2016 Learning Technology Research Taxonomy

Updated: January 2016
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For more information about this research, email: info@ambientinsight.com
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Ambient Insight's Research Taxonomy

Over several decades, Ambient Insight principals have refined a sophisticated and precise learning technology product categorization schema. Our research taxonomy is the backbone of our quantitative data repository. It is the foundation of our classification system that enables us to identify, catalog, and index addressable revenue opportunities for suppliers marketing specific products to discrete buying segments in particular countries across the planet. The purpose of our taxonomy is to provide tactical precision to suppliers competing in a complex global market.

Figure 1 – Ambient Insight’s Learning Technology Research Taxonomy

The purpose of our taxonomy is to provide clarity to suppliers competing in a complex global market. This document illuminates how we define different learning technology product types and buyer segments, as well as describes our research methodology. These definitions are a foundation for our research and analysis.

We track buying behavior in over 120 countries across seven international regions. **We track six buyer segments that buy seven types of learning technology products from four types of suppliers.** The four supplier types in our taxonomy map directly to the subcategories of learning technology products and services.

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We have the most complete view of the international demand for learning technology in the industry.

**Who are We?**
Ambient Insight principals are well-known competitive intelligence experts in the global learning technology industry. Ambient Insight was founded in 2004 by the original members of the Advanced Knowledge Engineering team that built the Microsoft Online Learning Institute (MOLI), the world’s first international commercial eLearning business, which launched in 1995.

Ambient Insight publishes quantitative syndicated reports. In our syndicated reports, Ambient Insight provides quantitative market research by customer segment (demand-side) and by product category (supply-side) based on our taxonomy and our proprietary Evidence-based Research Methodology (ERM).

**We Are Unique**
We are the only research firm in the industry that has developed a precise learning product taxonomy based on pedagogical principles, knowledge engineering systems, data science, and information architecture. We specialize exclusively in learning technology. We continue to modify, refine, and enhance our taxonomy as products and buying behavior changes. For example, Mobile Learning value added services (VAS), a subset of Mobile Learning, is essentially a new type of learning product that has come on the market in the last two years. Smartphone-based virtual reality educational apps were non-existent prior to 2014.

**We Are Dependable**
We serve our clients with targeted custom online learning research that meets and often exceeds a client's expectations. All custom research is delivered in the agreed upon timeframe. We pride ourselves on meeting deadlines - every time. Ambient Insight strives to make clients self-sufficient. Our project strategy is to provide continuous knowledge transfer that allows clients to own their intellectual property and to help them reduce dependencies on external consultants, including ourselves.

**We Are Precise**
We are a quantitative research firm. Quantitative market research is an empirical process in which deductive mathematical models are used to identify and calibrate statistically-valid variables that contain measurable data about target products, market conditions, and/or buyers. We use predictive analytics software and proprietary algorithms to triangulate measurable Total Addressable Market (TAM) forecasts and tangible revenue opportunities. Ambient Insight knows suppliers need precise product definitions and forecasts across all buyer segments to compete in the international learning technology industry. We provide our clients with precise actionable data.

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**We Are Ethical**

We do not endorse specific suppliers or products. None of our syndicated research is influenced, sponsored, or subsidized by suppliers. We do not evaluate, compare, or rank products. We understand the competitive value of the intellectual property owned by our clients and we take non-disclosure agreements (NDAs) seriously. All of the proprietary information that our clients have shared with us is kept in strict confidence.

**Our Quantitative Evidence-based Research Methodology**

Ambient Insight provides quantitative market revenue forecasts using our proprietary Evidence-based Research Methodology (ERM). We developed ERM by modifying and refining industry-standard quantitative methods to reflect the unique characteristics of the international learning technology market. The ERM is an iterative process with five key phases that:

- Isolate the target market
- Triangulate the baseline (the floor) and the topline (the ceiling) revenue boundaries
- Forecast the Total Addressable Market (TAM) for specific products
- Generate "market share maps" by supplier
- Quantify actionable competitive intelligence

**Figure 2 – Ambient Insight's Quantitative Evidence-based Research Methodology (ERM)**
Each phase of the ERM functions as an input and output in the process. In the sense that one phase "informs" the next phase, it is an input. Each phase also generates standalone data points, which are discrete outputs.

The ERM progresses from general patterns (the big picture) to very precise granular patterns. Once the target market is isolated, calculations triangulate the potential revenues boundaries. Actual revenues cannot be below the baseline boundary, known in the research industry as "the floor." Likewise, actual revenues cannot be any higher than the topline boundary. The TAM is located within these boundaries.

**Data Sources: Ambient Insight's Actionable Competitive Intelligence**

Ambient Insight generates actionable competitive intelligence by mapping the competitive landscape, performing supply-side and demand-side analyses, and by compiling data from a wide spectrum of information broadly classified as leading and lagging indicators.

- **Leading indicators** signal future events and include venture capital investment trends, patent applications, technology-related legislation, technology standards development, product research trends, product substitution patterns, technology infrastructure trends, labor demand, and outsourcing demand.

- **Lagging indicators**, referred to as "rear-view mirror" data, are past events captured in data that include supplier activity, M&A activity, divestitures, executive hiring patterns, US Economic Census data, SIC and NAICS tax data, SEC filings and financial reporting, international stock exchanges, local and federal government data, Universal Commercial Code banking reports, public-domain business records, court records, press releases, government export trade data, regional trade association resources, and international industry association information.

Many of the companies tracked by Ambient Insight are publicly traded on various international stock exchanges and their financial disclosures provide baseline data for global sales, regional competitive pressures, and specific country-by-country business activity.

Many private companies, particularly outside the US, report their revenues as a matter of policy. Non-profit education organizations (like ETS, Cambridge University Press, and Oxford University Press) also report their revenues. These financial disclosures provide baseline data for the demand for specific types of products in particular countries and regions.

Federal government and industry trade bodies, particularly in the US, Japan, South Korea, Germany, France, Canada, Ireland, China, Brazil, India, and the UK, provide extensive data on export opportunities in specific international education markets.

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Federal, state, provincial, and local agencies provide detailed reports on technology funding, the adoption of learning technology, and the buying behavior in the academic, vocational, and workforce markets. Educational legislation and policy mandates often include very detailed data on funding allocated to learning technology.

Several countries (particularly China, Japan, and South Korea) track consumer adoption of learning technology products and publish reports that include total annual expenditures in the consumer segment. The European Union funds ongoing research on the adoption of electronic learning in the EU and Eastern Europe. Several international bodies such as the World Bank, the UN, and the Commonwealth of Learning provide funding for projects and detailed data on the adoption of learning technology in developing countries.

There are now distance learning and learning technology trade associations in every region of the world. Publications, event presentations, and press from these associations provide valuable insight into the market conditions inside particular countries and regions. The various publishing, training, and education associations across the globe provide a wealth of information about the migration to digital formats and the buying behavior in specific countries.

**Countries Tracked by Ambient Insight**

Ambient Insight tracks the learning technology markets in 120 countries. While there can be similarities in buying behavior for a few countries, they are
usually confined to a particular buying segment. For example, consumer preference for certain types of Mobile Learning apps can be very similar. Brain trainers are now popular in over 100 countries. In general, however, the buying behavior is usually quite different in each country, particularly in the academic and government segments.

**Table 1 – The 120 Countries Tracked by Ambient Insight**

<table>
<thead>
<tr>
<th>Number of Countries Analyzed in Each Region</th>
<th>Countries Analyzed in this Report by Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 Countries in Africa</td>
<td>Algeria, Angola, Benin, Botswana, Burkina Faso, Cameroon, Chad, Côte d'Ivoire (The Ivory Coast), the Democratic Republic of Congo (DRC), Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe</td>
</tr>
<tr>
<td>21 Countries in Asia Pacific</td>
<td>Australia, Bangladesh, Cambodia, China (including Hong Kong and Macao), India, Indonesia, Japan, Laos, Malaysia, Mongolia, Myanmar (Burma), Nepal, New Zealand, Pakistan, the Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, and Vietnam</td>
</tr>
<tr>
<td>15 Countries in Eastern Europe</td>
<td>Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Serbia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.</td>
</tr>
<tr>
<td>17 Countries in Latin America</td>
<td>Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, Uruguay, and Venezuela.</td>
</tr>
<tr>
<td>12 Countries in the Middle East</td>
<td>Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Turkey, the United Arab Emirates (UAE), and Yemen</td>
</tr>
<tr>
<td>2 Countries in North America</td>
<td>Canada and the United States</td>
</tr>
<tr>
<td>24 Countries in Western Europe</td>
<td>Austria, Belgium, Bulgaria, Croatia, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom</td>
</tr>
</tbody>
</table>

**International Buyer Segmentation Descriptions**

Ambient Insight provides market research across all the global buyer segments including:

- Consumers
- PreK-12 academic institutions
- Higher education institutions
- Local, state/provincial governments
- Federal governments
- Corporations and businesses
Consumers

Ambient Insight defines consumers as individual buyers that purchase products directly. It should be noted that consumers do not buy tools or platforms.

The consumer segment is the only buying segment in which the buyer and the user are identical. In all other segments the buyers and the users are not the same.

Consequently, buying behavior in the global consumer markets tend to provide the best data on customer satisfaction from a product standpoint. In all other segments customer demand is based on the needs of organizational buyers, not the actual users. The consumer demand for technology-based learning products is different in each country across the planet.

PreK-12 (Preschool, Primary, and Secondary) Institutions

PreK-12 school systems are different in each country. Consequently, academic buying behavior is quite different in each country. In some countries, schools are autonomous and can make their own buying decisions. In other countries, central government agencies not only decide what products are used, but also purchase the products directly.

Figure 4 – International Catalysts Driving Adoption of Learning Technology in the Global Academic Segments
A country’s educational policies are often more important than a country’s technical readiness when it comes to the adoption of learning technology. A significant global catalyst driving the adoption of learning technology in the schools is the migration to digital content in the PreK-12 buying segments throughout the world.

There are now major digitization efforts going on in the school systems in South Korea, Thailand, China, Taiwan, Vietnam, Turkey, Brazil, France, Poland, Italy, Spain, Ukraine, Azerbaijan, Kazakhstan, Georgia, Brazil, Mexico, Japan, Singapore, Qatar, Kuwait, the United Arab Emirates (UAE), and in various school systems in the UK and the US.

While all domestic school systems are unique, the US stands out because it has the largest population of online PreK-12 students, so far. The large (and growing) number of children attending online primary and secondary schools **fulltime** in the US is a trend found nowhere else in the world.

**Higher Education and Tertiary Institutions**

The adoption of learning technology in higher education institutions varies dramatically from country to country. Government-mandated educational policies act as either catalysts or inhibitors.

One interesting trend across the globe is the emergence of **national** virtual universities funded by the government. Finland, Sweden, Norway, Bulgaria, Estonia, Malaysia, Tunisia, the Philippines, Mexico, Uganda, Australia, Kenya, Pakistan, and Switzerland have national virtual universities.

There are variations on these centralized virtual universities. The Bavarian Virtual University in Germany is an example of a state-funded virtual campus. ASEAN Cyber University, UNISA, and the African Virtual University are examples of pan-regional virtual universities.

Considering their large international student enrollments, the UK’s Open University and India’s Indira Gandhi Open University (IGNOU) can be considered international virtual universities.

**Local and State/Provincial Governments**

Relative to buying behavior, the local and state/provincial governments vary widely across the planet. The one common thread is the impact of training budget cuts induced by slowing economies in many countries in the world. Education and training budgets have been dramatically reduced except for training for public safety personnel.

One common adoption of learning technology in local and state governments around the world is electronic tests related to obtaining a driving license. Government agencies pay custom content service providers to create test prep products and usually offer the test prep to citizens for free. The agencies are
also converting their paper-based portions of the driving test to electronic formats, which dramatically reduces the costs compared to paper-based tests.

Interestingly, the 2008 recession has contributed to a spike in expenditures on learning technology in city and county libraries. Libraries across the globe have been purchasing learning content, particularly around workforce development, to help their patrons retrain for new jobs. Language learning content is also popular with library patrons. As of early 2015, US-based OverDrive (acquired by the Japanese company Rakuten in March 2015), one of the leading digital content suppliers for libraries, had over 15,000 library customers across 21 countries. A significant portion of their online content catalog is educational.

**Federal Governments**
A consistent international pattern is the growing demand for learning technology in government agencies. Federal governments are not only direct buyers of learning products for their civilian employees and military personnel, they also fund a great deal of technology-based learning initiatives as part of citizen outreach and export programs. For example:

- The French Ministry of Education, Youth, and Sports hired SIVECO Romania to build a professional development learning portal for teachers in France. The project was co-funded by the European Social Fund and was funded through 2014.

- The largest domestic Self-paced eLearning provider in the UK, in terms of enrollment, is learndirect, a federally-funded organization. The organization was created by Ufi, a UK charitable trust, to provide free vocational online learning in the country and they now serve 8,500 users a day. Pearson acquired learndirect's electronic assessment assets in September 2015.

- The South Korean government subsidizes a great deal of online learning. For example, the government's Cyber Home Learning System is essentially a national virtual school. The government also actively promotes domestic learning technology suppliers in foreign markets.

- Colombia's National Learning Service (SENA) awarded Rosetta Stone a million dollar contract to provide English language learning to over 100,000 Colombian citizens.

Brazil won the competition to host two major games: The 2014 World Cup and the 2016 Summer Olympics. Brazil's Ministry of Tourism awarded Englishtown a multimillion dollar multi-year contract to provide online language learning to the country's tourism professionals.
Corporations and Businesses
Large companies (particularly in the US) were early adopters of learning technology and during the current gradual economic recovery they are reducing their expenditures on all types of training and education products. On the other hand, small and medium-sized businesses (SMB) are migrating away from classroom products to a range of learning technologies.

The current economic conditions are influencing the growth rates of expenditures on specific types of content. Companies tend to calibrate budgets for certain types of content during economic recoveries, increasing expenditures in some areas and decreasing them in others.

One major change in the global corporate learning technology markets that emerged in 2014 is the presence of next-generation augmented and virtual reality educational products for industrial workers.

Learning Technology Product Definitions
Ambient Insight provides market forecast research for seven pedagogically-defined learning products:

- Self-paced eLearning (courseware)
- Digital Reference-ware (digital eTextbooks, instructional audio, lecture video, diagrams, maps)
- Collaboration-based Learning (live online classes and live tutoring)
- Simulation-based Learning
- Game-based Learning
- Cognitive Learning (behavior modification)
- Mobile Learning

While our product definitions are discrete, there are many cases where product types converge. For example, a Game-based Learning product may be designed for PCs or for handheld mobile devices. The latter could also be described as Mobile Learning.

Self-paced eLearning Courseware
Ambient Insight defines eLearning as self-paced courseware products. This includes off-the-shelf content, installed learning management platforms and authoring tools, and two types of services (content and technology).

The defining characteristic of Self-paced eLearning is the pedagogical structure imposed by formal instructional design and systematic development of the products.

There is a significant degree of "resistance" to traditional packaged Self-paced eLearning content in various regions, particularly in Asia, the Middle East, and Africa. This resistance is often due to the fact that content is translated, but not localized. Additionally, the systematic instructional design process
pioneered in the US results in a very distinct product design and a user experience that does not resonate in many countries.

**Digital Reference-ware**

Ambient Insight defines Digital Reference-ware as digital video, text, or audio reference content. This product type includes academic content, "how to" content, technical reference, scientific abstracts, medical research, and market research content. Digital audiobooks, eBooks, eTextbooks, dictionaries, video courses, maps, diagrams, schematics, and online technical manuals are common formats.

The vast majority of digital learning content in the world still resides in text-based formats. However, there is a surge in the demand for other types of digital reference media. There is an explosion of peer and user-generated content ranging from Wikipedia-like products, user-populated search engines, podcasts, and "how-to" videos. Likewise, the rapid digitization of academic content around the world is now a major catalyst for the global Digital Reference-ware market.

**Collaboration-based Learning**

Collaboration-based Learning is human-to-human collaboration and mentoring. As a knowledge-transfer method, by definition, collaboration requires the interaction between two or more people. Consequently the use of **synchronous** collaboration platforms is the defining pedagogical characteristic of Collaboration-based Learning.

Ambient Insight defines Collaboration-based Learning products sold via the hosted SaaS model as Technology Services in our market research. Access to the products is sold as a service and customers do not actually own the products.

There are five specific types of Collaboration-based Learning platforms:

- Remote assistance and screen-sharing tools
- Virtual labs
- Virtual classrooms and virtual learning environments (VLE)
- General-purpose collaboration platforms used for learning
- Classroom collaboration management systems

With the exception of classroom collaboration management systems, which to date, are usually sold as installed solutions; Collaboration-based Learning can all be sold either as hosted cloud-based solutions or as installed platforms.
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 and Game-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.

Virtual Reality (VR) Educational Products Hit the Market

The second wave of virtual reality educational products starting hitting the market in 2015. By October 2015, Google announced that Cardboard had been downloaded over fifteen million times. Cardboard viewer kits in just one year. In October 2015, the New York Times distributed an additional one million Cardboard viewers to their subscriber base.

Google started offering schools a free bundle called Expeditions based on the low-cost Cardboard VR technology in May 2015. As of November 2015, over 100,000 PreK-12 students in the US were using the platform. The bundle comes with smartphones for the students, the cardboard (literally) viewer, and a tablet for the teacher preloaded with a variety of field trips. The teacher selects the expedition on the tablet and all the students experience it simultaneously in the VR viewers. Google announced that it was working with the Planetary Society, the American Museum of Expeditions, and the Palace of Versailles on content for Expeditions.

A company called WEARVR operates a VR App marketplace. They have several categories related to learning including educational, architecture, travel, exploration, space, and virtual worlds. They support all the major VR headsets. They publish a weekly top-ten list and educational apps consistently rank in the top ten. WEARVR obtained $1.5 million in private equity in March 2015. One of the most popular VR apps according to WEARVR is DinoTrek designed for Google Cardboard and developed by Geomedia and HIVE VR.
Suppliers are already meeting the growing demand for VR-based learning for young children and students in the early grades. 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). 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, kids will immediately experience an imaginative and interactive learning environment."

**Augmented Reality (AR) Learning Products are Game Changers**

Augmented reality (AR) technology is evolving at a fast pace; new commercial innovations are coming on the market at a rapid rate. The products are too new and it is too early to make forecasts until a baseline emerges. Mobile AR is an ideal technology for Mobile Learning and there are dozens of new products on the market.

Augmented reality and virtual reality are not the same. 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. VR-based learning products are by definition a type of Simulation-based Learning.

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.

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 for industrial and field-based augmented reality learning in the corporate segments across the planet.

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 mobile players are now in the augmented reality market; they have entered the market by acquisition and internal product development. In
May 2015, Apple acquired Germany-based Metaio. Metaio developed the popular augmented reality platform called Junaio; this is a strong validation of the AR market. The vast majority of apps developed with Junaio are travel and tourism guides.

The major advantage augmented reality has in training is quantifiable performance support. In July 2015, Boeing shared the results of an internal study on the assembly of a wing unit using three groups; one group with paper PDF instructions, one group with the PDF instructions on a tablet, and one group with AR objects and guided instructions overlaid on the assembly on a tablet screen. "The AR-tablet group were 30 percent faster and 90 percent more accurate on their first tries than the other groups."

**Game-based Learning**

Game-based Learning is a knowledge transfer method that utilizes "gameplay," which includes some form of competition (against oneself or others) and a reward/penalty system that essentially functions as an assessment method. Game-based Learning products (edugames) 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 (learning), pedagogical intervention, or cognitive remediation. The first two are well known but the third is relatively new.

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

Virtual worlds designed for children often embed edugaming in semi-immersive environments. Whyville, JumpStart, and Mingoville are good examples of virtual worlds that include edugames designed for children. Most virtual worlds for children under ten include edugames.

Virtual worlds 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.

**Cognitive Learning**

Webster's Dictionary defines learning as "modification of a behavioral tendency by experience." Technology-based Cognitive Learning products are behavior modification products designed to improve or enhance perception, working memory, comprehension, emotional states, decision making, fluid intelligence (general problem solving), and reasoning.
They are meta-cognition products that enable users to modify cognitive behavior (learn) by understanding and manipulating the learning process itself. Behavior modification is a fundamental component of learning theory. Learning and behavior modification are synonymous; behavior modification is structured learning.

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.”

There are three primary types of Cognitive Learning products on the market:

- Cognitive assessments
- Cognitive and intelligent tutors
- Brain training and brain fitness products.

Cognitive assessments evaluate and measure the spatial perceptions, verbal abilities, memory, problem-solving skills, temperament, and the so-called “intentional” states of users. These products are used in two major areas: in the evaluation of childhood cognitive abilities and in employee personality screening during the hiring process.

Cognitive and intelligent tutors are meta-cognition technologies that simulate the behavior of a human mentor and provide personalized responses, remediation, and interventions in real time based on the knowledge, behavior, and cognitive abilities of a particular user.

Brain training and brain fitness products are based on brain-based learning theories emerging from educational psychology and educational neuroscience. Researchers and suppliers have a growing body of empirical evidence to show that people who use the products can condition and train the brain to improve memory, attention, visual and spatial awareness, auditory processing, linguistic skills, planning skills, and problem solving.

**Mobile Learning**

Ambient Insight defines Mobile Learning as knowledge transfer events, content, tools, and applications accessed on handheld computing devices. In our taxonomy, laptop and netbook computers, while perhaps mobile, are not considered handheld devices.

Many types of handheld devices are used for Mobile Learning including:

- Dedicated gaming devices
- Personal media players (PMPs)
- Handheld tablets and slates
- Handheld eReaders
- Personal learning devices (PLDs) designed solely for learning and performance support
- Mobile phones (feature phones and smartphones)
Mobile Learning now represents a product substitution threat to Self-paced eLearning courseware and there is clear evidence that it is cannibalizing courseware revenues, particularly in Asia, Africa, and Latin America.

Large rural populations across Asia, Africa, and Latin America are now avid users of Mobile Learning technology, while very few have experienced Self-paced eLearning on a desktop. In developing economies, PC penetration is often low, yet mobile subscriptions are relatively high.

For example, only 15.1% of the total African population has access to the Internet via a computer. In contrast, 76.4% of the population accesses the Internet via a mobile device.

Native Mobile Learning Products and Services
Ambient Insight defines four major types of "native" Mobile Learning products: Mobile Decision Support, Location-based Learning, and Mobile Learning VAS (value added service).

- **Mobile Decision Support** is an interactive application that provides sequential performance and decision support based on the input provided by the user. Handheld Decision Support is very common in corporate mobile field force, industrial, government, first responder, and clinical healthcare environments. The latest innovations are decision support displayed on headsets and smart glasses.

- **Location-based Learning** products are built on location-based services (LBS) technology. It is a type of knowledge transfer enabled by wireless network interfaces and sensors responding to the actions of a user at a specific location in space and time to create a situated learning experience. RFID chips, GPS chips, barcodes, Quick Response (QR) codes, Short Message Service (SMS) texts, and image recognition are used in Location-based Learning.

- A **Mobile Learning VAS** is a subscription-based product sold directly to consumers and organizations by telecom network operators, device makers, and content suppliers. The content is usually delivered over mobile networks via audio, SMS, or Interactive Voice Response (IVR). To date, Mobile Learning VAS products are heavily concentrated in Asia, Africa, and Latin America.

Subscription-based Mobile Learning content sold as a value-added service is quite new on the market and essentially represents a new type of Mobile Learning product – a fusion of packaged content and services. Ambient Insight has labeled this new product type "Mobile Learning VAS".

The mobile network operators (MNOs) initially launched their Mobile Learning VAS products in developing economies and are now expanding into the developed economies. Combining the Mobile Learning VAS products with the "legacy" Mobile Learning market in the developed economies exposes the clear contours of a cohesive worldwide Mobile Learning market. So far, language learning content is the most popular type of Mobile Learning VAS, which...
obviously threatens the revenues of the other language learning products. It is no surprise that the major educational publishers with language learning content are partnering with the carriers.

**Mobile Edugames**
Ambient Insight defines six categories of mobile edugames:

- Knowledge-based games
- Skills-based games
- Brain trainers
- Language learning games
- Location-based learning games (emerged in 2009)
- Mobile augmented reality games (emerged in 2010)

**Knowledge-based Games**
Handheld and mobile knowledge-based edugames are designed to help users learn and memorize concepts, principles, facts, patterns, and rules (such as verb conjugation.) These edugames are usually designed as quizzes, flashcards, or trivia games.

They are relatively easy to design and there are commercial development tools on the market. Players compete for high scores and often the incentive is a race against the clock. In the current market, the majority of knowledge-based mobile games are designed for the PreK-3 market. They focus predominantly on the "3 R's" to help children learn to recognize shapes, colors, letters, words, and numbers. Test prep edugames for college entry exams are also prevalent.

**Skill-based Games**
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.

**Brain Trainers and Brain Fitness Games**
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.

The "fitness" metaphor derives from physical exercise concepts. Researchers and suppliers have a growing body of empirical evidence to show that people who use the products can condition and train the brain to improve memory, attention, visual and spatial awareness, auditory processing, linguistic skills, planning skills, and problem solving. Ambient Insight does not categorize or
include in forecasts as brain fitness or brain trainer products those products that are designed for cognitive rehabilitation or for clinical diagnosis. Brain trainers continue to be popular in the US and Canada. 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.

**Language Learning Games**
Memorizing foreign words is knowledge-based, while using those words in speech and writing is a skill. Ambient Insight breaks out mobile language learning edugames for suppliers because they are part of the greater language learning market. There is a growing demand for language learning edugames on mobile devices. 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.

**Location-based Learning Games**
Location-based Learning games, one of the “native” types of Mobile Learning, emerged in 2009. Essentially, developers are designing educational game play around physical locations and time.

**Figure 5 – Proximity Triggers Location-based Learning**

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.

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, tourist attractions, navigation applications, and in the travel industry.

**Mobile Augmented Reality Edugames**

Ambient Insight defines **mobile augmented reality** in this way: Mobile Augmented Reality utilizes images, schematics, audio, multimedia, historical context, location data, and other forms of content overlaid on real-world objects via the device’s camera and manipulated by users holding a mobile device. The augmented elements are triggered by specific objects, print-based markers, and/or by location coordinates.

Mobile augmented reality games emerged in 2010. Ogment, founded in 2009, was one of the first venture-backed companies that went into business to develop and publish augmented reality games.

**Mobile Virtual Reality Edugames**

Virtual reality (VR) immerses the user entirely in a simulated world and augmented reality (AR) overlays digital content on the real world. If either of them are game-based, they can both be categorized as types of Game-based Learning. Commercial virtual reality educational products were quite rare prior to 2014. This changed in late 2014 and 2015; new virtual reality educational apps are coming on the market at a steady pace.

This coincides with a spate of new VR headsets hitting the market (or that will hit the market in 2016). In March 2014, FaceBook bought Oculus, a virtual reality headset developer, for a staggering $2 billion; this clearly validates the market for VR. As of July 2015, the headset was only available to developers; the consumer version of the headset will interface with the Xbox and will be released in early 2016; it will certainly be marketed heavily by FaceBook. Oculus already has over 50 education titles in their developer catalog.

Most VR systems coming on the market require integration with either a PC or a gaming console. In that sense, only the wireless headset can be considered a mobile device. The proliferation of new PC-based and console virtual reality platforms is a catalyst for Game-based Learning and Simulation-based Learning.

On the other hand, Samsung, LG, Google, Shoogee, and Carl Zeiss are developing VR systems that are smartphone enabled. These products are catalysts (the delivery channels) for Mobile Learning apps and mobile edugames. Virtual reality is ideal for learning experiences involving travel, history, exploration, science, medicine, architecture, and engineering.
Subcategories of Learning Technology Products

Ambient Insight defines four sub-types of learning technology products and services for our seven product types. While some suppliers offer a full catalog of products, most tend to specialize in specific areas. The four sub-types are:

- Retail packaged content
- Custom content services
- Value added services (VAS)
- Authoring tools and learning platforms

Not all of the seven learning technology products have all of these subcategories yet.

Retail Packaged Content

Packaged content includes self-contained products delivered on tangible media such as DVDs, as well as web-based content. Packaged content types include (but are not limited to):

- IT-related
- General academic textbooks, courses, and references
- Exam and test preparation
- Hobbies and "how to" guides
- Tourist guides
- Vertical professional skills and professional development
- Channel, partner, and supplier education
- Continuing education (CE) and continuing medical education (CME)
- Professional licensure and certification
- Internal and external sales
- Decision and performance support
- Business processes
- Customer, patient, or constituent education
- Business and finance
- Organizational, management, and leadership development
- Compliance and mandated learning
- Language learning

Ambient Insight can break out each of these content types to provide clarity for content suppliers. For example, language learning can be broken down further by revenues for specific languages. Likewise, exam and test prep can be broken down by specific tests.

Custom Content Services

Custom content services cover a wide range of services including analysis, design, development, conversion, delivery, localization, translation, and maintenance of courseware content.

Content services is a complex global industry with literally thousands of regional suppliers offering services to local businesses, major national brands
offering services to large companies, business process outsourcers (BPOs) offering services to global buyers, and well established "courseware factories" in Canada, Ireland, India, China, Russia, and Pakistan selling retail services directly to companies and selling wholesale services to BPOs.

**Value Added Services (VAS)**

It should be noted, that not all education-related value added services (VAS) are mobile. For example, McGraw Hill, Pearson, and Houghton Mifflin Harcourt provide value added services designed for PCs. Yet, it is the mobile versions of educational value added services that are having the most dramatic impact on the global Mobile Learning industry.

Mobile Learning has spread like wildfire across the planet primarily due to the launch of dozens of successful Mobile Learning value-added service (VAS) products sold directly to consumers and organizations by telecom network operators, device makers, and content suppliers.

On average, 5-6 new Mobile Learning VAS products are launched somewhere in the world every month. Most of them are sprouting up in developing economies. This has major implications for the Mobile Learning industry. **Suppliers in developing countries are now driving the innovation in Mobile Learning**

**Authoring Tools and Learning Platforms**

The current Self-paced eLearning authoring tool market is dominated by products marketed as "rapid learning" tools. Many of these tools originated as screen capture utilities and have been modified to create self-paced courseware as well.