes. His work is best known for his Nine Steps of Instruction (also known as the events of instruction) that are deployed by instructional designers that develop content and by teachers and trainers in the classroom. The use of Gagné’s nine steps is endemic in all systematic approaches to
instructional design (SAID) widely used in organizational training and education scenarios. The nine steps are:

1. Gain attention
2. Inform learners of objectives
3. Stimulate recall of prior learning
4. Present the content
5. Provide learning guidance
6. Elicit performance (practice)
7. Provide feedback
8. Assess performance
9. Enhance retention and learning transfer to the job

All nine steps are closely related to classical game theory that implements similar steps in an implicit manner. Instructional designed implement the nine steps in an explicit manner. Gagné’s model is not only used to develop and deliver learning, it is also used to evaluate the effectiveness of the instruction. This allows designers and teachers to tweak the material to improve learning outcomes. It is well known in the training and certification industry that collective pass rates on certification exams below 50% or above 90% indicate serious problems with the training content.

Game-based Learning products can also be classified as enabling declarative or procedural knowledge (knowing and doing). Declarative knowledge is knowledge about facts and can usually be verbalized and tested. Procedural knowledge involves how to perform mental or physical tasks.

Game-based Learning products have explicit pedagogical goals. A user "wins" an edugame when they achieve the learning objectives of the gameplay. All educational games are designed for behavior modification, pedagogical intervention, and/or cognitive remediation. The first two are well known but the third is relatively new.

There are remediation-based edugames designed to alter behavior attributed to developmental or cognitive challenges (such as dyslexia, anxiety disorders, phobias, PTSD, and attention deficit.) There are remediation edugames that are also used to strengthen appropriate (and mitigate inappropriate) behavior in areas of health and wellness, diversity, conflict management, team building, and leadership.

So-called virtual worlds (that are not actually virtual) that embed edugames illustrate the difference between Simulation-based Learning and Game-based Learning. The "environment" is indeed simulated but the knowledge transfer method is game-based. In Simulation-based Learning, the simulation itself is the knowledge transfer method.

**Definition of Simulation-based Learning**

There are distinct pedagogical differences between Simulation-based Learning and Game-based Learning. There is confusion in the marketplace with practitioners and suppliers using the terms interchangeably.

The definitions of Simulation-based Learning in our taxonomy are based on the research done by Alessi and Trollip. In their seminal work entitled, "Computer Based Instruction: Methods and Development," they identified five types of computer-aided instruction (CAI):
drills, tutorials, simulations, instructional games, and tests. Alessi and Trollip define four types of Simulation-based Learning:

- Physical Object and Environmental
- Process
- Procedural
- Situational

The researchers compressed these four into two instructional strategies: learning about something (physical and process), and learning to do something (procedural and situational). These can be restated in instructional terms as knowledge-based and performance-based simulations.

Ambient Insight does not include high-end military, aviation, and heavy equipment simulator revenues in our forecasts. The barriers-to-entry are quite high to develop and market these machines and only a handful of suppliers can compete in the simulator market.

**Gamification Versus Game-based Learning**

There is a continuing debate (if not confusion) about the difference between gamification and Game-based Learning and the two terms are often conflated. They are different things. Edugame provider SpongeLab describes the difference this way:

"Gamification is the application of videogame rules, mechanics and conventions to a non-gaming situation. Put simply, if a student is playing a videogame and learning from it, we aren’t witnessing gamification - the student is experiencing game-based learning. An educational game hasn’t been ‘gamified’ - because it’s a game already!"

Brian Burke, author of the 2014 book called *Gamify: How Gamification Motivates People to Do Extraordinary Things*, writes that "Gamification is often loosely defined, leading to market confusion, inflated expectations and implementation failures." The confusion in the education and training industry is due in some part to the "bolting on" of game elements to legacy education and training products.

For example, Badgeville sells gamification add-ons for corporate training. Course Hero has online courses that use Bunchball's game mechanics. Oxford University Press and Scholastic use SecretBuilder's game platform to "gamify books". This is not to say that "bolted-on" gamification is not useful in performance improvement.

Badgeville claims that "Game-based motivation—including competitions, goal-setting, performance rewards, success statistics and status recognition—is improving the work experience for nearly all employees who use it and 95% say they enjoy using it. Gamification increases productivity levels for 90% of workers and increases awareness of co-workers' goals and tasks for 86%. The top benefits of gamification, according to survey respondents, are an increased desire to be at work and engaged (30%), inspiration to be more productive at their job (27%) or the focus to stay on task and avoid distraction (20%)."

According to Bunchball, "Gamification is the process of taking something that already exists – a website, an enterprise application, an online community – and integrating game mechanics into it to motivate participation, engagement, and loyalty. Gamification takes the
data-driven techniques that game designers use to engage players, and applies them to non-game experiences to motivate actions that add value to your business."

**The Pedagogy: A Pedagogical Framework for Ten Types of Edugames**

To be classified as an education game, a product must implement game play as a method to achieve Knowledge transfer, also known as behavior modification. Behavior modification is a fundamental component of learning theory. Learning and behavior modification are synonymous; behavior modification is identical with structured learning. Ambient Insight is the only research firm that has developed a precise pedagogical framework for educational games.

**Figure 5 - The Ten Edugames in Ambient Insight’s Game-based Learning Pedagogical Framework**

Ambient Insight's Learning Taxonomy identifies ten distinct types of Game-based Learning products, each of them with unique pedagogical characteristics that map to specific learning theories, domains in *Bloom’s Taxonomy*, and *Gagné’s Conditions of Learning*. Ambient Insight’s edugame framework is the only pedagogically-sound classification of Game-based Learning products in the learning technology industry. The ten types of edugames are:

- Brain trainers (emerged in 2006, second-generation products hit the market in 2015)
- Knowledge-based games
- Skills-based games
- Language learning games
- Early childhood learning edugames
- Assessment and evaluation edugames
The edugame framework provides suppliers with a precise method of identifying revenues and a concise instructional design specification for developing profitable edugames. We track global revenues generated by each type of edugame across 122 countries.

Table 2 - Game-based Learning Product Types Mapped to Knowledge Transfer Methods, Domains in Bloom’s Taxonomy, and Gagné’s Category of Learning

<table>
<thead>
<tr>
<th>Game-based Learning Product Type</th>
<th>Primary Knowledge Transfer Methods</th>
<th>Bloom’s Taxonomy Domain</th>
<th>Gagné’s Category of Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain trainers</td>
<td>Psychometrics</td>
<td>Affective</td>
<td>Cognitive Strategies, Attitudes</td>
</tr>
<tr>
<td>Knowledge-based games</td>
<td>Behaviorism, Mnemonics</td>
<td>Cognitive</td>
<td>Intellectual Skills, Verbal Information</td>
</tr>
<tr>
<td>Skills-based games</td>
<td>Constructivism</td>
<td>Cognitive</td>
<td>Cognitive strategies</td>
</tr>
<tr>
<td>Language learning games</td>
<td>Connectivism</td>
<td>Cognitive</td>
<td>Intellectual Skills, Motor Skills</td>
</tr>
<tr>
<td>Early childhood learning edugames</td>
<td>Social Cognition Learning</td>
<td>Affective</td>
<td>Verbal Information</td>
</tr>
<tr>
<td>Assessment and evaluation edugames</td>
<td>Psychometrics</td>
<td>Affective</td>
<td>Cognitive Strategies</td>
</tr>
<tr>
<td>Experiential role-playing edugames</td>
<td>Experiential Learning</td>
<td>Affective</td>
<td>Cognitive Strategies, Attitudes</td>
</tr>
<tr>
<td>Location-based learning edugames</td>
<td>Situated Learning</td>
<td>Psychomotor</td>
<td>Attitudes</td>
</tr>
<tr>
<td>Mobile augmented reality edugames</td>
<td>Connectivism</td>
<td>Cognitive</td>
<td>Intellectual Skills, Motor Skills</td>
</tr>
<tr>
<td>Virtual reality edugames</td>
<td>Kinesthetic Learning, Experiential Learning, Observational Learning</td>
<td>Psychomotor</td>
<td>Intellectual Skills, Motor Skills</td>
</tr>
</tbody>
</table>

When revenue forecasts for these ten types of edugames are aggregated across the seven regions of the world, it is clearly evident that brain trainers were the top revenue-generating edugame across the planet in 2016. This will change over the next five years and early child learning edugames will be the top revenue generating edugame by 2021.

**Brain Trainers**

Brain trainer and brain fitness games are based on cognitive science, neuropsychology, and brain-based learning theories emerging from educational psychology and educational neuroscience. It is an instructional method that targets the neuro-physiological processes involved in learning and has little in common with traditional instructional design principles.
They are meta-cognition products that enable users to modify cognitive behavior (learn) by understanding and manipulating the learning process itself. Meta-cognition was defined by the educational psychologist John W. Santrock in 2008 as the information process that, "includes knowledge about when and where to use particular strategies for learning or for problem solving."

Researchers and suppliers have a growing body of empirical evidence to show that people who use brain training products can condition and train the brain to improve memory, attention, visual and spatial awareness, auditory processing, linguistic skills, planning skills, and problem solving. Despite criticism of the effectiveness of brain trainers, there is empirical evidence proving otherwise.

Perhaps the most persuasive evidence is the research done by Jaeggi on the use of so-called dual n-back tasks in brain training. The dual n-back tasks require users to process information simultaneously from two different sensory domains. She found that performing dual n-back tasks "accrues transferable benefits in Gf (fluid intelligence), over and above any gains in working memory capacity. This finding merits particular attention because Gf has traditionally been viewed as highly heritable and stable and is positively correlated with a large number of desirable outcomes including academic success, and neurological, psychological and physical health.'"

Jaeggi's research has been replicated by other researchers. "These findings constitute preliminary evidence that intensive cognitively demanding brain-training can improve not only our abstract problem-solving capacity, but also ameliorate cognitive control processes (e.g. decision-making) in our daily emotive environments." (National Center for Biotechnology)

As of June 2016, there are dozens of brain trainers on the market that use the n-back method. The majority of these edugames are mobile apps. Many are free and offer fee-based premium content. BrainScale.net provides a free brain trainer based on the n-back method and sells subscription-based premium upgrades for $2.99 a month or $14.99 a year.

Brain trainers are evolving into increasingly sophisticated products as new suppliers bring innovative products to market. A unique Game-based Learning product is marketed by Akili Interactive Labs. They develop games that assess the cognitive states of users. In that sense, it is a hybrid between an edugame and a Cognitive Learning product. The company garnered $30.5 million in investment in January 2016 and an additional $11.9 million in July 2016. "Our cutting-edge cognitive gaming engine enables three separate clinical game versions for remote data-capture, with features designed for extreme patient engagement. Our proprietary adaptive mechanics allow the software to automatically personalize to the patient's ability level with no clinician input required."

Halo Neuroscience "develops neurotechnology to unlock human potential in both the healthy and impaired. Their first product, Halo Sport, stimulates the motor cortex to accelerate gains in skill and strength acquisition when paired with athletic training. In their first month since emerging from stealth mode, Halo has partnered with the US Military, three MLB teams, two NBA teams and the US Olympic Ski Team."

In June 2015, a new company called HeadTrainer launched a mental training app for athletes "that is the first sports based app and offers to train the brain in the areas of focus and concentration, visual and spatial awareness, processing speed, memory and decision making. HeadTrainer's games are all sports-specific, directed at improving decision-making, processing speed, focus/concentration, visual/spatial awareness and memory."
**Knowledge-based Edugames**

Handheld and mobile knowledge-based learning games are designed to help users learn and memorize concepts, principles, facts, patterns, and rules (such as verb conjugation.) These edugames are often designed as quizzes, flashcards, or trivia games. They are increasingly being used in museums and tourist attractions to impart knowledge about the exhibits.

These educational games are relatively easy to design and there are commercial development tools coming on the market that are making it even easier to develop these games. In September 2015, Muzzy Lane Software announced their new Game-based Learning authoring tool, one of the first commercial Game-based Learning development tools on the market.

Knowledge-based games are now common in primary, secondary, and tertiary institutions. They have been in wide use in the military and are now gaining traction in the corporate segment. All the commercial eLearning authoring tools (like Adobe's Captivate) include game modules.

A common method of compiling new product information for sales people is creating what are known as "battle cards" that include product details and competitive messaging. These can be quite complex. A simple Knowledge-based Edugame modeled on the Concentration game show is now common in game-based battle cards used by sales organizations.

Knowledge-based edugames are now recognized as effective mnemonic devices. Test prep edugames for standardized exams are in demand in most countries of the world. Medical and nursing students must memorize a great deal of information and it is no surprise that healthcare-related edugames are top sellers in the app stores.

**Skill-based Edugames**

A skill is the ability to apply knowledge in the context of a performance. skill-based games are designed to improve hand-eye coordination, improve performance on physical tasks, and hone psychomotor skills of players. For example, a math game is considered a skill-based game. Memorizing the rules of math is knowledge-based. Applying that knowledge in calculations is a skill. Memorizing facts for a driver's license written test is knowledge-based, while applying those rules in the car is a skill.

A recent trend in Skill-based Edugames is the launch of computer coding games for young children. A company called Osmo started out as an augmented reality developer and released their Osmo Coding edugame in late 2014. As of July 2016, it was being used by over 15,000 schools.

In June 2016, Apple announced their Swift Playgrounds edugame, designed to teach young children how to code in Apple's programming language Swift. In July 2016, Code.org announced a partnership with Disney to bring coding games to the market using characters from Disney's animated films.
The 2016-2021 Worldwide Game-based Learning Market, Ambient Insight, LLC
For more information about our research, email: info@ambientinsight.com

The most innovative skill-based edugames on the market in 2016 use robots as an integral part of the edugame. South Korean operator SK Telecom sells the Albert robot bundled with the Smart Robot Coding School training program developed by SK Telecom teach children how to develop software. The product has been sold to schools in South Korea, Spain, France, Brazil, Colombia, Taiwan, and Malaysia. In May 2016, SK Telecom signed an MOU with the Central State Government of Paraguay to supply 10,000 units of the smart learning robot to schools in the country.

Many new educational robots designed to teach kids programming and related skills have entered the market over the past year including the Vortex, the Kamibot, the Fisher-Price Code-a-Pillar, Codeybot, Aisoy, and Ozobot.

Language Learning Edugames

Memorizing foreign words is knowledge-based, while using those words in speech and writing is a skill. Ambient Insight breaks out language learning edugames for suppliers because they are part of the greater language learning market and a very distinct revenue opportunity.

This type of mobile edugame has been a staple in the Japanese market and now games like this are being adopted across the planet. The language "coaching" games for the Nintendo devices are good examples of this genre. Speech recognition and real time translation are used in the more sophisticated language learning games.

Language learning games are commonly used in the early grades in primary school, but there are language learning games designed for all age groups. Mindsnacks, Duolingo, FluentU, Bravolol, Studycat, Three Flip Studios (Influent), and Memrise specialize in game-based language learning products.

Rosetta Stone launched their first language learning edugame for children in November 2014, as such it is a hybrid between a language learning game and an early childhood learning game.

Some of the most sophisticated game-based language learning products was developed by Alelo for the US military. In June 2016, the government awarded them a $3 million contract to develop a game-based language learning platform called ALLEARN.

"ALLEARN engages learners in interactive learning activities that develop their communication skills on a mobile device or regular computer. As they do this the system analyzes responses, and collects analytics on the key metrics of spoken language proficiency – fluency, accuracy, and complexity of language."

DuoLingo is a Carnegie Mellon spinoff that launched in 2012. They offer free game-based language learning products. The generate revenue by selling certification tests and selling translations of web content created by their users. They raised $45 million in a funding in late 2015 in a round headed by Google. They had previously raised $20 million in 2014. Clearly, investors are interested in language learning game developers.

In February 2016, Rovio Entertainment announced a partnership with the language learning provider papagei.com to sell English language learning games based on Angry Birds.
characters. The edugames were available in Germany, Poland, the Russian Federation, Brazil, and Mexico at launch.

In March 2016, US-based Imagine Learning (acquired by Weld North in April 2014) announced that downloads of their Imagine Learning English and Imagine Learning Español combined had reached over a million since the launch in late 2013.

As of July 2016, the vast majority of language learning edugames are mobile and consistently rank in the top twenty best-selling educational apps in almost all the 122 countries tracked by Ambient Insight.

Early Childhood Learning Edugames

Edugames for very young children under four years old are quite 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.

PBS Kids, Disney, Sesame Street, Spin Master, Toca Boca, and Sago Mini (both acquired by Canada-based Spin Master in April 2016) are major early childhood learning edugame developers. Duck Duck Moose, PlayKids (Movile), DragonBox, Osmo, and Dr. Panda are also well-known early childhood learning edugame developers.

Fingerprint sells a mobile early childhood learning education platform and has over 200 developer partners in over 40 countries. Their white-label platform allows major brands to get educational games up and running quickly. Well-known brands that use the Fingerprint platform include Mattel, National Geographic, Toca Boca, Sylvan Learning, Tiny Tap, China-based BabyBus, PBS Kids, and Nickelodeon. By March 2016, they had over 2,000 apps for kids on the platform and announced in the press that they expected to double this by the end of 2016.

One of the most successful early childhood learning suppliers is Age of Learning, which sells the immensely popular ABCmouse app. Their app consistently ranks in the top best-selling educational apps in over 100 countries in the world. They garnered an unprecedented $150 million in private equity in May 2016; this is the highest amount invested in a Game-based Learning company in the history of the learning technology industry.

Assessment and Evaluation Edugames

Assessment edugames evaluate the user on knowledge and skills in a particular domain. These are quite common in test prep for standardized exams and in recruitment and employee performance evaluations. The knowledge transfer is usually a score that defines the level of ability; players learn about themselves.

Zero Hour Threat is an interactive action game designed by a division of Disney "to increase your ACT and SAT standardized test scores while boosting your general mathematics and vocabulary skills. With each correct answer, you move one step closer to decoding a virus that international criminals have set in place to infect the United States' banking systems. Raise your SAT and ACT scores while having fun playing your SAT and ACT test preparation

Barclays recently released a mobile stock-trading edugame called Stockfuse, developed by SHFuse to attract and evaluate potential job applicants. "The game allows users to practice trading skills and, if their virtual portfolio performs well enough, win a conversation with a Barclays Markets professional." More than 4,500 college students have played the game and dozens have received job offers from Barclays.

Kaplan University is a private corporation and partnered with High Voltage Software to integrate game-play into Kaplan's CareerNetwork platform. "Students start by creating their own avatar—a virtual representation of themselves. They receive points and advance levels for compiling personal information that in turns helps the University’s Career Services team learn more about them and their job search. This helps the team provide more effective coaching."

A wave of new companies have entered the market for corporate-facing edugames in the last 2-3 years selling products based on psychometrics used to assess the abilities of job recruits.

A company called Scoutible launched in May 2016. They have developed a gaming platform that combines gameplay with job hunting. "The company aims to improve hiring and retention by using immersive games to find the right candidate for different positions. Scoutible offers users the chance to play a 20-minute game to learn about themselves. It uses proprietary game technology from Harvard and Stanford that learns from the player’s unique actions in the game to measure their skills and discover their talents."

An Australian company called Revelian sells an job recruit assessment edugame called Theme Park Hero. "Theme Park Hero is underpinned by a validated predictive psychometric framework. This means the reports you receive will contain valuable, reliable information to reveal which people on your shortlist have high potential." In May 2015, Revelian's CEO stated in the press that the company was generating $10 million in annual revenues.

India-based Edsix Brain Lab serves the PreK-12 segment and "aims to strengthen cognitive skills for critical thinking, learning agility, increased attention span, and more." They have a suite of over 500 games that they call Skill Angels that assess the cognitive abilities of students.

SimCityEDU, developed by GlassLab, Electronic Arts, and Maxis, includes "a set of formative assessment tools which gauges the ability of the students to discover and understand the tools they're given, allowing GlassLab to analyze their problem-solving capabilities. Every action the player takes in-game is tracked and used to assess how well that student is applying critical thinking and problem-solving skills."

GlassLab published a free whitepaper called "Psychometric Considerations in Game-Based Assessment" in early 2014. "Game-based assessments can provide a rich understanding of the different factors that affect educational achievement and predict how a student’s performance might change over time."

Co-authors of the report include researchers from the Institute of Play, Educational Testing Service (ETS), Electronic Arts, and Pearson’s Center for Digital Data, Analytics and Adaptive Learning.
**Experiential Role-based Edugames**

Players take on the role of particular characters in role-based edugames. Players interact with the game in that role. These are found in edugames developed for all of the segments and for players of all ages. Role-playing edugames are by definition a form of Experiential Learning, also known as Discovery Learning.

Experiential Learning is a learning theory developed by David A. Kolb. The theory posits a cyclical model of learning consisting of four phases: concrete experience (doing), reflective observation, abstract conceptualization, and active experimentation.

There are role-playing serious games for business communication, business management, sales, finance, law, customer service, negotiation, conflict resolution, diplomacy, healthcare, cybersecurity, first responder, hazardous waste, disaster recovery, and public safety for adults. Role-playing games for children usually relate to academic subjects, particularly civics, health, math, history, and science.

Role-based edugames are common in so-called Games for Good, or humanitarian and environmental games. Filament Learning (a division of Filament Games) sells range of role-playing edugames for a variety of academic subjects including biology, astronomy, math, archeology, and civics.

Harvard Business Publishing sells over a dozen online role-based business edugames, ranging from ethics, organizational management, and human resources. "Role plays allow students to practice real-world skills by assuming a specific role and interacting with other students who also play characters in the exercise."

Odeum is a new company that launched in 2016. They target the academic segments. It has premade 3D role-playing games and an authoring platform allowing teachers to develop their own role-playing edugames. It is one of the new commercial Game-based Learning platforms that have come on the market in just the last year.

One of the most popular and well-known role-playing games is Civilization. In June 2016, Take-Two Interactive Software and Firaxis Games announced a partnership with GlassLab to bring a modified version of Civilization V called CivilizationEDU to high schools in North America in the fall of 2017.

"CivilizationEDU will provide students with the opportunity to think critically and create historical events, consider and evaluate the geographical ramifications of their economic and technological decisions, and to engage in systems thinking and experiment with the causal/correlative relationships between military, technology, political and socioeconomic development. GlassLab will add a learning analytics engine to CivilizationEDU to capture students’ progress and assess their problem-solving skills – harnessing the popularity and innovation of interactive entertainment and turning it into a powerful tool for the classroom and alternative to standardized tests."

GlassLab intends to sell annual online subscriptions CivilizationEDU to schools for between $2 and $5 per student. In June 2016, GlassLab reported in the press that there serious games were being used in more than 10,000 schools across the US and Canada.
**Location-based Learning Edugames**

Location-based Learning is one of the "native" types of Mobile Learning defined by Ambient Insight. This new Mobile Learning type emerged in 2009. Developers are designing learning experiences triggered at geotagged physical locations and in time. Interestingly, the time-based triggers can provide learning experiences relating to the past, present, or future.

Location-based Learning suppliers have been leveraging the technology innovations that have been driving location-based services (LBS) from 2-D and 3-D bar-code services to mobile augmented reality technologies; and have taken advantage of proximity marketing—the localized wireless distribution of content. Transmissions can be received by users who have devices capable of and are enabled to receive time and/or place specific information, media, or special offers.

**Figure 6 - Mobile Location-based Learning: Proximity Triggers Knowledge Transfer**

RFID chips, GPS chips, barcodes, SMS short codes, image recognition, and augmented reality technologies are often used in Location-based Learning games, particularly in clinical healthcare environments, first responder situations, consumer and patient education, museums, galleries, tourist attractions, navigation applications, and in the travel industry.

Location-based Learning products are used in many situations, particularly in clinical healthcare environments, first responder incidents, consumer and patient education, museums, tourist attractions, parks, and exhibitions.

Tour and exhibition guides are among the fastest growing type of Location-based Learning. Suppliers create their own apps to sell directly to consumers and offer a range of custom content services for organizational buyers that provide museum tours, gallery tours, history tours, nature tours, and city tours to tourists and patrons.
Augmented location-based learning apps and edugames are popular with young children and are now common in venues that cater to young children. The incredible global popularity of the recently released Pokémon Go by Niantic and Nintendo is a clear indication that well-designed location-based games appeal to users. By July 20, 2016, the edugame had been downloaded over 15 million times after only three weeks on the market.

Jaiden Mehta, managing director at the international research firm IDC, stated in the press in July 2016 that "The innovative combination of AR, gaming and mapping technologies have created a very interesting, indeed addictive, gaming experience which has entranced the world. It will certainly accelerate interest in AR technologies."

**Mobile Augmented Reality Edugames**

Mobile augmented reality (AR) overlays images, schematics, multimedia, 3D objects, animation, location data, and other forms of digital content on real-world objects and locations using the device’s camera and sensors; most AR content is interactive.

Augmented reality and virtual reality are not the same, although the distinction is becoming less clear. In AR, digital information is overlaid on the real world. In virtual reality, the user is totally immersed in a simulated environment. Almost all AR educational products on the market are mobile and Ambient Insight categorizes AR-based learning products as a native type of Mobile Learning.

The augmented elements are "triggered" by object recognition, print-based markers, barcodes, and geotags (collectively these are known as triggers). Mobile augmented reality educational apps emerged in 2010 and had a rocky start. The demand diminished in 2012-2013, but came roaring back in 2014 and the first half of 2015. This is due to the proliferation of new AR hardware and software being developed and marketed by large companies like Microsoft, Sony, Google, Intel, Apple, and Qualcomm and the booming demand across the planet for industrial and field-based augmented reality learning in the corporate segments.

Until recently, the most successful mobile augmented reality learning apps were consumer-facing Mobile Learning products for astronomy, anatomy, and tourism. Popular augmented Mobile Learning apps include Star Chart with 18 million global users and Star Walk with 10 million users across the planet.

All of the major technology players are now in augmented reality and virtual reality. Google and Mattel announced a partnership in February 2015 to launch a smartphone enabled product for the iconic View-Master that displays animated virtual learning experiences when the viewer is pointed at a physical "experience reel" (a physical disk-shaped trigger). It is essentially a hybrid AR-VR edugame. The device shipped in October 2015.

The reel triggers a virtual reality experience on Cardboard's smartphone display. "Mattel's new View-Master offers an easy-to-use and affordable platform that will enable users to take engaging field trips where they can explore famous places, landmarks, nature, planets, and more in 360 degree 'photospheres'. By pairing the View-Master's 'experience reel' and app with an Android smartphone."
The Calgary Zoo has an augmented reality app called Dinosaurs Alive Augmented Reality Experience that is part of their Prehistoric Park exhibits. There are 14 "tags" spread out across the park. When visitors point their smartphones at the tags, they see 3D dinosaurs and can access additional information about the dinosaur. ConocoPhillips donated $50,000 for the custom development of the app.

Some of the most innovative augmented educational products are designed for early childhood learning:

- One of the best known augmented reality platform is PTC's Vuforia (formerly owned by QUALCOMM). Of the 88 AR games in their catalog, 42 were edugames and they were all designed for young children.

- Chromville is an interesting augmented reality app that launched in March 2014 designed for early childhood learning. The Chromville educational apps are triggered by print-based coloring pages. The child points their smartphone at the pages and educational animations appear on the surface of the page. Chromville targets both the consumer and PreK-3 segments with a growing catalog of content on a variety of subjects including biology, astronomy, and anatomy.

- A company called Atlanta AR Design developed an app called ZooKazam that uses paper triggers to launch 3D zoo animals on a device. One of the versions in ZooKazam Atlanta Zoo that teaches children about the various animals in the zoo using very realistic 3D animations. The app allows children to select a range of different weather elements as well.

- Disney has a similar app called Disneynature Explore except the animals are all viewed in their "natural" environment. Children are taken on various adventures. "Kids can select the animal they want to see with the Disneynature Explore app, and then carry out different activities for each. They can either choose to play with brown bears and catch salmons in their neighborhood or their own backyard or they can make animal noises for calling these virtual animals onto the screen. They can also try to help a bear find her cub by following the tracks, or hunt for a warthog with a lion."

- Another interesting augmented reality app for young children is sold by a company called Powerful Plants. The company sells packets of various vegetable seeds that encourage kids to plant their own vegetables. The packets trigger augmented educational content related to the particular vegetable. The content was developed in collaboration with Edutainment Systems. Edutainment Systems specializes in augmented reality edugames for early childhood learning.

- Alive Studios sells a range of augmented storybooks for children called Storybooks Alive. They focus on math and literacy for very young children. They sell the print-based books and provide the augmented reality component for free in the commercial app stores.

Although not a game, one of the most sophisticated AR products on the market is DAQRI's Smart Helmet, which is a hardhat that has a visor that displays procedural data over objects (machinery, construction sites, etc.) as a worker performs job tasks in the field. They are targeting the industrial verticals with the helmet. "Reduce talent and experience gap with repeatable, fully modularized, and contextualized training capturing experts’ knowledge and experience; avoid costly human teaching errors with the use of precise data driven decision-
support training." This product merges the knowledge transfer and learning transfer processes into a simultaneous experience.

**Virtual Reality Edugames**

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

The latest innovations in VR edugames are 100% immersive and experienced while wearing a headset or using a 3D viewer like Google’s Cardboard. These new immersive Game-based Learning products are what Ambient Insight defines as virtual reality edugames.

In January 2015, the game developer Nival launched a new division called NivalVR that focuses on mobile educational VR games. Their first game was inMind and their inCell app came out in September 2015. The edugames cost $6.

Cerevrum "is a cutting-edge software development group with a focus on progressive educational VR projects." Their first VR edugame was a brain trainer. "Cerevrum helps you learn and improve cognitive abilities in virtual reality. Cerevrum is rethinking learning itself and designing fun VR neurogaming experiences."

In this whitepaper, revenue forecasts are not provided for VR Edugames. This type of edugame is too new to establish baselines for calibrating revenue forecasts. For a new product on the market, it typically takes 2-3 years to establish revenue baselines. It should be noted that augmented edugames were surrounded by hype in 2010, but sputtered with slow growth until reinvented in 2015. What is different for VR-based education products is the presence of the major technology players in the market including Google, Apple, and Microsoft.

In July 2015, a company called Touchstone Research released the results of a survey of 500 children on the topic of VR. 79% of the kids were aware of VR. But the interesting thing is what they said they wanted to do with VR: 64% wanted to visit another country, 64% wanted to go someplace they could not go in reality (like space or another planet), 62% wanted to go on an adventure, and 58% wanted to travel back in time (not surprisingly, most of them wanted to go back to see dinosaurs in their natural surroundings.) This is invaluable information for suppliers developing educational VR apps for children.

**Sources of Data on the US and Worldwide Edugame Market**

The financial reports from the domestic and international online education companies provide invaluable insight into the rapidly evolving market conditions and revenue opportunities in any given country. The financial reports of publicly-traded online education suppliers are particularly useful in providing insight into buying behavior in specific regions and countries.
Most of these learning technology companies focus on particular products, buying segments, and specific types of content so their financial reports provide details on specific buying behavior patterns in each of the buying segments analyzed in this whitepaper.

The major international educational publishers are active in most countries of the world. Pearson, McGraw-Hill, Santillana, Cengage Learning, Singapore-based Popular Holdings, Japan-based Benesse, Macmillan, France-based Hachette Livre (Lagardère), Houghton Mifflin Harcourt, the Klett Group in Germany, and the European publisher Sanoma Learning all sell Game-based Learning products. Pearson joined Google's Expeditions project in June 2016.

Rosetta Stone acquired Vivity Labs in late 2013 and announced at that time that they expected the product to add $3-5 million in revenues for the company in October 2014.

There are several analytics firms that track the top selling mobile apps in the major app stores in countries across the planet. All of them have an education category. App Annie is the best-known global app analytics firm; they provide extensive data on the top selling and top downloaded Mobile Learning apps in all of the countries analyzed in this report. They have two categories related to education: general education apps and educational games. Their top 100 rankings provide insight on the demand for specific types of content.

A comprehensive source of data on trends in the Game-based Learning industry is the Gamesandlearning.org site. "Gamesandlearning.org is a news and information service aimed at increasing the amount of information available for those interested in developing and funding new educational games for children and young adults. The site is operated by the Joan Ganz Cooney Center at Sesame Workshop and is a project of the Games and Learning Publishing Council. The Council and the Site are made possible by a grant from the Bill & Melinda Gates Foundation."

One of the most valuable services that Gamesandlearning.org provides to the Game-based Learning community is the aggregation of research on the effectiveness of edugames.

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**2016-2021 Worldwide Game-based Learning Revenue Forecasts**

Worldwide revenues for edugames (mobile and non-mobile combined) reached $2.6 billion in 2016. The five-year compound annual growth rate (CAGR) is a robust 22.4% and revenues will surge to $7.3 billion by 2021. The global Game-based Learning revenues are heavily concentrated in Asia, followed by North America.

**Where are the Buyers? Global Game-based Learning Revenues by Region**

Asia accounts for the vast majority of mobile edugame revenues throughout the forecast period. China is the top edugame buying country in Asia (and indeed, the world), followed by the US, South Korea, and Japan.