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Advanced Learning Technology Research

The 2019 Global Learning Technology Investment Patterns:
Another Record Shattering Year

Analysis by: Sam S. Adkins

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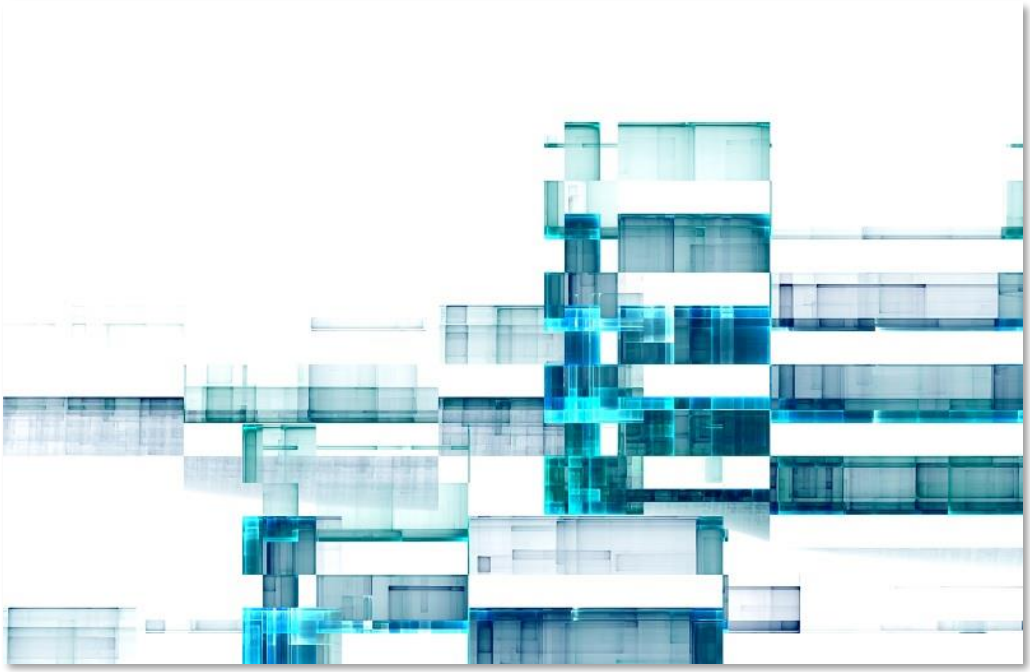

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About Metaari

Metaari (formerly Ambient Insight) is an ethics-based quantitative market research firm that identifies revenue opportunities for advanced learning technology suppliers. Metaari publishes quantitative syndicated reports that break out revenues by customer segment (demand-side) and by product category (supply-side) based on our industry-leading learning technology taxonomy and our Evidence-based Research Methodology (ERM).

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

About the Analyst

Sam S. Adkins is the CEO and Chief Researcher at Metaari. Sam has been providing market research on the IT Training and learning technology 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 advanced learning technology research across several technologies including mobile, augmented reality, virtual reality, artificial intelligence, cognitive systems, psychometrics, simulation platforms, robotics, and game engines.

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.

Sam was the co-founder and Chief Research Officer for Ambient Insight between 2004 and 2016 before rebranding the company to Metaari in early 2017. Sam was a business development manager for Microsoft's Training and Certification group. During his eight years at Microsoft, he managed the Advanced Knowledge Engineering team that built the world's first commercial online learning business (The Microsoft Online Learning Institute). Prior to that, he was a Senior Instructional Designer at United Airlines.

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

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

Sam Adkins and Tyson Greer founded Ambient Insight in 2004. Ambient Insight ceased operations in late 2016 and rebranded as a new company named Metaari that launched in January 2017. "Ambient Insight has been in operation for twelve years and we have a well-respected brand and a very successful company," comments Adkins. "The global learning technology market has changed dramatically in the last few years and the new advanced learning products coming on the market essentially represent a 'brave new world' in education. We want to be an active part of this new world and launched our new company to focus on these incredible innovations."

Scope of this Whitepaper

This analysis includes investments made to three legacy learning technology products and seven advanced learning technology product types. The three legacy products include self-paced courseware (eLearning), reference-ware (digital audio, video, and eTextbooks), and collaboration-based products (live online classes and live tutoring). Metaari discontinued commercial forecast analyses for these legacy products in late 2016, but still tracks the funding going to the companies that sell these products.

The global five-year compound annual growth rates (CAGRs) for two of these products (eLearning and reference-based products) are now quite negative (particularly in the US) and while the investments are still relatively high, the growth rates and the investments being poured into advanced learning technology are far outpacing the activity surrounding the legacy products.

The investment totals in this whitepaper include crowdsourced, seed, early stage, expansion stage (growth capital), later stage, angel, venture capital, private equity, accelerator/incubator cash awards, debt financing, and initial coin offerings (ICO).

The funding totals in this whitepaper do not include government grants (such as SBIR grants), government-funded accelerators (like Start-Up Brasil), or corporate foundation grants. This whitepaper does not include investments made by non-profit educational institutions unless the investments are made to commercial spinoffs.

This analysis does not include leveraged buyouts or acquisitions made by investment firms. Once an investment firm takes a majority stake in a company, Metaari defines that as an acquisition, not an investment.

The whitepaper only covers digital learning technology companies that sell digital products directly related to knowledge transfer (instruction) and behavior modification and does not deal with investments made to print-based, brick-and-mortar, classroom equipment companies, or non-instructional software (such as fintech, HR systems, student retention and engagement systems, academic messaging platforms, or student information systems). Metaari does not define these peripheral academic products as learning technologies.

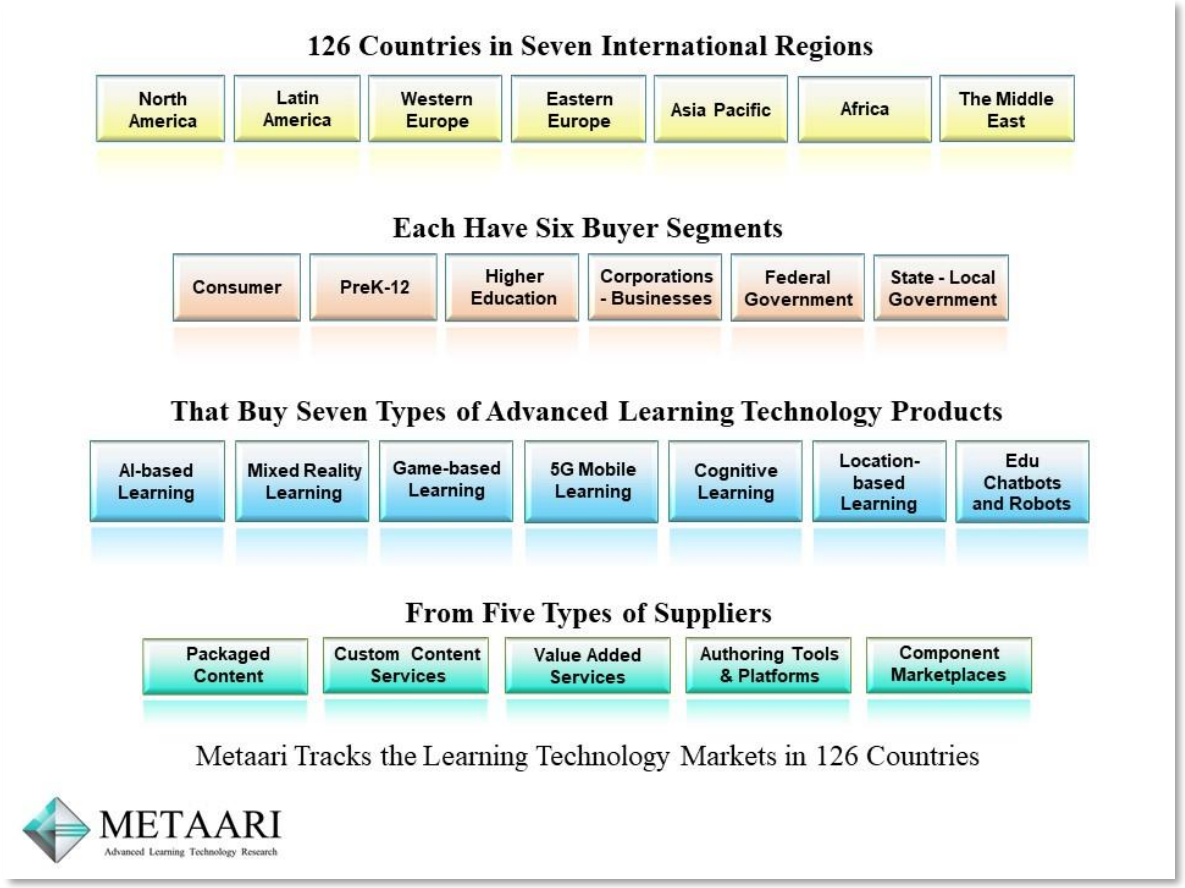
Metaari's Advanced Learning Technology Research Taxonomy

Metaari's analysis of global learning technology investment is unique in that we only track products directly related to knowledge transfer and learning transfer (collectively defied as behavior modification). We track investments that map to our learning technology framework; a precise model that narrowly defines learning products used

for knowledge and learning transfer. The definition of learning is behavior modification. Learning and behavior modification are synonyms.

In educational psychology, there are two phases of the learning process; 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.

Figure 1– Metaari's Advanced Learning Technology Research Taxonomy



Over several decades, Metaari (formerly Ambient Insight) principals have continually refined a sophisticated and precise learning technology product categorization schema based on established pedagogical models, psychometrics, biomedical informatics, knowledge engineering systems, empirical research on learning and knowledge transfer, behavior modification (i.e., learning), educational psychology, cognitive science, data science, and information architecture.

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.

The seven advanced learning technologies defined by Metaari's Advanced Learning Technology Research Taxonomy are: AI-based Learning, Mixed Reality Learning (virtual reality and augmented reality), Game-based Learning, Mobile Learning, Cognitive Learning, Location-based Learning (Location Intelligence), and Educational Bots (both physical and virtual combined). Several of these products are quite new on the market.

We still track the investments made to three legacy learning technology products: Self-paced eLearning, Digital Reference-ware, and Collaboration-based Learning (narrowly defined as live synchronous online tutoring). ***But we do not publish market forecasts on legacy learning technology products and discontinued our global eLearning reports in 2016. Buyers won't pay for bad news.*** A great deal of investment is still flowing to Collaboration-based Learning firms, but investment has stagnated refence-based learning technology firms and eLearning revenues have been in steep decline for the last five years.

The first iteration of our taxonomy was developed by Microsoft's Advanced Knowledge Engineering team that was managed by the author of this whitepaper. The team was comprised of seasoned education and training professionals, experienced corporate and government instructional designers, and information scientists. The team was building a platform called Smart MOLI, an intelligent version of Microsoft Online Learning Institute (MOLI). Consultants on the project included the world-renowned biomedical informatics expert Dr. Mark Musen from Stanford and the gifted psychometrician Dr. Richard Rovinelli, an Item Response Theory (IRT) expert, who later became the VP of Information Technology at the American Board of Family Medicine (ABFM).

We have continued to refine our taxonomy as learning technology evolves. Our chief researcher, Sam S. Adkins, introduces the taxonomy at all his presentations across the planet and has found that the Cognitive Learning category is difficult for individuals to grasp, particularly those not academically trained in education psychology and instructional design and for professionals working outside the corporate and government education and training industry.

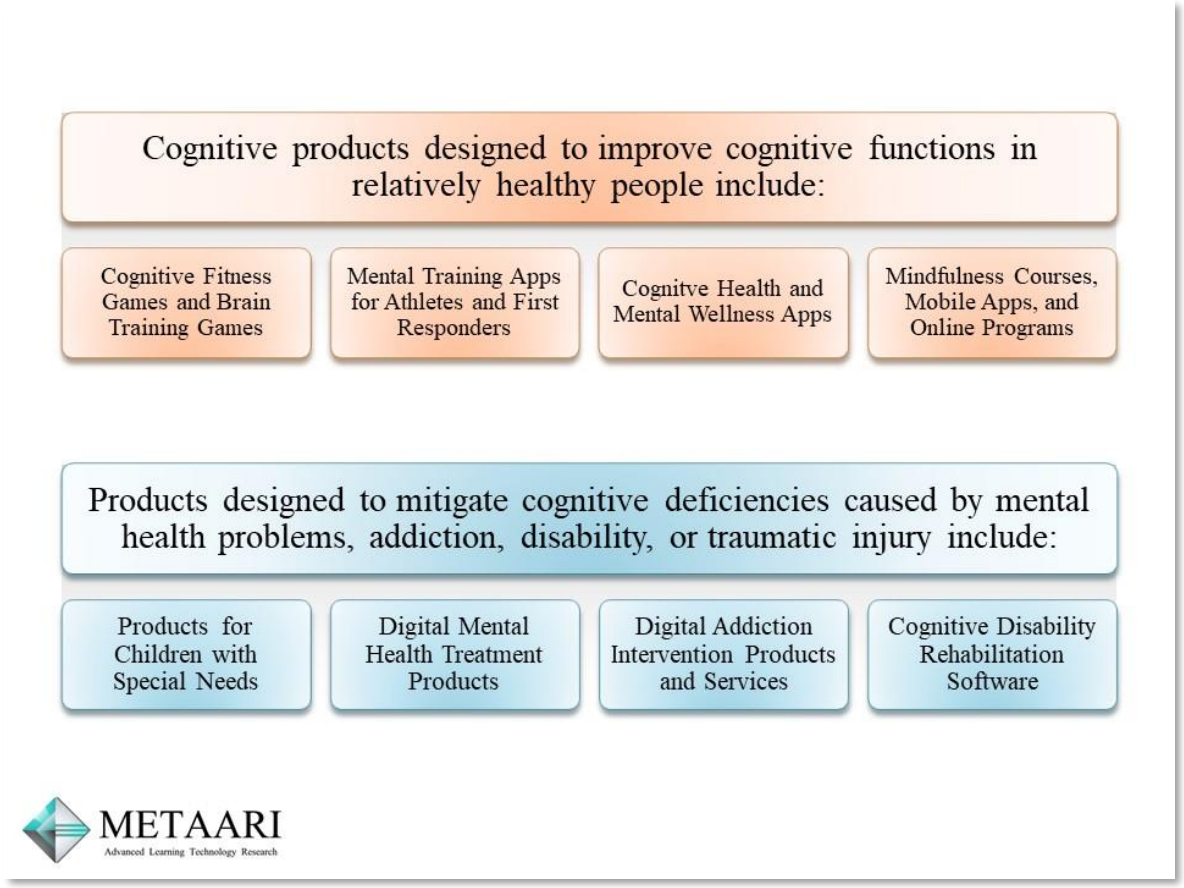
The Eight Types of Cognitive Learning Products

Cognitive Learning Theory posits that the learning process is based on observable changes in behavior. Learning (knowledge acquisition) is simply an acquisition of a new behavior; a change in behavior.

Cognitive Learning products are designed to change or modify cognitive abilities. Webster's Dictionary defines learning as "a modification of a behavioral tendency by experience. Learning is demonstrated by a change in behavior." ***Learning and behavior modification are synonyms, they are identical.***

The identical nature of learning and behavior modification is clearly evident in Bloom's Taxonomy, Gagné's Nine Events of Instruction, and in Robert Mager's work surrounding observable and measurable performance objectives. These three Instructional Systems Design (ISD) methods are still the foundation of corporate and government training development. The four dominant learning theories (Behavioral, Cognitive, Experiential, and Constructivism) all define knowledge acquisition as a process of cognitive behavior change.

Figure 2 – The Eight Cognitive Learning Product Types Grouped in Two Broad Categories



(Source: "The 2018-2023 Global Cognitive Learning Market" report published in October 2018 and updated in May 2019)

In the revised Bloom's Taxonomy developed in 2001, the researchers Anderson and Krathwohl wrote "A statement of a learning objective contains a verb (an action) and an object (usually a noun). The verb generally refers to actions associated with the intended ***cognitive process***. The object generally describes the knowledge students are expected to acquire or construct. ***The cognitive process dimension represents a continuum of increasing cognitive complexity***."

In Metaari's Advanced Learning Technology Taxonomy, Cognitive Learning products are divided into two broad categories: products designed to improve cognitive functions in relatively healthy people and products designed to mitigate cognitive deficiencies or impairments caused by mental health problems, addiction, disability, or traumatic injury.

In relatively healthy people, Cognitive Learning products are designed to improve or enhance perception, working memory, comprehension, emotional states, decision making, fluid intelligence (general problem solving), and reasoning.

In people with cognitive impairments, Cognitive Learning is designed to treat specific impairments like autism, dyslexia, addiction, stress, anxiety, phobia, and dementia. These products are designed to treat a range of cognitive impairments from mild cognitive impairment (MCI) to severe impairment. The goal is still the same in both categories – cognitive behavior change.

Investors have shown a keen interest in Cognitive Learning companies with $1.34 billion going to 96 of these companies in 2019. This is up significantly from the $839.1 million that was invested in 77 Cognitive Learning companies in 2018.

Countries Tracked by Metaari

We monitor the learning technology markets and investment patterns in 126 countries across seven international regions. We track six buying segments in each region that buy seven types of advanced learning technology products from five types of suppliers. ***We have the most complete view of the international demand for learning technology in the industry.***

Table 1 - The 126 Countries across the Seven Regions Tracked by Metaari

Number of Countries Analyzed in Each Region	Countries Analyzed in this Report by Region
30 Countries in Africa	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Chad, Côte d'Ivoire (The Ivory Coast), the Democratic Republic of Congo (DRC), Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Tunisia, Uganda, Zambia, and Zimbabwe (*Metaari has suspended analyzing Zimbabwe during the current socio-economic crisis in that country*)
21 Countries in Asia Pacific	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
15 Countries in Eastern Europe	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Serbia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.
18 Countries in Latin America	Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Perú, Uruguay, and Venezuela (*Metaari has suspended analyzing Venezuela during the current financial crisis in that country*)
12 Countries in the Middle East	Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Turkey, and the United Arab Emirates (UAE)
2 Countries in North America	Canada and the United States
28 Countries in Western Europe	Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, and the United Kingdom

Investment patterns tend to be unique to each country. Private investment is by definition unpredictable and investment patterns can change in particular countries and regions from year to year. For example, investments made to Brazilian edtech

companies all but dried up in 2015 and 2016 but began to come back in 2017 and 2018. Investment activity is still anemic in Brazil (and across most of Latin America).

Metaari does not track the markets in so-called conflict zones until the conflicts are resolved. For example, we stopped tracking investments in Côte d'Ivoire (The Ivory Coast) during the two civil wars but we track the learning technology market in the country now.

Sources of Investment Activity Information

Metaari tracks private investments made to learning technology suppliers across the planet via a wide range of secondary sources including press releases, financial reports, investment firm sites, edtech funder sites, edtech accelerator sites, startup news portals, and targeted searches.

We constantly monitor public-domain investment tracking sites including (but not limited to) CrunchBase, peHUB, the PE Hub Network, Xconomy, DealStreetAsia (Singapore), VCCircle (India), VatorNews, Robotics Business Review, KrASIA (China), Education Investor (UK), China Money Network, Tech in Asia, AltAssets, VC4Africa, FinanceAsia, VentureVillage (Germany), the Latin American Private Equity & Venture Capital Association (LAVCA), Nordic 9, the Nordic Web, South Korea's The Investor, the Wall Street Journal's Venture Capital Dispatch, FinSMEs (UK), the Asian Venture Capital Journal (AVCJ), DealCurry (India), Nearshore Americas (Latin America), Private Capital Journal (Canada) and VentureBeat.

- All of these portals keep track of investments at regular intervals. For example, the Nordic Web site publishes a monthly tally of investments in Denmark, Finland, Iceland, Norway, and Sweden. They list the company name, the type of products they sell, and the funding amount they raised in that month. The China Money Network publishes a daily synopsis called DealShot that lists the recent investment activity in China by company name, investment amount, and type of products sold.

All the major educational publishers periodically invest in other edtech companies. Those investments are reported in the financial statements. One of the largest education investors is Bertelsmann. Their education group became a stand-alone division at the start of 2016. They also acquire edtech companies usually through their Relias Learning subdivision. They report their investments in their financial reports.

We also track public-domain investment sources that focus on particular countries. For example, the top information source for learning technology investment in China is an

educational portal called Jiemo Media (JMDedu). The majority of investment activity posted on JMDedu never gets mentioned in the Western media.

Advanced learning technology product forecasts cited in this whitepaper are derived verbatim from seven recent Metaari market reports:

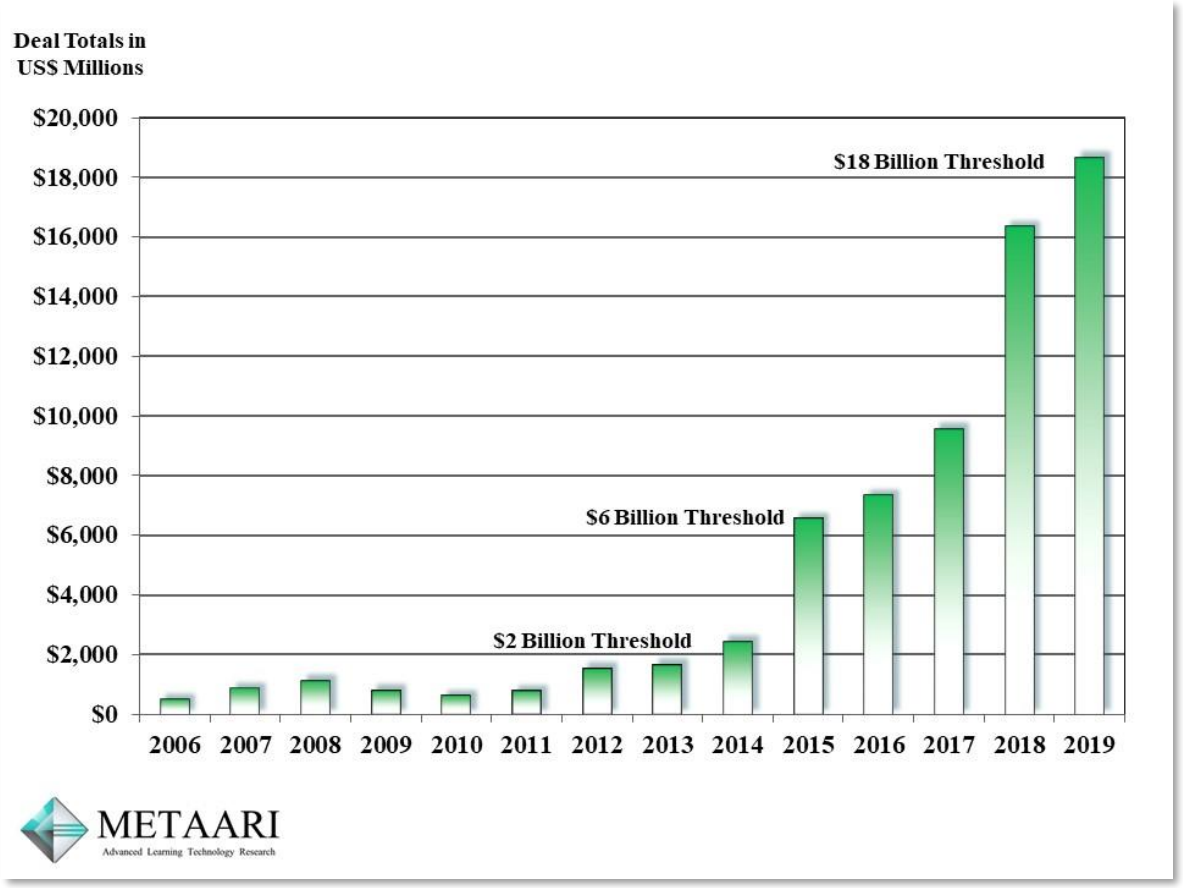
- ***"The 2018-2023 Worldwide Mixed Reality Learning Market"*** report published in September 2018
- **"*The 2018-2023 Global Cognitive Learning Market*"** report published in October 2018 and updated in May 2019
- **"*The 2018-2023 Worldwide Educational Bot Market*"** report published in November 2018
- **"*The 2019-2024 Global AI-based Learning Market*"** report published in March 2019
- **"*The 2019-2024 Global Game-based Learning Market*"** report published in August 2019
- **"*The 2020-2025 US Mobile Learning Market*"** report published in December 2019
- **"*The 2020-2025 Worldwide Mobile Learning Market*"** report published in January 2020

All revenue forecasts in this report are in US$ dollars based on the exchange rates for each country's currency as of December 2019.

2019 Investment Totals Shatter Records (Again)

While 2018 appeared to be a banner year for global learning technology investment with total investment reaching an astonishing $16.34 billion, it pales in comparison to the investment patterns of 2019. ***A breathtaking $18.66 billion flowed to edtech companies around the world in 2019.*** To put this in perspective, investments in 2018 and 2019 combined far outstrip the total combined investments made to all edtech companies for the entire twenty-year period between 1998 and 2017. There are interesting patterns in the recent investor behavior.

Figure 3 – 2006-2019 Annual Totals for Global Private Investment in Learning Technology Suppliers (in US$ Millions)



For example, the bloom appears to be off the rose in China. In 2019, "only" $3.90 billion went to Chinese learning technology companies. While this is a very large number, it is down dramatically from the $7.22 billion that went to Chinese companies in 2018. That said, of the ten companies that garnered over $300 million in funding in 2019, half of them were Chinese companies. Of the 44 companies that obtained over $100 million in funding in 2019 (unicorns), 12 of them were in China. Yet, 17 of those

44 companies were in the US. A detailed analysis of the investment patterns in China is provided later in this whitepaper.

There are a number of factors inhibiting the learning technology market in China. The primary inhibitor is so-called "regulatory uncertainty" with a growing number of regulations being imposed by the government including the laws limiting screen time for children and laws prohibiting unapproved apps in the schools. There are also strict guidelines on the type of digital content allowed in the country.

It is virtually impossible for a foreign company to gain traction in the country without a distribution agreement with a licensed domestic company. New regulations are imposed regularly, if not unexpectedly, creating a great deal of uncertainty in the industry

- Game developers must get government approval and obtain a license to sell products in China. The government has made it quite difficult for developers to get to market. In fact, they fined a gaming company $100,000 in December 2019 for selling an unlicensed game. This is the first time they have fined a developer and indicates that they will impose penalties going further.

Another indication that the bloom is off the rose in China is the growing number of well-funded online education startups laying off staff because they were unable to monetize their business models. On the one hand, you read breathless stories about the near insatiable demand for online education in China, but on the other hand, companies are struggling to make money.

One of the most well-funded online education companies in China is VIPKID. They have garnered a breathtaking $971.5 million since they launched in Beijing in 2013 including a $150 million round in October 2019. It was reported in the press in November 2019 that they were laying of as much as 30% of their workforce.

ByteDance's Gogokid announced in April 2019 that they were laying off half of their staff. Udacity's China office laid off 20% of their staff in April 2019. Knowbox slashed 40% of their workforce in December 2019. HuJiang is a publicly-traded online education company and they laid off 1,100 workers in December 2019.

Analysts are stating in the press that the customer acquisition costs are skyrocketing in the online education industry in China and that more than 80% of the companies are losing money. Dozens of online education companies have gone public in the last year and it will be interesting to track revenues going forward. Private investment is inherently unpredictable and it is entirely possible that funding will increase in China in the future.

Another interesting investment pattern is the investor interest in new advanced learning technology products and the drying up of funds going to legacy learning tech companies like eLearning and Learning management systems (LMS).

Once the darling of the edtech industry, the global Learning Management System (LMS) market has been in steep decline since 2015. Despite the breathless announcements from entrenched LMS suppliers about new procurements, new buyers are few and far between and customers are simply swapping out their systems. This is not new money, but rather recycled money. There has been no significant innovation in LMS technology and eLearning in over two decades.

Investors have aggressively shifted their interest away from legacy products like Self-paced eLearning to next-generation companies developing Cognitive Learning, AI-based Learning, Mixed Reality Learning (AR-based Learning and VR-based Learning), 5G Mobile Learning, Location-based Learning (Location Intelligence), Game-based Learning, and even Educational Bots (both physical and virtual).

In 2019, the number of deals made with learning technology companies declined from the 1,087 made in 2018 to the 896 deals made in 2019. This is a 17.6% decline compared to 2018 but much higher than the number of deals made prior to 2018.

China's online education giant TAL Education (formerly Xueersi) garnered the highest investment amount in 2019 at a breathtaking $500 million. TAL is publicly traded on the New York Stock Exchange (NYSE). TAL started out as an after-school tutoring firm but is now the "the largest public listed education company by market cap in the world" and has diversified into a range of online education services including online Prek-12 education, digital English language learning, and online STEM content.

TAL is a prolific investor in other learning technology companies, including the astonishing $255 million they gave to DaDa in 2019, a game-based English language learning company for young kids.

2019 Investment Blast Past Previous Historic Highs

The investments made to learning technology companies in 2019 were the highest in the history of the learning technology industry by an extraordinary margin and blasted past the records set between 2015 and 2017 ***and far outpaced the historic high in 2018.***

A total of $18,661,036,466.00 was invested in 896 learning technology companies across the planet in 2019. The spike in the fourth quarter is directly related to the steep increase in the number of deals made in that quarter.

Table 2 2015-2019 Learning Technology Investment by Quarter (In US$ Millions)

Quarter	2015 Investment Totals	2016 Investment Totals	2017 Investment Totals	2018 Investment Totals	2019 Investment Totals
First	$1,414,184,500	$1,647,774,500	$1,397,708,010	$2,991,208,477	$4,755,079,712
Second	$1,534,885,000	$1,549,500,615	$2,795,427,000	$4,937,951,417	$3,143,107,305
Third	$1,234,974,100	$2,201,935,897	$2,580,695,172	$3,193,822,884	$4,565,541,128
Fourth	$2,358,561,918	$1,940,404,408	$2,788,824,832	$4,866,659,050	$6,197,308,321
Total Annual Investment	***$6,542,605,518***	***$7,339,615,420***	***$9,562,655,014***	***$16,344,641,828***	***$18,661,036,466***

The massive funding in 2019 is heavily concentrated in the edtech unicorns. Education technology unicorns were relatively rare until 2017 and 2018. The large education publishers like Houghton Mifflin Harcourt and Pearson are indeed unicorns but they still generate a great deal of revenue from legacy print content. There were 44 learning companies that garnered over $100 million in 2019 compared to the 31 that obtained over $100 million in 2018.

The Rise of the Global Edtech Unicorns

A unicorn is a private company that has reached a valuation of over $1 billion. In 2019, investments over $100 million were heavily concentrated in just 44 companies. There were "only" 31 unicorns in 2018. "In the venture capital industry, a unicorn refers to any tech startup company that reaches a $1 billion-dollar market value as determined by private or public investment." ***(Divestopeida)***

China's online education juggernaut TAL Education obtained a breathtaking $500 million in investment in February 2019, the highest investment of the year. "TAL Education, which provides after-school tutoring services in subjects including

mathematics and physics, is expected to use the funds to further its inorganic growth moves and for business expansion."

Table 3 - Global Edtech Companies that Raised Over $100 Million in 2019

Company Name	Funding Amount	Type of Product Type Being Sold	Country of Base Operations
TAL Education	$500,000,000	Collaboration-based Learning	China
Niantic	$435,000,000	AR-based Mobile Learning	USA
Zhihu	$434,000,000	Mobile Learning	China
Zhangmen	$350,000,000	Collaboration-based Learning	China
Click Therapeutics	$300,000,000	Cognitive Learning	USA
Yuanfudao	$300,000,000	Collaboration-based Learning	China
KnowBe4	$350,000,000 In Two Rounds	Game-based Learning for Cybersecurity	USA
Automattic	$300,000,000	Collaboration-based Learning	USA
Celonis	$290,000,000	AI-based Learning	Germany
Magic Leap	$280,000,000	AR-based Mixed Reality Learning	USA
A Cloud Guru	$257,000,000	Collaboration-based Learning	UK, Australia, and the USA
DaDa	$255,000,000	Game-based Learning (for kids)	China
Clio	$250,000,000	AI-based Learning	Canada

ThoughtSpot	$248,000,000	AI-based Learning	USA
Coveo	$227,000,000	AI-based Learning	Canada
Gaosi Education Group (now rebranded as Aixuexi)	$210,000,000 in Two Rounds	Collaboration-based Learning	China
Fractal Analytics	$200,000,000	AI-based Learning	India
BYJU's 3 rounds	$193,800,000 in Three Rounds	Mobile Game-based Learning	India
Aakash Education Services	$190,000,000	Collaboration-based Learning	India
Checkr	$160,000,000	AI-based Learning	USA
Guild Education	$157,000,000	Collaboration-based Learning	USA
Element AI	$151,400,000	AI-based Learning	Canada
Knowbox	$150,000,000	Game-based Learning	China
VIPKid	$150,000,000	Collaboration-based Learning	China
NetDragon (Education Division)	$150,000,000	Collaboration-based Learning	China
Ruangguru	$150,000,000	Mobile Learning (test prep)	Indonesia
D.Share	$137,000,000	Collaboration-based Learning	South Korea
PathAI	$135,000,000 in Two Rounds	AI-based Learning	USA
Omada Health	$123,000,000 in Two Rounds	Cognitive Learning	China

Vayyar Imaging	$109,000,000	Location-based Learning (Location Intelligence)	Israel
Moveworks	$105,000,000 in Two Rounds	AI-based Learning	USA
Coursera	$103,000,000	Self-paced Learning (eLearning)	USA
BetterUp	$103,000,000	Collaboration-based Learning	USA
iTutorGroup	$100,000,000	Collaboration-based Learning	China
Near	$100,000,000	AI-based Learning	Singapore
Scale	$100,000,000	AI-based Learning	USA
Lucidworks	$100,000,000	AI-based Learning	USA
SparkCognition	$100,000,000	AI-based Learning	USA
Midu Reader	$100,000,000	Mobile Learning	China
Pendo	$100,000,000	AI-based Learning	USA
Kenzie Academy	$107,800,000 in Two Rounds	Self-paced Learning (eLearning)	USA
Top Aces	$100,000,000	Mixed Reality Learning (simulation)	Canada
Unacademy	$100,000,000	Collaboration-based Learning	India
Ryan EduNation	$100,000,000	Digital Reference-ware	India
Total Unicorn Funding in 2019	***$8.561 Billion***		

One of the most significant trends that emerged in 2019 was the pivot away from consumer markets and a move to the business sectors by AR and gaming companies. Magic Leap is the most notable example. After burning through funding and experiencing dismal headset sales in the consumer segment, they pivoted to the business segment in late 2019. They now have dozens of reseller partners (mostly content developers) that compete in the corporate segments across the planet.

A Significant Decline in the Number of Edtech Deals in 2019

A total of 1,087 deals were made in 2018, up dramatically from the 813 deals made in the 2017. This declined in 2019 to 896 deals, an 17.6% decline compared to 2018. That said, there were 44 learning technology companies that garnered $100 million or more in 2019. This is in contrast to the 30 companies that raised $100 million or more in 2018.

Table 4 - 2014-2019 Number of Investment Deals by Quarter

Quarter	2014 Number of Deals	2015 Number of Deals	2016 Number of Deals	2017 Number of Deals	2018 Number of Deals	2019 Number of Deals
First	91	135	168	160	272	202
Second	72	178	174	179	330	159
Third	77	199	189	192	224	229
Fourth	76	216	164	282	261	306
Total Annual Deals	***316***	***728***	***695***	***813***	***1,087***	***896***

An interesting pattern is the spike in the number of deals made in the fourth quarter of 2019 and the sharp decline of deals made in the second quarter. Investment behavior is inherent unpredictable and this is a good example.

There was a surge of investments going to learning technology companies in the UK, France, Germany, the Nordic Cluster, Israel, Australia, and Canada; 210 companies were funded across these areas, up from 148 the year before.

Extraordinary Innovation: The Contours of the Investment Patterns

There were ten trends that were clearly evident in the 2019 global learning technology learning investment patterns:

- A massive amount of funding, far surpassing the historic records set in 2018
- Strong investor interest in corporate-facing learning technology companies
- Slowing of investments going to Chinese learning technology companies
- A significant decline in the annual total number of deals made
- A surge in investments to companies in India
- The spike in the investments made to companies in the UK, France, Germany, and Canada
- The decline in investments made to companies in Israel, Australia, and the six countries in the Nordic Cluster
- A new investor interest in learning technology companies in Southeast Asia
- The continuing weakness in learning technology investments in Latin America
- And the clear investor attraction to next-generation edtech companies selling products that integrate a range of new technologies including robotics, cognitive science, artificial intelligence, mixed reality (augmented reality & virtual reality), location intelligence, and neuroscience.

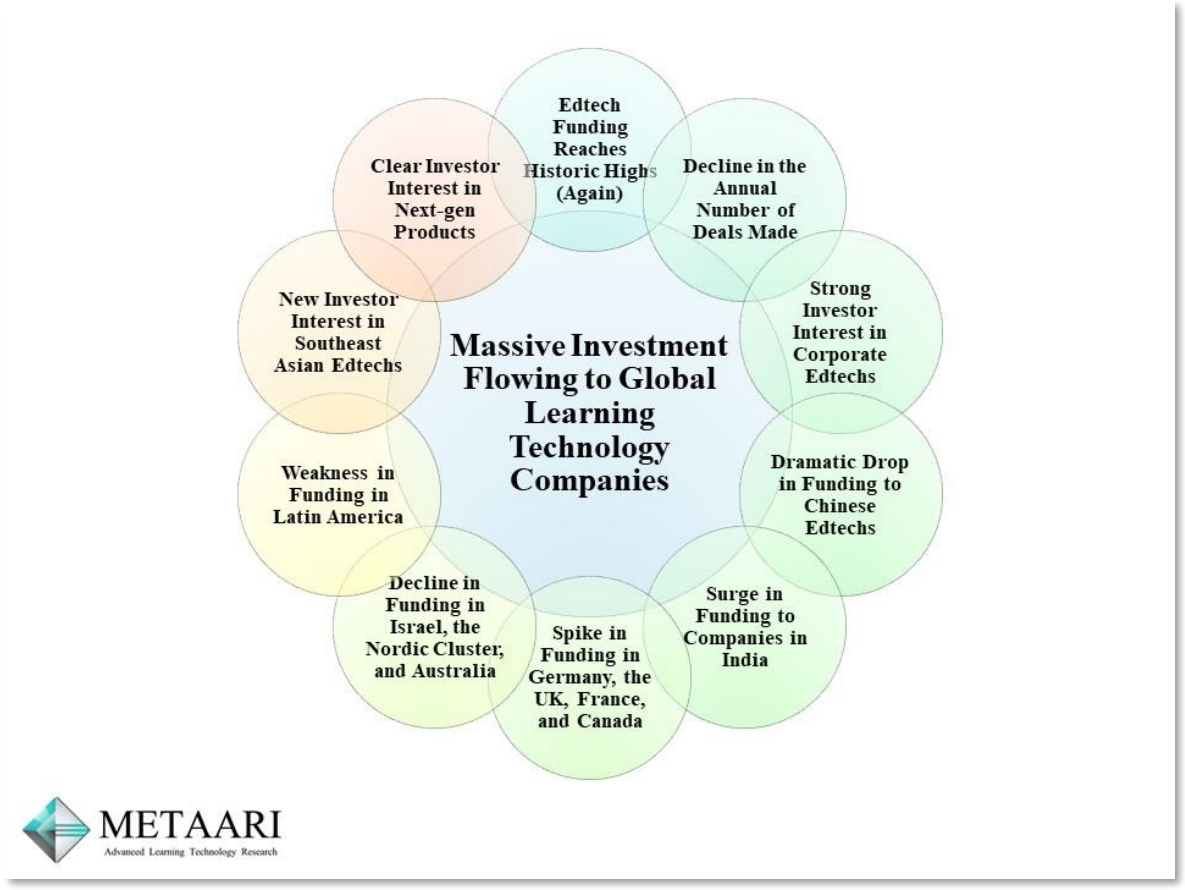
It is interesting that there are entirely new types of learning technology products on the market including AI-based Learning products, Mixed Reality Learning apps, and intelligent Educational Bots. The companies developing these products are mostly startups and are attracting significant amounts of investment.

There has also been a surge of innovation in products that have been on the market for some time. For example, new types of Game-based Learning products based on psychometrics are experiencing rapid uptake in the corporate sectors across the planet.

New Cognitive Learning products that incorporate the concepts of brain plasticity and the latest findings in cognitive science and neuroscience are hitting the market at a steady pace. Mixed Reality Learning products are relatively new on the market and are now incorporating advanced simulation, virtual reality, and augmented reality technologies.

And while both Mobile Learning and Location-based Learning products have been on the market for over a decade, they are now taking advantage of cutting-edge device capabilities and advances in Location-based Services and blazingly fast 5G networks.

Figure 4 – 2019 Dominant Trends in the Global Learning Technology Investment Patterns



For example, first-generation Location-based Services (LBS) emphasize the position of the object (triggers, markers, beacons, anchors). Second-generation Indoor

Positioning Systems (IPS) emphasize the position of the user via smartphone sensors including the gyroscope, compass, altimeter, and the accelerometer.

Location-based Learning can occur on physical locations and in virtual locations. It can also occur in a past or future time (temporal experiences). Many products on the market combine all three modalities.

Temporal Location-based Learning in time essentially accomplishes virtual time travel. It is one thing to visit the Coliseum in Rome today and walk through the ruins. It is an entirely different thing to walk through it when it was new two thousand years ago. The learning technology industry is in a period of profound innovation and transformation.

These trends are iterative and may or may not remain stable in 2019 and beyond. Considering the dramatic spike in funding in the last four years it might be tempting to determine that this is "the new normal", but investment patterns are inherently unpredictable.

- And while so-called "rear-view mirror" analysis can be made, investment patterns in any given year cannot be used ***to predict*** subsequent patterns. That said, investors are now very interested in next-generation learning products.

Metaari views investment patterns as leading indicators that can be used to isolate product trends and buying behavior. Investors only take risks with companies that sell products that customers want. The number one reason that startups fail is that they developed products that nobody wanted to buy.

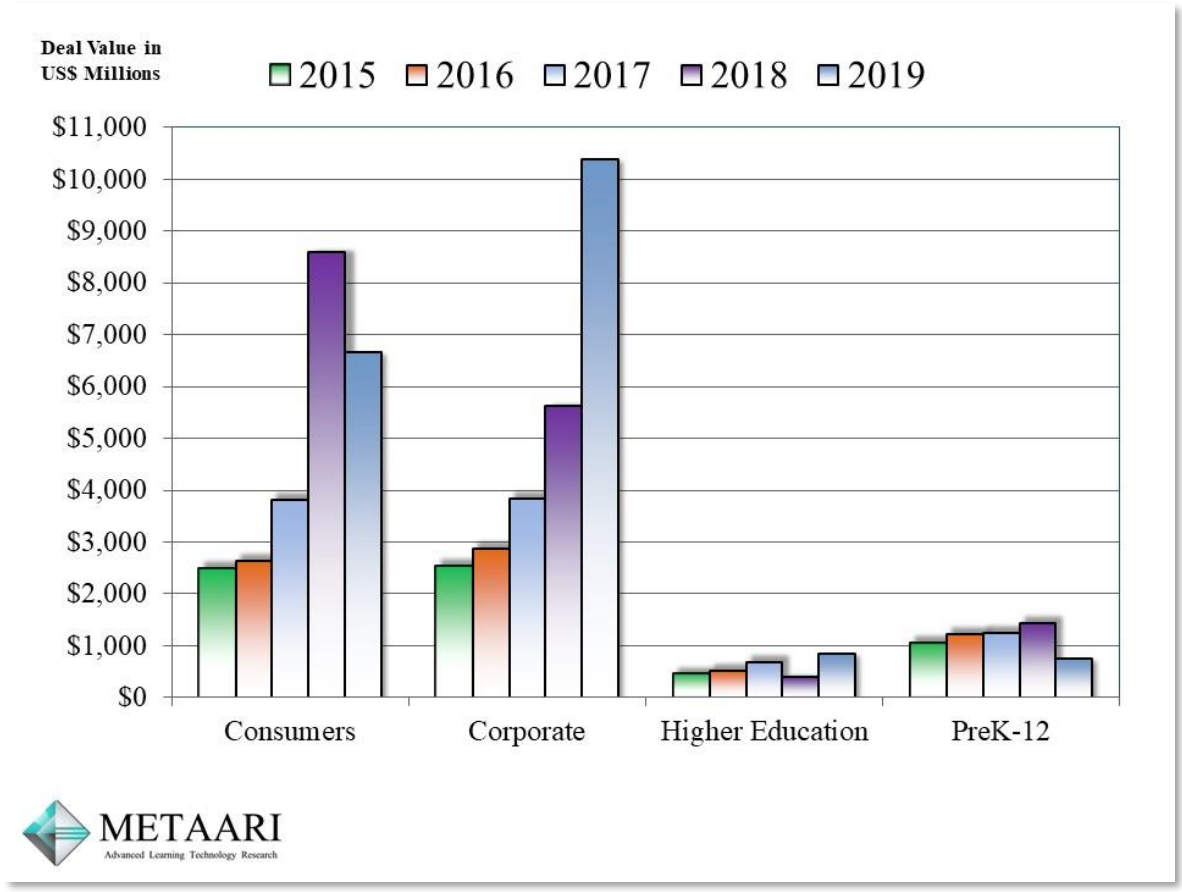
Investment Patterns by Customer Type

Investment patterns can expose "customer-facing" trends if funding shifts to companies that serve specific buying segments. In 2019, investors showed a strong interest in corporate-facing learning technology companies.

- Investment in corporate-facing companies nearly doubled compared to 2019; ***investment reached a breathtaking $10.39 billion.***

Funding for higher education learning technology companies increased in 2019 to $740.58 million, nearly double the funding that went to these companies in 2018. One surprising pattern was the decline in funding going to PreK-12 edtechs. Funding dropped by almost half for PreK-12 learning technology companies in 2019.

Figure 5 - 2015-2019 Total Global Learning Technology Investments by Target Customer Type



Funding also declined for consumer-facing learning technology companies. Funding dropped to $6.67 billion in 2019, down from the $8.60 billion invested in these

companies in 2018. This is a 23.2% decline and despite the large amount going to these companies this is steep decline in funding.

Global investments made to higher education companies were rising steadily beginning in 2014 driven in large part by the demand for managed services in institutions across the planet. Yet, funding dropped significantly in 2018 with 53 companies only raising a combined total of $406.8 million, down from $681 million in 2017. This changed in 2019 with funding nearly doubling to $748.58 million compared to 2018.

Investments made to PreK-12 companies spiked in 2015, but have leveled off in 2016 and 2017. Investments made to PreK-12 learning technology companies increased to $1.42 billion in 2018, up from $1.23 billion in 2017. The number of deals declined slightly in this segment. In 2017, 155 deals were made with PreK-12 edtech companies and 144 were made in 2018. ***In 2019, there were only 84 deals made with PreK-12 learning technology companies and investment fell to $855.32 million.***

In 2017, 13% of all funding went to PreK-12 companies and 8% went to higher education edtech companies for a combined total of 21.4%. Barely 8.7% of total global investment went to PreK-12 companies in 2018 and only 2.5% went to higher education companies for a combined total of 11.2% of all funding, down almost half from 21% in 2017. ***This dropped to 8.6% in 2019***

Table 5 – 2019 Total Number of Deal and Funding Amounts by Four Customer Types

Target Customer Type	Total Number of Deals Made in 2019	2019 Investment Totals (in US$)
Consumer	290	*$6,671,495,752*
Corporate	463	*$10,393,610,596*
Higher Education	59	*$740,583,821*
PreK-12	84	*$855,346,297*
Total Annual Investment	***896***	***$18,661,036,466***

In 2019, 4% of all global funding went to higher education learning technology companies and 4.6% went to PreK-12 edtechs. It should be noted that these are percentages and are heavily skewed by the massive investments going to consumer and corporate edtechs.

Yet, the investor interest in PreK-12 companies waned significantly in 2019 in terms of real investment. That said, investment trends are inherently unpredictable and this could be an anomaly.

Lessons Learned: Consumer AR/VR Companies Pivoting to the Business Segment

Metaari's clients may be surprised that we now categorize companies like Niantic and Magic Leap is learning technology companies. One of the most significant trends that emerged in 2019 was the pivot away from consumer markets and a move to the business sectors by the AR and AR companies.

Magic Leap and Niantic are the most notable examples but are among several companies that have pivoted away from the consumer segment. After burning through funding and experiencing dismal headset sales in the consumer segment, they pivoted to the business segment in late 2019. They now have dozens of reseller partners (mostly field performance support and expert assistance developers) that compete in the corporate segments across the planet.

Niantic is the Google spin out that developed the enormously popular (and profitable) Pokémon GO AR-based mobile game. They continue to develop commercial games but are rapidly diversifying into new sectors and integrating educational content into their commercial games. They are now an AR platform provider, a smart glasses developer, and a tourist app developer. Niantic joined the United Nations World Tourism Organization (UNWTO) agency as an affiliate member in September 2019 "to promote responsible tourism with augmented reality. The partnership will include 'new adventures inside Niantic’s popular games and a campaign around playing safely."

- Over the last year, UNWTO has been working with innovators from around the world and promoting the use of new technologies through the newly created UNWTO Tourism Tech Adventures. UNWTO is reaching out to technology and communication partners beyond tourism to identify new ways of promoting destinations and reaching new audiences.

Niantic released their Real-World Platform development kit to selected participants through the Niantic Creator Program in November 2019. The company is effectively "developing information layers anchored in the real world, which could one day power all kinds of applications for AR glasses and similar devices." The company also announced in November 2019 that they were inviting small businesses to participate in their sponsored locations program. In December 2019, Niantic announced that they were collaborating with Qualcomm to build 5G-ready smart glasses.

Magic Leap has raised billions $2.6 billion since they launched in 2010) of venture capital and garnered an additional $280 million in April 2019 with funding led by Japan's NTT DOCOMO. Niantic raised $435 million in two rounds in early 2019.

It has become apparent that the consumer demand for both AR and VR is quite weak. Devices are still relatively expensive, and except for games, content is a weak link in the consumer story. The major headset developers are pivoting away from the consumer segment and are now marketing their products to corporations and government agencies.

Microsoft has always marketed the HoloLens to corporations (particularly the industrial vertical and the helathcare sectors) and government agencies. Microsoft won a lucrative $480 million contract with the US Army to deliver up to $100,000 modified HoloLens devices.

Cornerstone OnDemand is a legacy eLearning provider and announced in November 2019 that they were partnering with Oculus "to help shared clients utilize data to build better virtual reality (VR) training experiences. Through the partnership, shared clients of Cornerstone and Oculus for Business, launched earlier this year to make it easier for companies to bring headsets, including the Quest, into the workplace."

Oculus launched Oculus for Business in April 2018. "Oculus for Business offers a secure and reliable VR solution for enterprise customers. The offering includes software to set up and manage VR deployments, a tailored in-headset experience and enterprise-grade customer support. Oculus for Business was designed for professional settings and enterprise needs. Making learning and collaboration tasks more immersive helps employees focus on the tasks at hand."

Google launched their Google Glass Enterprise Edition 2 in May 2019. They also announced that support for their consumer device, Glass Explorer Edition will be discontinued in 2022. The company has essentially admitted that their consumer push has been unsuccessful with some analysts calling it an outright failure. The Glass Enterprise Edition is being used by more than 50 businesses in the US, including AGCO, DHL, Dignity Health, NSF International, Sutter Health, Boeing, and Volkswagen.

HTC launched their VIVE Enterprise Solutions business unit in July 2019. "Recognizing that hardware alone isn't enough, this new business organization combines software, hardware, professional services, business solutions, and support to address four key areas where enterprises are investing today: Training and Simulation, Design and Visualization, Virtual Collaboration, and Location-Based Entertainment and Attractions." HTC launched their untethered VR headset called the Vive Focus Plus in early 2019. Despite the fact that HTC claims that the Focus Plus is a popular headset with consumers in China, the company did not release a consumer version in the US.

The Chinese AR headset provider Nreal has focused on consumer solutions until now. They have now pivoted to business solutions. During the Snapdragon Tech Summit in Maui in December 2019, Deutsche Telekom showcased a preview of a prototype field service app that is Nreal's first B2B application designed for remote AR assistance. The solution is called AR FieldAdvisor and developed in cooperation with Qualcomm Technologies and 6D.ai. "The app will enable Nreal Light users to annotate objects that are within their field of view and then stream the images to remote experts. The remote experts are also able to add their diagrams or virtual notes to the scenes and share this data with the remote technician in real time." The spatial mapping is a form of location intelligence based on the 6D.ai technology. The company raised $15 million in investment in January 2019.

In December 2019, Magic Leap announced a pivot from the consumer segment to the corporate segment and announced a new set of services for corporate clients. At that time, they announced that they had only sold on 6,000 of their AR headsets in the first six months after launch, far from the 100,000 they wanted to sell in the first six months. They now offer a "slightly updated version of its mixed reality headset and a set of spatial computing services specially designed to help corporations collaborate in virtual spaces. ***The first mixed reality services fall into four basic buckets: collaboration, location-based experiences, 3D visualization, and training (also called Learn and Assist)***."

- "The final group of apps are designed to train employees for specific tasks while they're in the actual work environment and able to work hands-free, as opposed to in a classroom or training space. For instance, a remote trainer or expert might show a worker how to repair a machine in a manufacturing facility. Enterprises have used VR and AR to train employees, but this really takes it to the next level."

- Magic Leap provides the development tools and other resources for enterprise customers to build their custom versions of the apps. The new Magic Leap Enterprise Suite, priced at $2,995, includes the Magic Leap 1, an updated version

of Magic Leap One Creator Edition, as well as two years of access to enterprise-level support, Device Manager, that lets administrators manage hardware and software remotely.

Magic Leap is referring to their new enterprise bundle as a spatial computing platform. "To make the most of the spatial computing platform for collaboration, visualization, training, and location-based experiences, Magic Leap has partnered with Arvizio, EON Reality, Immersion Analytics, Immersiv, Flow Immersive, Nomtek, Minsar, Obsess, PTC, RoOomy, Spatial, Spatiate, Taqtile, Verses, and VIM to create applications in these core areas."

- PTC is one of the world's largest AR-based decision support providers for the industrial sectors. In December 2019, they reported that they had formed a strategic alliance with Magic Leap to sell their Vuforia AR engine to Magic Leap customers. "AR offers companies an innovative and effective way to connect people to digital content where and when they need it, thereby increasing efficiency, providing more-impactful training, and achieving greater overall cost savings."

PTC now sells Magic's headsets preloaded with the Vuforia Engine. A Google search on Magic Leap now returns the header "Magic Leap: Spatial Computing for Enterprise."

Massive Spike in Funding to Corporate-facing Edtech Firms in 2019

A breathtaking $6.22 billion went to 479 corporate-facing learning technology companies in 2018. In 2019, an astonishing $10.63 billion went to 453 companies.

Corporate training and education buyers across the planet are migrating rapidly away from legacy products like self-paced courseware and are now avid buyers of psychometric Game-based Learning, AI-based Learning, Cognitive Learning, Location-based Learning (Location Intelligence), and Mixed Reality Learning (that includes both VR and AR-based products). Companies that sell (or lease) Education and Training Bots (both physical robots and virtual bots) to corporations are also attracting the attention of investors. ***Investors are keenly aware of the new corporate buying behavior.***

A major innovation in learning technology is the real-time augmented performance improvement products designed for field and industrial workers. These products integrate physical reality with augmented reality (AR) and mixed reality (MR). They also produce impressive empirical performance improvement.

In educational psychology, there are two phases of the learning process; 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. They are almost all Mixed Reality Learning products.

There are new AI-based Learning products coming on the market that are fundamentally new types of learning technologies. New AI-based decision support, performance support, Natural Language Processing (NLP) Knowledge Management, intelligent big data analysis, machine learning data visualization, deep learning predictive analysis, and augmneted business process intelligence have fundamentally altered the corporate learning landscape.

- An Israeli AI-based company called Epistema raised $6 million in 2018 and sells a fundamentally new kind of learning technology. They claim their product combines the enterprise's human knowledge with raw data. It defines a new field that they call "collaborative knowledge analytics" that enable the collection of knowledge within the enterprise and then compares it to the raw data. Epistema then "surfaces the enterprise's 'best current knowledge', that allows faster and more reliable decision-making process."

- Zurich's Starmind sells a very unique AI-based Learning product. "Starmind allows organizations to gather company knowledge across existing organizational boundaries, making it available to all employees, everywhere and in real time. Using self-learning algorithms based on latest principles of brain and artificial neural network research, posed questions are automatically forwarded to the right person within the company. Starmind learns about interests and expertise, creating a self-learning knowledge network." The company raised $15 million in investment in May 2018.

- London's ProFinda raised $6.5 million in funding in January 2018. Their AI engine "helps to address a key issue in many companies – the fact that they are brimming with amazing knowledge that is wasted because firms cannot identify the skills that exist within their workforce. ProFinda’s AI-powered engine builds a dynamic map of all the skills, knowledge, connections, and expertise available across a company. Machine learning helps to match the people with the right expertise to others who require their assistance. ProFinda gives firms an accurate birds-eye view of all the knowledge contained across their entire talent pool – including employees, alumni, freelancers and other contractors."

Ten corporate-facing edtech companies garnered over $100 million in 2018: four were AI-based Learning companies, three were Collaboration-based Learning firms, two

were Mixed Reality Learning companies, and one was a Game-based Learning developer.

Country Investment Analysis: The Flight from China

The US accounted for just over 58% ($5.5 billion) of all investments made to learning technology companies in 2017. This changed dramatically in 2018, with companies in China garnering 44.1% of all funding, followed by the US at 32%. India accounted for the third-highest investments in both 2017 and 2018.

This reverted in 2019 with the US retaking their status as the top edtech investment destination. In 2019, China accounted for "only" 21% of all funding on the planet while the US accounted for 42.9% of all global funding, double the investments made in China."

The Bloom is Off the Rose: Investment Slows in China in the Midst of Excessive Regulation Hurdles

The bloom appears to be off the rose in China. In 2019, "only" $3.90 billion went to Chinese learning technology companies. While this is a very large number, it is down dramatically from the $7.22 billion that went to Chinese edtech companies in 2018.

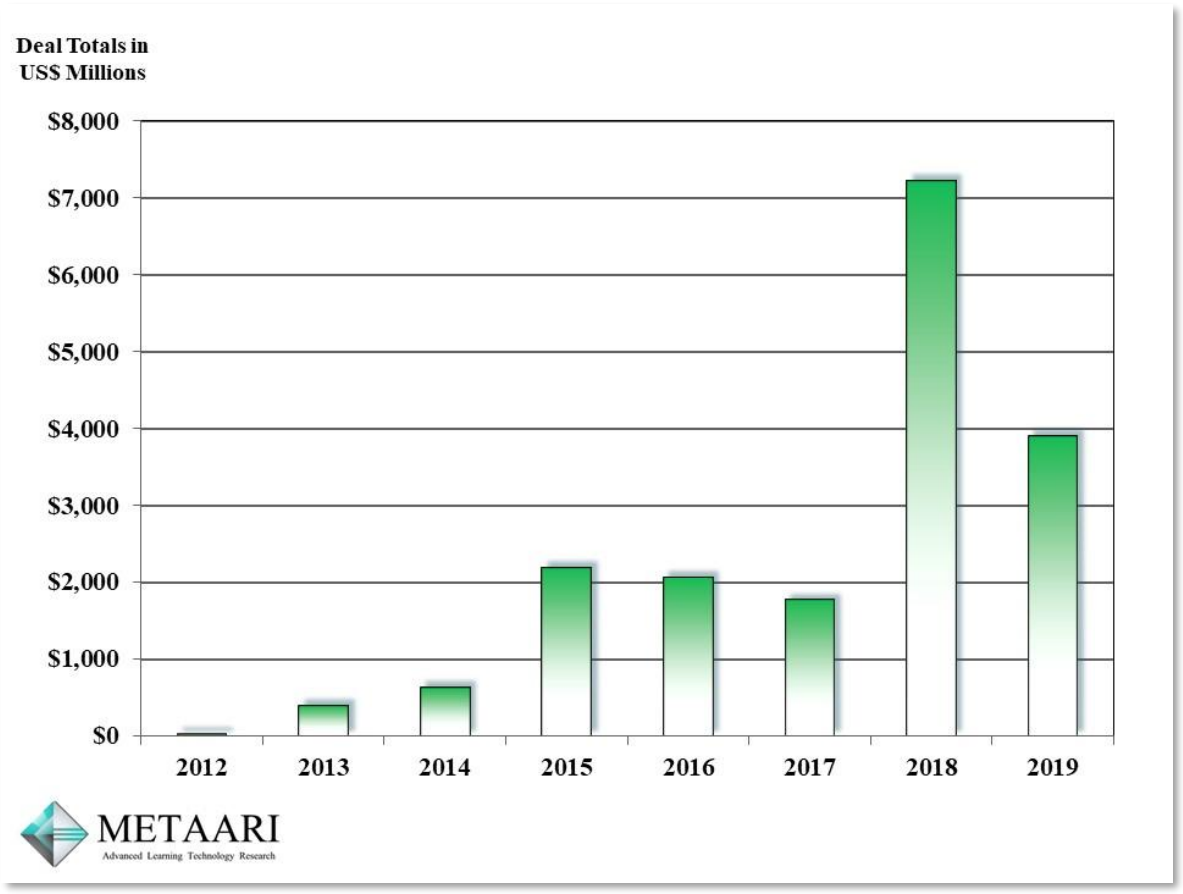
- TAL Education obtained a breathtaking $500 million in investment in February 2019, the highest amount going to any edtech company in 2019. "TAL Education, which provides after-school tutoring services in subjects including mathematics and physics, is expected to use the funds to further its inorganic growth moves and for business expansion."

China has essentially become a hostile business environment for tech companies that develop digital content. An onslaught of government regulations has effectively hobbled the learning technology industry in China. This is now called "regulatory uncertainty" since new regulations tend to be announced unexpectedly.

A stunning $7.22 billion was invested in Chinese learning technology companies in 2018. There was also a sharp spike in the number of companies getting funding, jumping to 207 in 2018, up dramatically from the 67 Chinese companies funded in 2017. ***This changed dramatically in 2019 with only 79 Chinese companies garnering a combined total of $3.90 billion.***

For the second year running China trailed the US in the funding for AI-based Learning products. Only $187.69 million went to just eight AI-based learning companies in China in 2019. This is down significantly from the $299.7 that went to 12 AI-based Learning companies in China in 2018. In stark contrast,

Figure 6 - 2012-2019 Total Investment Amounts Made in China



When viewed visually in a knowledge graph it certainly looks like the 2018 learning technology investments in China were an anomaly. Yet this could be said for the 2019 funding that was dramatically higher than the funding amounts prior to 2018. Investment in edtech companies in China are essentially a new phenomenon with virtually no funding activity prior to 2013.

The Internet giant Tencent is a major investor in advanced learning technology in China and across the globe. They have poured billions of dollars into companies like UBTECH, Zhihu, VIPKID, Yuanfudao (formerly Yuantiku), India's BYJU'S, and BabyEnglish.

Tencent's investment activity is interesting considering that they operate a highly successful online education portal called Tencent Class that has 300 million registered users and over 100,000 courses. Yet, the edtech companies they are investing in are not direct competitors.

A major trend in China is for well-funded edtech companies to go public. For example, the leading online learning firm HuJiang raised $230 million in three tranches in 2015. The company went public in July 2018 launching on the Stock Exchange of Hong Kong. In 2017 and 2018, 18 Chinese edtech companies went public accounting for more than half of all edtech IPOs on the globe. They are analyzed in a subsection of this section.

An interesting new trend is the entry of non-Chinese investors in China's edtech industry. Singapore's Temasek led the $250 million round to 17Zuoye (means Homework Together) in March 2018 and Japan's SoftBank invested $500 million in Zuoyebang in late 2018.

Table 6 – 2012-2019 Total Number of Edtech Deals and Investments Made in China

Investment Year	Total Number of Deals Made	Investment Totals (in US$)
2012	6	*$33.2 Million*
2013	47	*$398.5 Million*
2014	36	*$634.4 Million*
2015	63	*$2.19 Billion*
2016	51	*$2.06 Billion*
2017	67	*$1.77 Billion*
2018	207	*$7.22 Billion*
2019	79	*$3.90 Billion*

Reference-based Learning (what Metaari calls Digital Reference-ware) is very popular in China, particularly online videos and digital test prep. A combined total of $1.16 billion was invested in 36 Digital Reference-ware companies in China in 2018.

China's 13th Five-Year Plan was released in March 2016 and spans the years 2016 through 2020. It explicitly supports the growth of online education. "The Plan calls for faster development of online and distance education, and vocational and continuing education, offered to all including farmers, workers and retired veterans to help meet the growing demand for a more educated and skilled workforce." The Chinese government has announced that it will invest over $30 billion in edtech by 2020.

In 2017, the total investments made to companies in China reached a breathtaking $1.77 billion. As impressive as this is, it was down from the $2.19 billion reached in 2015 and the $2.06 billion reached in 2016.

That pales in comparison to the $7.22 billion invested in 207 edtech companies in China in 2018. This funding is heavily weighted in the 31 companies that obtained over $100 million; eighteen were in China. Eight edtech companies raised over $200 million in 2018 in China. Funding dropped dramatically in 2019 with "only" $3.90 billion going to just 79 edtech companies in China.

Steady Collaboration-based Learning Funding in China Driven by the High Demand for Tutoring

The online tutoring industry in China is massive on a scale not found anywhere else in the world. Firms target three main areas: early childhood learning, after-school tutoring for K-12 students, and English language learning for people of all ages (particularly children). there were over 500 million online learners in China by the end of 2019.

In 2019, $2.64 billion went to just 33 online tutoring firms in China. This is the one bright spot for China as 2019 funding topped the $2.01 investments made to online tutoring companies in 2018.

The online tutoring company that raised the highest amounts of funding in China was Zhangmen. Zhangmen raised $350.0 million in January 2019. Yuanfudao obtained $300.0 million in January 2019. Other online tutoring firms that raised high amounts in 2019 in China include:

- VIPKID raised $150.0 million in October 2019 in a round led by the Internet giant Tencent. They had previously raised $500.0 million in June 2018.

- NetDragon's Education division focuses heavily on tutoring and they obtained $150.0 million in November 2019.
- Gaosi Education Group (now rebranded as Aixuexi) garnered $140.0 million in April 2019 in a round also led by Tencent.
- Huowua Siwei raised $125.0 million in two rounds in 2019.
- iTutorGroup obtained $100.0 million in July 2019.

As massive as the online tutoring market is in China, it is still in a nascent stage and has enormous room to grow. Several of the larger online tutoring firms have filed IPOs including New Oriental's Koolearn brand, which has the largest market share in college test prep mentoring. China Online Education Group, branded as 51Talk, claims to be the largest online English language learning company in China. They went public in late 2017. Twenty online education companies in China went public in 2018 and 2019 and six of them were online tutoring firms.

The Grass is Greener: Chinese Edtech Companies File IPOs Outside the Mainland

Chinese education companies are launching IPOs at a growing rate. This gives them access to an enormous amount of capital and a fast track to unicorn status. There are three primary stock exchanges Chinese companies prefer: domestic (Shanghai and Shenzhen), Hong Kong, and the US. Mainland China edtech companies are flocking to the Hong Kong and US stock exchanges. They are migrating away from domestic exchanges as a way to avoid Chinese regulations and to expand outside of China.

Eight online education companies in China went public in 2019, Twelve digital education companies in China launched IPOs in 2018 in addition to the six that went public in 2017. In 2018, only four non-Chinese digital education companies went public: Pluralsight in the US, ReadCloud in Australia, Immersive VR Education in Ireland, and Arco Platform in Brazil. ***Over half the world's largest listed digital education companies are now from China.***

- China's Retech Technology went public in early 2017 in the first quarter of 2017. Online education companies SchoolPal Online and Sooc also went public in early 2017.
- RISE Education, Wisdom Education, and China Online Education Group went public in late 2017. China Online Education Group, branded as 51Talk, claims to be the largest online English language learning company in China. At the time of the IPO, they were generating just over $125 million in annual revenue.

- Bojun Education filed their IPO in October 2017 on the Stock Exchange of Hong Kong. The company offers "services from kindergarten through to university by student enrolments in the 2015-2016 school year, with 48,220 students."

Sunlands Online Education went public in March 2018 on the New York Stock Exchange. Founded in 2003 as a traditional education company, it transitioned to online education in 2014. It provides online education for higher education and professional certifications.

OneSmart International Education Group went public in March 2018 on the New York Stock Exchange. Founded in 2008, OneSmart was the largest "premium" K-12 after-school education service provider in China in terms of revenue in 2016 and 2017. OneSmart's revenue was $311.3 million in 2017, an increase of 34.6% compared with the year before. While they operate physical schools, they place a great emphasis on digital learning.

In July 2018, Koolearn, the online education arm of New Oriental Education & Technology filed for IPO on the Hong Kong exchange. Koolearn is the largest online education brand in the Chinese college-exam preparation market, and holds an 8.2% market share in terms of revenue. The company was generating just under a $100 million in annual revenue at the time of the IPO.

- For the nine months ended February 28, 2018, Koolearn had 852,000 students enrolled in its college-tutoring programs, or 59.1% of its total student enrollments. The rest of their students were preschoolers and K-12 students. New Oriental owns 66.7% of the company.

In July 2018, China-based Liulishuo filed their IPO on the New York Stock Exchange. Their flagship product is an AI-based language learning tutor called Dong Ni Ying Yu (means "the tutor that understands you"). It provides users with personalized learning content. The company obtained $100 million in funding in July 2017.

HuJiang Education Technology is a very popular online education platform in China. HuJiang raised $230 million in three tranches in 2015. They filed their IPO on the Stock Exchange of Hong Kong in July 2018.

Other online education companies in China that filed for IPOs in 2018 include:

- China Xinhua Education Group filed their IPO on the Stock Exchange of Hong Kong in March 2018. The company serves the higher education and vocational

segments of China. While they operate brick and mortar schools, they make extensive use on learning technology and distance learning.

- China 1st Century Education Group went public in May 2018 on the Stock Exchange of Hong Kong. The company "is a large established private education service provider based in Hebei Province, China, serving a wide range of students, from preschool students through primary school, middle school, and high school students."

- Ambow Education Holding went public in May 2018 on the US NASDAQ exchange. They used to be traded on the New York Stock Exchange. Their offerings include "a learning engine, which enables students to personalize their studying method; a tracking system, which monitors the student's studying progress; and an e-learning platform, which provides an online education environment."

- Babytree started trading on the Stock Exchange of Hong Kong in November 2018. The Internet giant Alibaba invested $216.2 million in the company in June 2018 in exchange for a 10% stake.

While filing an IPO on the Hong Kong exchange insulates the companies from the strict regulations on the mainland as long as they don't try to sell products in mainland China. Then they must adhere to the regulations.

China Gingko Education Group went public on the Hong Kong exchange in January 2019. They are an online higher education provider. China's Meten filed their IPO on the New York Stock exchange in May 2019. Meten is a large English language learning provides in China via their Likehhuo platform. Interestingly, they announced a merger with EdtechX Holding in December 2019. The new comoany is called Meten EdtechX and plans to file an IPO on the NASDAQ. Youdao went public on the New York Stock Exchange in October 2019. They are the education division of the Internet giant NetEase.

Buying their Way Out: Chinese Edtech Companies Go Global

Chinese edtech companies have started to acquire non-domestic digital education companies in what is clearly a move to expand globally and to sidestep oppressive regulations in the country. They are also taking stakes of various sizes in learning technology companies outside China thereby entering a revenue sharing agreement with companies outside the mainland. As massive as their domestic market is, they have clearly set their sights higher.

The Chinese online education giant TAL Education acquired Israel's CodeMonkey in December 2018 for an estimated $20 million. TAL has invested in over 100 companies, but this is the first foray into a non-Chinese venture. They bought the globally popular Dr. Panda (based in China) in September 2018. Panda develops mobile edugames for kids and had 90 million active users across the planet at the time of the acquisition.

CodeMonkey also has a large demographic. At the time of the acquisition, the company already had 10 million users around the world. Their coding games have been in use in the Israeli education system since 2014 and 75% of the elementary and middle schools in Israel use CodeMonkey.

- TAL stated in the press that "Together, the duo plan to continue to expand the CodeMonkey brand internationally and develop extensions for the Chinese market." By working with TAL, CodeMonkey hopes to become “the number one coding platform for kids in the world.”

TAL acquired Ready4 in February 2019. Ready4 is a test prep company and has offices in Boston and Tel Aviv. It is highly likely that TAL will continue to diversify outside of China. TAL obtained an astonishing $500 million in funding in February 2019.

The gaming giant NetDragon has been on an acquisition spree and is clearly eyeing global expansion. NetDragon is a major game developer in China (second largest after Tencent) and acquired US-based JumpStart, developer of the globally popular Math Blaster game for kids, in July 2017 and created a subdivision called JumpStart World. NetDragon's JumpStart World acquired the best-selling US-based Sokikom math game in January 2018. Sokikom was being used by "hundreds of thousands of students and educators from all 50 states and over 120 countries."

- JumpStart operates the virtual world for kids called Neopets that has over 80 million registered users across the planet. Jumpstart acquired Neopets from Viacom in 2014. JumpStart released a Mobile learning game based on the Neopets characters in May 2019 called Neopets Legends & Letters. " In this epically fun game, players, particularly children, can establish and enrich their library of vocabularies in a happy and encouraging atmosphere, while jumping into their unlimited creative world of imagination." At the time of the release, JumpStart stated in the press that they had "a large user base of over 5 million monthly ***active*** users spanning across North America, Europe, South America, Asia and Oceania.

- Read more: https://www.tweaktown.com/pressrelease/12696/jumpstart-subsidiary-netdragon-launches-neopets-legends-letters-mobile-revitalize-brand/index.html

- NetDragon acquired UK's smart board supplier Promethean in 2015. At the time of the acquisition, the company was doing business in 110 countries and had products installed in 1.3 million classrooms worldwide. Half of their annual revenues were generated in North America at the time. Yet, Promethean has large deployments across the globe as well. In December 2019, the Egyptian Ministry of Education selected Promethean as a strategic partner "to digitally enhance teaching and learning throughout the country." Over 26,000 schools will get upgrade Promethean smart panels.

- In January 2018, NetDragon acquired the US learning technology platform Edmodo. Edmodo had "over 90 million registered users in 400,000 schools across 192 countries" at the time of the acquisition.

The Neopets active user base, the Promethean deployments, and the installed Edmodo user base are ideal distribution channels for NetDragon's new line of educational games. In October 2019, NetDragon stated in the press that their "education footprint now extensively covers over 2 million classrooms in more than 192 countries, benefiting over 100 million users and 12 million teachers." Interestingly, NetDragon's education division obtained $150 million in investment in November 2019 from Ascendent Capital Partners, a Chinese investment firm.

US-based Wonder Workshop sells educational robots and obtained $41 million in funding in October 2017. While Wonder is US-based, the funding came from China powerhouse companies including TAL Education, the leading online education provider, and the Internet giant Tencent.

Tencent has been on an investment roll in 2019. They invested a massive $779.5 million in eight learning technology firms in 2019; six were in China but two were in the UK including the $10 million they gave to a UK company called SenSat, a location-based geospatial startup that has an amazing platform called MAPP. "Mapp is an easy to use, cloud based digital twin platform that allows teams working in physical environments to interact with their workplaces digitally. We create digital twins, or digital representations of real world locations, then infuse real time data sets from a variety of sources. Our product Mapp helps offline industries analyze their environments to learn how things work and improve the way we make decisions."

In May 2019, Tencent led the $25 million round invested in UK's Prowler.io. Pearson Education was also an investor. Prowler develops a platform called VUKU ("The world’s first autonomous decision-making platform for AI") used to deliver AI-based decision-support. "Effective decision-making is the key to the success of all businesses. Any company, large or small - will stand or fall based on the quality of its decision-making. PROWLER.io has developed a unique platform based on artificial intelligence and proven mathematical principles to ensure those key decisions are fast,

accurate – and commercially effective. Our platform - underpinned by world-class AI research - helps people make better business decisions and delivers significant value across the enterprise."

China's short video platform TikTok launched their #EduTok platform in India in October 2019. TikTok is the international version of the internet giant ByteDance's Douyin platform. ***TikTok has over 240 million users in India***. TikTok is not ad-based (yet), but generates revenue from in app purchases. ByteDance selected six commercial Mobile Learning providers from India to develop content for #EduTok: Vedantu, Toppr, Made Easy, Gradeup, Vidya Guru, and Hello English. Except for Hello English, each of these companies specializes in test prep for standardized exams used in India:

- Vedantu sells live online test prep tutoring for a range of academic standardized tests used in India for college entrance. They garnered $48.5 million in investment in three rounds in 2019.

- Toppr also provides digital test prep products for college entrance exams. They provide recorded video instruction and practice test banks.

- Made Easy specializes in graduate school exam prep like the Graduate Aptitude Test in Engineering (GATE) taken by post graduate engineering students. They primarily provide test prep instruction via physical classes and print-based products, so the #EduTok will allow them to diversify into Mobile Learning.

- Gradeup is also a test prep company and sells mobile apps. Yet, they specialize in professional certification exams for banking, finance and civil service.

- Vidya Guru also sells test prep for professional exams. They specialize in exams required by the government to get employed in civil service. They produce exam prep for seven Staff Selection Commission (SSC) exams, six banking exam, five general civil service exams.

- Hello English (developed by Culture Alley) claims to be India's top mobile English language learning company. They claim to have reached over 50 million users across the globe. They are primarily consumer facing but now offer an enterprise version. They have attracted dozens of global enterprise clients.

Effectively, TikTok has covered the entire spectrum of standardized exam prep in India by partnering with these providers. The business model has not been disclosed, but at the very least, #EduTok provides a huge increase in reach to these providers and a lucrative new revenue stream for ByteDance outside of China.

Investments Surge in India: Learning Technology Companies Raking in Capital

The was a sharp increase in funding going to learning technology companies in India in 2019. Investment jumped to $1.66 billion in India in 2019, up from the $1.09 invested in 2018.

There was also a massive spike in investment in edtech companies in India in 2018, but most of it went to just one company. Just over $1.0 billion dollars went to 86 edtech companies in 2018 and just under 53% of that went to a company called BYJU'S (a brand of Think & Learn). Investment increased in India across the board with nearly $453 million going to the other 85 companies that were funded in 2018.

BYJU'S is an Indian edtech unicorn subsidiary of Think & Learn that raised an incredible $640 million in two tranches in 2018: $100 million in September 2018 and an astonishing $540 million in December 2018. They have raised $1.043 billion since they launched in 2011. The massive December 2018 funding was led by South Africa's Naspers and the Canada Pension Plan Investment Board (CPPIB).

BYJU'S raised $193.8 million in funding in 2019 including a $150 million round in July. The July round was led by Qatar Investment Authority (QIA), the sovereign wealth fund of Qatar. BYJU's has indicated that they would user their new funding to expand overseas, particularly in the US and the UK. BYJU'S acquired US-based Osmo (Tangible Play) in early 2019. Over 90% of Osmo's user base is in the US. By mid-2018, Osmo had over a million families and 2,000 schools using their iPad game platform.

BYJU'S dominated the investments in 2017 and 2016 as well. The company raised $85 million in 2017 and obtained $125 million in two tranches in 2016. In July 2017, BYJU'S acquired Pearson's TutorVista, an online tutoring company with a large international presence.

Funding declined to $397.6 million in India in 2017 compared to 2016. In 2016, 105 learning technology companies in India were funded for a total of $564.22 million, up dramatically from the $297.4 million that went to a total of 62 Indian companies in 2015.

To put this in perspective, in 2012, only 10 learning technology companies in India were funded: a mere $36.4 million went to these companies for the entire year of 2012.

Investor interest picked up considerably in 2013 with a total of $141.7 million going to 17 companies operating in India.

Table 7 - 2012-2018 Total Number of Edtech Deals and Investments Made in India

Investment Year	Total Number of Deals Made	Investment Totals (in US$)
2012	10	*$36.4 Million*
2013	17	*$141.7 Million*
2014	13	*$83.0 Million*
2015	62	*$297.4 Million*
2016	105	*$564.2 Million*
2017	83	*$397.6 Million*
2018	86	*$1,092.9 Million*
2019	76	*$1,660.9 Million*

It is interesting that $227.1 million was invested in 23 AI-based Learning companies in India. Two companies garnered $25 million in funding: Education Initiatives (developer of the MindSpark platform) and Sentieo. India is rapidly becoming a powerhouse in AI research and it is likely that investment will flow to new AI-based Learning companies.

It is too soon to determine if the investment patterns in India are anomalies. BYJU'S funding has definitely skewed the overall patterns. It is interesting that the Chinese Internet giant Tencent and the South Africa media conglomerate Naspers are major investors in BYJU'S.

A test prep company called Vedantu garnered $48.5 million in funding in three rounds in 2019 including a $42 million round in August 2019. They have raised a total of $59.9 in six rounds since they launched in 2011. As of early 2020, "More than 1.5 million students consume educational videos on Vedantu each month, of which 30,000 are paying subscribers."

New Investor Interest in Southeast Asian Edtech Companies

Eighteen edtech companies in Southeast Asia raised a combined total of $327.8 million in funding in 2019, up more than four times from the $75.5 million invested in 2018. Ten of them were in Singapore. Most if the funding was in small amounts excepts for two companies: Ruangguru in Indonesia and Near in Singapore.

- Southeast Asia is geographically divided into two subregions: Mainland Southeast Asia (or Indochina) and Maritime Southeast Asia. Mainland Southeast Asia includes Cambodia, Laos, Myanmar (Burma), Peninsular Malaysia, Thailand, and Vietnam. Maritime Southeast Asia includes Indonesia, the Philippines, East Malaysia, Brunei, Singapore, and East Timor.

The largest investment in Southeast Asia in 2019 was the unprecedented $150 million that went to an Indonesia company called Ruangguru. Ruangguru launched in 2014 and is the largest online tutoring firm in the country with over 7 million students. Indonesia's Zenius Education garnered $20 million in investment in October 2019. A managed services provider serving the higher education market in Indonesia is HarukaEDU that obtained $4 million in November 2019.

Indonesia has the largest population at 272 million people by the end of 2019. According to BuddeComm, "Compared to other Asian nations, Indonesia has very low fixed line and fixed broadband penetration, high mobile penetration and moderate mobile broadband penetration. Indonesia has seen a very rapid increase in mobile broadband penetration over the past five years. Strong growth is predicted through 2023."

Vietnamese learning technology companies are starting to attract private investment. A combined total of $36.4 million went to ten edtech companies in Vietnam in 2019 including the $12.5 million that went to a company called Gotit! and the $10 million obtained by YOLA. To date, the largest amount of investment in Vietnam was the $50 million obtained by TOPICA Edtech in November 2018. TOPICA has operations across Southeast Asia.

- In 2019, TOPICA invested $3.5 million in a new English language tutoring app for kids called Kidtopi. At the time of the investment, TOPICA stated in the press that "Vietnam currently has about 87 edtech startups and the sector is poised to attract more investments in the region, driven by demand from willing-to-pay parents and hungry learners."

Three edtech companies raised funding in the Philippines in 2019: Phinma Education, Edusuite, and Edukasyon.ph. Phinma garnered the highest amount at $31.5 million. They are an online test prep startup specializing in healthcare licensure prep.

Just over $117.6 million went to ten learning technology companies in Singapore in 2019 in comparison to the $25.7 million that went to just six edtech companies in Singapore in 2018. While this may not sound very high, it is quite high for a country with just over 5.7 million people.

Singapore startup Near develops an extraordinary ai-based business intelligence platform. "Near provides insights into human behavior by analyzing where people are, and combining that with a multitude of data points to predict and influence behavior. The Near Platform has the world's largest data set of people's behavior in the real-world, and uses powerful artificial intelligence and machine learning models in a privacy-led environment to power self-serve SaaS products." They garnered $100 million in funding in 2019.

In December 2019, Singapore's startup incubator Spaze Ventures launched EduSpaze, "With an aim to nurture a vibrant edtech start-up ecosystem in Singapore and Southeast Asia, this accelerator will support early-stage edtech companies with up to S$500,000 (US $368,000) funding."

India's Kaizen Private Equity is an investment firm that specializes in learning technology investments. In October 2019, they announced that they would invest in edtech companies in Bangladesh, India, Myanmar, the Philippines, Sri Lanka, Thailand and Vietnam. They gave the $10 million to Vietnam's YOLA in 2019. YOLA is an online English language learning startup.

2019 Investments Surge in the UK, France, Germany, and Canada

Investment activity is quite robust in Europe, particularly in the UK where 83 companies obtained a combined total of $635.8 million, up from $488.1 million in 2018.

A combined total of funding of $387.0 went to 21 companies in France, more than double the $169.7 million in 2018. In 2019, 23 companies in Germany garnered a combined total of $482.5 million, more than double the amount in 2018.

Table 8 - 2018- 2019 Investments Made to Companies in the UK, France, Germany, and Canada

Country & Region	Total Number of Deals Made in 2018	2018 Investment Totals (in US$)	Total Number of Deals Made in 2019	2019 Investment Totals (in US$)
The United Kingdom (UK)	64	*$488.1 Million*	83	*$635.8 Million*
France	11	*$169.7 Million*	21	*$387.0 Million*
Germany	16	*$177.5 Million*	23	*$482.5 Million*
Canada	33	*$245.8 Million*	18	*$882.2 Million*

The total number of deals made in Canada in 2019 dropped to 18 compared to the 33 deals in 2018. Yet, the total combined funding was ***more than triple the 2018 amount.*** A combined total of $882.2 million was invested in Canada in 2019, up from $245.8 million in 2018.

AI-based Learning Dominates: The UK is a Vibrant Learning Technology Innovation Hub

In 2019, investments spiked to $635.8 million with 83 companies raising funding. This is contrast to the $488.1 million that went to 64 companies in 2018, up from $290.1 million that went to 48 companies in 2017. So, the total number of deal and the combined investment amounts have increased for the last three years in the UK.

An interesting trend that emerged in the UK in 2018 is the investor interest in AI-based Learning companies. This continued in 2019. In 2018, eleven AI-based Learning companies obtained a combined total of $98.1 million in investment. ***In 2019, twenty AI-based Learning companies were funded in the UK, garnering a combined total of $264.2 million in investment.***

The highest amount went to a company named Healx in that raised $57.29 million in October 20189. They sell a sophisticate knowledge graph platform design for the healthcare vertical. They have pioneered the use of AI in accelerating the treatment discovery for rare diseases. " Our AI platform uses natural language processing (NLP) to extract disease knowledge from published sources and to complement biomedical databases and proprietary, curated data.

These data are integrated in the form of the largest, rare disease-focused Knowledge Graph."

- Eigen Technologies raised $37 million in November 2019. They sell an ai-based knowledge extraction engine capable of trolling through massive amounts of textual data. "Equip yourself with the answers you need to meet your most critical business challenges. We place the power of machine learning in your hands so you can extract text and get answers. Leverage institutional knowledge from various sources."

- A company called Sparx Maths obtained $26.2 million in September 2019. They develop an ai-based math learning tool called Sparx for the PreK-12 segment. "Our debut product Sparx combines world class, rigorously tested Maths content; intelligent data science and a simple-to-use technology platform to enhance and support the teaching of Maths in schools. Sparx is about learning."

- An extraordinary AI-based Learning startup in the UK is PROWLER.io. They raised $25.0 million in May 2019 in a round led by Tencent and Pearson Education. "Our platform - underpinned by world-class AI research - helps people make better business decisions and delivers significant value across the enterprise." They sell an ai-based decision support tool called VUKU. " VUKU is a highly sophisticated set of AI and machine learning tools that can transform the decision-making processes of any enterprise."

A company called AppLearn obtained $25.0 million in investment in September 2019. They sell an ai-based performance support tool called ADOPT. "ADOPT is the leading Digital Adoption Platform (DAP) designed to make digital transformation seamless and effortless, providing tailored in-app training, step-by-step guidance, and advanced adoption analytics."

A combined total of $101.8 million went to 18 Game-based Learning companies in the UK in 2019. Immersive Labs raised $48 million in two rounds in 2019. They claim to be "The world’s first fully interactive, gamified and on-demand cyber skills platform. Our challenge-based skills content is developed by experts and derived from world-class threat intelligence. Get points and rewards with every lab you complete. Move up the leaderboard and champion your team. Hack-the-box and capture-the-flag challenges for all levels."

Surge in Funding in France and Germany

In 2019, a combined total of $387, million went to 21 learning technology companies in France. This is more than double the $168.7 million that went to just 11 companies in 2018. There were ten companies that garnered $10 million or more in France in 2019.

The highest amounts went to opensquare and OpenClassooms who both raised $60.0 million in funding.

- "In partnership with Inria, the French Institute for Research in Computer Science and Automation, opensquare developed a revolutionary product grounded on artificial intelligence that reinvents employee surveys. Our mission: help organizations unleash collective intelligence, which we believe withholds the answers to the obstacles they face."

- "OpenClassrooms is an online platform offering top quality, education-to-employment programs and career coaching services for students worldwide. Different from all other online learning platforms, our Career Paths include weekly, one-on-one mentorship sessions with a dedicated professional in each field, supporting you through your studies."

Talentsoft obtained $50 million in funding in January 2019. They are one of the few legacy learning technology companies to raise funding in 2019. "Connect your organization with unlimited learning activities, experts and communities, and ensure you build a tailored and engaging pathway to the future."

A Collaboration-based Learning company called 360Lernaing obtained $41,0 million in April 2019. "With 360Learning for Enterprise, transform your dedicated training team into facilitators of bottom-up learning. Crowdsource learning needs and monitor the progress of in-house experts as they create, deliver & optimize courses themselves."

A combined total of $482.5 million went to 23 learning technology companies in Germany in 2019. This is up sharply from the $177.5million that went to 16 companies in 2018.

An astonishing $290.0 million went to Munich's Celonis. The develop what they call a Process Mining platform. "The Celonis Action Engine is a new kind of process excellence tool—an AI-powered process assistant that constantly analyzes data, and then sends signals to everyone involved to let them know that they need to take action to get a process back on track. Mining your processes is just the beginning—with the Action Engine, you can now you can turn those insights into real-time, automated actions, so your processes just keep getting better and better."

AMBOSS's raised $33.9 million in September 2019. They sell test prep apps for medical licensure. "In just 5 years, AMBOSS has become the #1 European medical study resource. Already, 96% of German medical students and more than 70% of German-speaking medical schools have made AMBOSS their primary study resource. Since launching the English platform in Spring 2017, we now have more than 200,000 users in over 191 countries."

Berlin's Rasa garnered $13 million in April 2019. They sell a platform designed to create virtual assistants and chatbots. "Build contextual AI assistants and chatbots in text and voice with our open source machine learning framework. Scale it with our enterprise grade platform."

A company called i2x obtained $12 million in March 2019. It is an ai-based assistant for sales and call center personnel. "i2x helps sales and customer support teams to excel at their job. We do that by providing the most intuitive, productive and personally tailored tool to steer operations and revolutionize coaching. For agents, i2x is a digital coach that empowers sales and customer support agents to learn from their previous customer interactions and the overall team's experience."

The Spike in Canada

Canada experiences a surge in learning technology investment in 2019. The total number of deals decreased to 18 down from the 33 I 2018, but the combined amount in 2019 was a staggering $882.2 million, up from $245.8 million in 2018.

Québec's Coveo raised $227.0 million in investment in November 2019. They sell an ai-based search engine platform that has a component they call a Relevance Engine that brings "artificial intelligence and human intelligence together for real relevance and real results. Coveo Machine Learning models bring together user history and context to return the precise recommendation and suggestion users need. Every time."

Montréal Element AI garnered $15.4 million in funding in September 2019. The sell an extraordinary AI-based Learning platform. It includes a component they call Knowledge Scout. It is essentially an ai-based knowledge management (KM) tool. "Accelerate accurate knowledge transfer between employees. Easy-to-use interface that allows users to ask questions in simple, plain language and returns responses based on the system’s analysis of both structured and unstructured data. As users bookmark their search results, the AI captures the relationships users make between different pieces of information, allowing it to learn and improve over time while building a repository of tacit knowledge."

A wearable device company called RealWear raised $80 million in July 2019. They develop AR-based performance support solutions for industrial clients. "Better than a tablet. Smarter than glass. The HMT-1 has a completely hands-free voice-controlled user interface allowing workers to operate the tools and equipment needed for the job, even while climbing a scaffold or tower. Allowing the worker to maintain full situational awareness and maximum productivity Every aspect of the HMT-1 augmented reality headset was built to enhance worker performance. The HMT-1 is built to move knowledge across a workforce in minutes." As of late 2-19, they had 101 development partners across the planet, mostly field service support and remote assistance companies.

Investments Decline in the Nordic Cluster, Israel, and Australia

Investments to learning technology companies in 2019 declined in the Nordic Cluster, Israel, and Australia. The declines were significant in the Nordic Cluster and Australia. The total number of deals made in each country dropped dramatically.

Table 9 - 2018- 2019 Investments Made to Companies in the Nordic Cluster, Israel, and Australia

Country & Region	Total Number of Deals Made in 2018	2018 Investment Totals (in US$)	Total Number of Deals Made in 2019	2019 Investment Totals (in US$)
Six Countries in the Nordic Cluster	48	*$313.5 Million*	19	*$126.3 Million*
Israel	21	*$388.3 Million*	14	*$256.7 Million*
Australia	17	*$123.0 Million*	6	*$85.6 Million*

These is the first time that funding has declined in the Nordic Cluster, Israel, and Australia since Metaari has been tracking edtech investment. Investment activity is inherently unpredictable and it is likely that funding will recover going forward.

Innovation Still Thrives in the Nordic Cluster Despite the Decline in Investment

In Metaari's taxonomy, the Nordic Cluster includes Denmark, Norway, Sweden, Finland, Iceland, and Greenland. Almost all for the edtechs operating in the Cluster are startups.

Funding was down in the Nordic Cluster with only 19 companies obtaining a combined total of $126.3 million. This region is a mature learning technology hub and investments seem to have peaked in 2018. While funding is down, the Cluster is still one of the most innovation learning technology hubs in the world.

In 2019, a mere $126.3 million was invested in nineteen learning technology startups in the Nordic Cluster. This is down significantly from the $313.5 million that went to 48 edtech startups in the Cluster in 2018. In 2017, 44 learning technology companies in the Nordic Cluster garnered a combined total of $240.9 million in investments.

Learning technology companies in the Nordic Cluster tend to be quite unique in both their product design and their distribution strategies. In general, learning technology companies in the Nordic Cluster design products for children and most of them are mobile and game-based.

Innovation in Cognitive Learning was evident in the Cluster in 2019. Even though only seven Cognitive Learning companies garnered a combined total of $22.1 million in 2019, their products are world class.

Sweden's Lifesum raised $5.0 million in investment in March 2019. " Lifesum is a Stockholm-based digital health startup with a mission to help create a world full of healthy, happy people. Our approach to health is personalized and we hope to be the daily companion you need along the way. We rely on technology, data and behavioral science to provide you with the best possible experience in your journey toward health." They had previously raised $6.7 million in 2014.

Finland's Combinostics obtained $4.4 million in investment in December 2019. They sell a clinical decision support platform called cNeuro that provides "quantitative assessment of brain images and for providing clinical decision support in neurological disorders. cNeuro gives healthcare professionals a comprehensive view of patient data which helps them to make an early diagnosis of neurodegenerative diseases." They obtained the US FDA's 501(k) clearance for their product in early 2018.

Helsinki's Meru Health obtained $4.2 million in funding in April 2019. "Meru Health's digital clinic offers an app-based treatment program for depression, anxiety, and burnout. The program combines technology, evidence-based therapy, anonymous peer support and daily support from licensed clinicians - the new standard of mental healthcare."

Flow Neuroscience raised $1.5 million in July 2019. The Swedish company developed an extraordinary headset-based product based on brain stimulation, an established treatment protocol in cognitive interventions. "Flow is a new medication-free way to

treat depression based on brain stimulation and an app for behavioral therapy. The technology used in the Flow headset is called transcranial Direct Current Stimulation (tDCS). To maximize your chances of recovering from depression, the brain stimulation is combined with behavior therapy delivered through the app Flow – Depression. The therapy focuses on lifestyle changes that significantly reduce symptoms of depression."

A startup in Sweden called Learning to Sleep has developed a cognitive product designed to mitigate sleep disorders. They obtained the equivalent of $1.13 million in March 2019 and intend to use the funds to expand into the UK. "The startup has developed a digital, drug-free sleep treatment that patients can access anywhere with no waiting time. The company has already treated over 1,000 patients in Sweden and Norway with its award-winning platform based on cognitive behavioral therapy (CBT). Learning to Sleep is a registered care provider in Sweden, and its treatment is approved by the Swedish equivalent to NHS (Läkemedelsverket). Its CE marked, conforming to relevant European health, safety and environmental protection legislation." CE Marking is the certification of medical devices and apps required in the European Union.

Funding Down in Israel: Innovation Up

Learning technology companies in Israel attracted a substantial amount of funding in 2017 and 2018. In 2017, 17 educational technology companies in Israel obtained a combined total of $235.7 million. The funding increased to $388.3 million in 2018 with 21 edtech companies were funded. That dropped to $256.7 million in 2019 with just 14 companies raising funding. That said, the learning technology landscape in Israel is characterized by widespread innovation.

Investment declined in Israel as well with only 14 companies raising $256.7 million, down from the $388.3 million that went to 21 companies in 2018. Yet. Israel attracted edtech funding early and it appears most startups are well funded.

Yet, eight companies in Israel obtained over $10 million in investment in 2019. The highest finding went to a Location-based Learning company called Vayyar Imaging that raised $109.0 million in November 2019. They had previously obtained $45 million in late 2017. They develop an extraordinary sensor that generates what they call 4D imagery.

- "The company’s sensors can see through walls and objects and track and map everything happening in an environment in real-time. The sensors can differentiate between objects and people, determine location even when mapping very large areas, and create a 3D image of the environment in real time." One of their target verticals in healthcare. The product has a variety if

uses. "The sensors can monitor the composition of materials, allowing sensitive users to monitor the fat, protein, alcohol content, and other percentages in food and drinks.

JoyTunes raised $25 million in September 2019. They developed an amazing learning product that enable music instruction using sound recognition. "JoyTunes is bringing music learning into every single household around the world, whether it's piano, guitar, sax, singing, or any other instrument. Our current piano learning apps are seeing fast user and revenue growth, chosen as one of the best apps by Apple and Google and used by 10% of US piano teachers."

Voca.ai obtained $20 million in funding in October 2019. It develops an ai-based virtual call center agent. They position it as an assitant to human agents. "Voca.ai has developed a ground-breaking approach to Natural Language Processing technology called Speech to Intent and Speech with Intent. In simple terms, Voca Agents discern contextual meaning directly from the expressive human voice (not text), and converse using variable intonation, pausing and non-verbal expressions." They claim the virtual agent "delivers empathy to scale."

Explorium obtained $19 million in September 2019. They develop an ai-based decision support platform and target a number of verticals including healthcare and human resources.

- "Healthcare organizations rely on the Explorium platform to recognize complex patterns from within their volumes of healthcare data generated during practice, much of which remains siloed or inaccessible. Additionally, Explorium's data enrichment adds more socioeconomic, behavioral, and trend context to internal datasets for more representative predictive models that help increase patient diagnosis accuracy."

- "With Explorium, Human Resource (HR) professionals are able to enrich their own unstructured employee behavior and internal workforce data with our competitive business and professional data to drive better decisions that improve organizational performance. With more reliable predictive models, HR teams can now explore and discover additional patterns which help optimize recruitment campaigns, reduce employee turnover, improve recruitment processes by enhancing their selection process, and personalize employee training."

A cybersecurity simulation company called Cymulate "tests the strength of your security by simulating real cyber-attacks across all attack vectors based on MITRE ATT&CK. Stay one step ahead of the game. Cymulate gives you direct instructions to

reduce your attack surface, and makes it easy to prioritize which gaps to close first." They garnered $15 million in funding in November 2019.

An extraordinary innovation was developed by Israel's PlayerMaker. "PlayerMaker is the ultimate performance insight product for football (soccer) teams." Their product uses a physical sensor that us strapped on a player's shoes. "PlayerMaker's flagship device uses a sensor strapped to a player's boot to monitor technical, tactical, biomechanical, and physical data from each athlete. Get accurate gait profiles, help prevent injury, detect outlier players, optimize training, drive efficiency and much more." The company raised $10 million in December 2019.

Weakness Down Under: Australia Learning Technology Investment Declined in 2019

Funding dropped dramatically in Australia in 2019 with only 6 companies attracting investments. In 2019, only $85.6 million was invested in Australia learning technology companies, down from $123.0 million in 2018.

A tutoring company for kids aged three to twelve called Cluey in Sydney raised $34 million in two rounds in 2019. They have tiered pricing model depending n the age of the student and the length of the session. "As an education company, we provide students with the right help at the right time through expert online tutoring, carefully developed learning programs in English, Maths and Chemistry, and personalized content that's mapped to the Australian syllabus."

A corporate training firm called GO1 raised $23.1 million in March 2019. "Corporate training online marketplace GO1 has become the first Australian start-up to be backed by Microsoft's global venture capital arm M12." M12 was formerly known as Microsoft Ventures that was founded in 2016. This was M12's first edtech investment. GO1 had raised $7.7 million in investment in August 2018 and $3.08 million in 2017.

In September 2019, Australia's EdApp (formerly Ed MicroLearning) obtained a $4.25 million investment from the workplace safety company, SafetyCulture. EdApp "is a microlearning based Mobile Learning management system (LMS) with integrated authoring tool, spaced repetition & gamification. Since launching in 2015, EdApp has partnered with large Australian and global corporations, including: Pandora, Pernod Ricard, Shell, Mercedes Benz, Sodexo, Commonwealth Bank and Mars." They use a subscription-based pricing model and the price depends on the number of users.

Inexplicable Weakness in Latin America

Latin America has, until recently, been a hotbed of investment in edtech startups. Investment activity is inherently unpredictable. Investment has steadily weakened in

the last three years. In 2019, $98.7 million was invested in just 12 learning technology companies in the region.

There are economic factors at work. Venezuela is in the midst of socioeconomic turmoil. Bolivia, Colombia, Perú, Ecuador, and Chile have all experienced periods of civil unrest and protests during 2019. Mexico has been in an economic slump that has persisted for two years. While not technically in a recession, the country's economy has zero growth.

Argentina (the region's third-largest economy) is undergoing a major economic downturn. The country barely came out of an 18-month recession in December 2019 with a quarterly growth rate at an anemic 0.9%. There was no edtech investments in Argentina in 2019.

Platzi is a Colombian edtech startup that has since moved their operations to Mexico and the US. They obtained $6 million in funding in June 2019. Platzi claims to be the largest online technical provider in the Spanish-speaking world with over a million students across 20 countries.

Perú 's Crehana Education develops online education content for creative professionals. They garnered $4.5 million in investment in February 2019. The company has raised $6.2 million since they launched in 2013. They have over 650,000 students across all the Spanish-speaking countries.

Brazil just came out of a prolonged recession that started in 2014. Brazil was once the bastion of edtech innovation and startups attracted significant amounts of capital until the last few years. Investment has essentially dried up in Brazil. Investment is still flowing to physical education companies but relatively little is going to online firms.

That said, a combined total of $70.2 million went to five companies in Brazil in 2019, but $60 million of this went to a single Game-based Learning company called Wildfire.

Wiser Educação is a holding company that includes the brands WiseUp, NumberOne, mySucesso.com, and Buzz Editora. Wiser obtained $5.17 million in investment in April 2019. Wise Up is the largest English language learning chain in Brazil. While they deliver lessons in physical locations, they have a massive online enrollment with students across the region. The other investments in Brazil were quite modest:

- TNH Health is a Brazilian developer of virtual mental health "digital assistants" and they raised $2 million in two rounds in 2019.

- Brazil's Luma raised $500,000 in December 2019. "Luma is an online education platform designed to ‘individualize’ the teaching process by providing one-to-one online classes for students, as well as forums, preparations for English exams, and other teaching resources."

- Árvore Educação is a Brazilian edtech that resulted from the merger of Árvore de Livros and Guten. Árvore garnered $625,000 in September 2019.

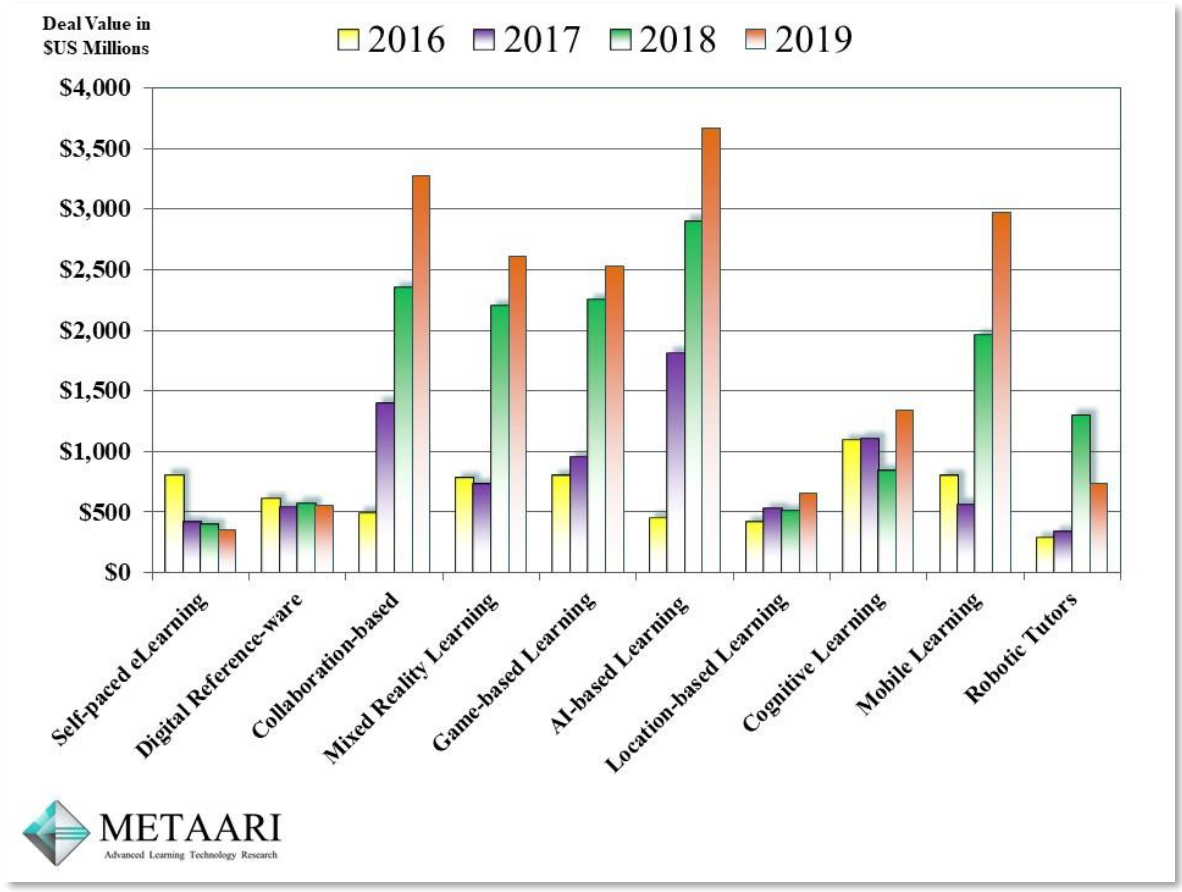
Adobe Capital invested $1 million in Universidad Kuepa in August 2019. They are "a Mexican online university offering bachelors and master's degrees to its student base in Mexico and the Spanish-speaking world."

In December 2019, DUX Capital made a $500,000 investment in Baud, a Mexican early childhood learning technology startup. "The company’s first product, Bucky, offers children (6-12), the opportunity to approach and learn technology and robotics through an intuitive platform that includes a physical robot and a storytelling dynamic."

Legacy Products are Obsolete: Investors Migrate to Next-generation Advanced Learning Technology Products

Metaari considers learning technology investment patterns to be leading indicators. Those patterns can show a shift away from legacy product types toward different or even new product types. They can also plot the pace that investor interest shifts to companies that target particular buying segments.

Figure 7 - 2016-2019 Total Global Learning Technology Investments by Learning Technology Type



Despite the massive funding that went to edtech companies in 2019, only $312.2 million went to just 13 Self-paced Learning companies. The funding was heavily concentrated in just three companies: Coursera, Degreed, FutureLearn (half owned by the UK's Open University), and OpenSesame. Combined, they garnered $272 million in 2019. Coursera obtained the highest amount at $103 million in April 2019. Interestingly, the Australian employment marketplace SEEK was the investor in both Coursera and FutureLearn (they took a 50% stake in FutureLearn).

In 2018, only $398.5 million went to 43 Self-paced Learning companies including the managed services provider in India called Nspira that raised $75 million in July 2018. Managed services are one of the few eLearning revenue opportunities left in the declining market. ***To put this is context, eLearning companies raised a staggering $2.1 billion in 2015***, but then the global eLearning market declined dramatically and investors turned their interest elsewhere. In 2016, "only" $806 million was invested in eLearning companies, less than half from the year before. The funding plummeted again in 2017 by nearly half to reach only $416 million.

Funding declined slightly for only one advanced learning technologies in 2019: Educational Bots. This was less due to the lack of investor interest. Just over $736.5 million went to 53 edubot companies. The apparent drop in funding was due to the rather unusual $820 million invested in UBTECH's new educational division by Tencent in 2018.

The big winners in 2019 were AI-based Learning, Collaboration-based Learning (live online tutoring) providers, and Mobile Learning edtech companies:

- A breathtaking $3.67 billion went to 120 AI-based Learning companies in 2019. The overwhelming majority of this funding went to corporate-facing AI-based Learning companies. Almost all of the funding was obtained by US companies although AI-based Learning companies in the UK, Israel, Canada, and India attracted significant investments. Only one Chinese AI-based Learning company obtain funding in 2019 and that was a company called GENIUS (UBGenius), an edtech firm serving the PreK-12 segment in China.

- In 2019, $3.27 billion went to Collaboration-based Learning companies. Over half of this went to companies in China. Just over $1.77 billion went to 15 online tutoring companies in China in 2019. The largest amounts went to TAL Education, Zhangmen and Yuanfudao, who raised $500 million, $340 million, and $300 million, respectively. Tencent invested $150 million in VIPKID in October 2019. Gaosi Education Group (now rebranded as Aixuexi) raised $140 million in April 2019 and an additional $70 million in November 2019.

- In 2019, $2.97 billion went to 176 Mobile Learning companies. This is up drastically from the $1.96 billion that went to 74 Mobile Learning companies in 2018. The highest investment in 2019 went to Zhihu in China that raised an astonishing $434 million. They sell what is known as a "homework helper" app, which are enormously popular in China.

- The second largest amount went to a company in India called Aakash Education Services. They are the largest exam prep company in India and while they do have physical classes the vast majority of their revenue is derive form mobile

test prep apps. Aakash acquired a majority stake in the online test prep company Meritnation in January 2020. 39 Mobile Learning companies operating in India raised a combined total of $581.0 million in 2019 and most of them were test prep developers.

Just over $555.9 million went to 54 Digital Reference-ware companies in 2019, down slightly from the $570 million reached in 2018. It is challenging for developers to generate revenues for this type of learning technology in the presence of a large amount of free content on the market. It should be noted that Metaari recategorized geography and map content as Location-based Learning in their updated taxonomy.

Over $2.61 billion went to 97 Mixed Reality Learning companies in 2019, up from the $2.20 billion invested in 76 of these companies in 2018. This is in comparison to the $728.6 million invested in 80 Mixed Reality Learning companies in 2017.

- The spike in the funding for Mixed Reality Learning companies coincides with the vibrant innovation occurring in the industry in general. The catalysts driving Mixed Reality Learning in the corporate segment are the rapid adoption of real-time AR-based remote expertise products, field decision support platforms, and onsite performance support systems in the industrial sectors and the increased use of sophisticated VR-based education products in healthcare.

There was a sharp uptick in investment in Game-based Learning companies in 2018 and 2019. In 2019, $2.52 billion went to 126 edugame companies (down slightly from the number of deals made in 2018). In 2018, a combined total of $2.25 billion went to 133 companies. In contrast, $948.2 million was invested in 150 Game-based Learning companies in 2017.

- The vast majority of educational game investment went companies that market their products to consumers and corporations. In 2019, $1.26 billion went to 70 consumer-facing Game-based Learning companies. $1.13 billion was raised by 41 corporate-facing edugame developers in 2019. Combined, these companies accounted for just over 95% of total 2019 funding.

In 2019, $736.5 million went to 53 education and training bot companies. In 2018, $1.30 billion was invested in 29 education and training bot companies (including developers of both physical and virtual bots). This is probably an anomaly due to the astonishing $820 million invested in UBTECH by Tencent. In 2017, just over $335.6 million was invested in 25 learning companies that were selling educational and training bots. While the total funding amount was up in 2017 from the $286.4 million invested in education and training bot companies in 2016, only six companies were funded in 2016 and four of them were in China. The 2017 and 2018 investments went

to companies all over the world including the US, China, the UAE, the UK, India, South Korea, Australia, Tunisia, Denmark, Israel, France, and Sweden.

Education and training bots are designed specifically for knowledge transfer and are different from so-called companion, social, and family robots. Many companion robots (like Blue Frog Robotics' Buddy robot) do have education content for young children but they are not designed exclusively for education. ***(Source: Metaari's "The 2018-2023 Global Education and Training Bot Market").***

According to the report, *Executive Summary World Robotics 2019 Service Robots* published by the International Federation of Robotics (IFR), "About 5 million robots for education and research are expected to be sold in the period between 2019 and 2022."

In January 2020, the US Toy Industry Association (TIA) reported that the "hottest robots of the year will be customizable and teach kids important concepts, including coding, engineering, problem-solving and building." TIA operates a non-profit organization called Genius of Pay that promotes the use of play for early childhood learning,

The Science of Knowledge: AI-based Learning Goes Mainstream

In 2016 and 2017, investors began shifting their funding to new types of advanced learning technologies including AI-based Learning, which is a very new type of learning technology product. This pattern continued in 2018 and exploded in 2019.

Over $2.89 billion was invested in 197 AI-based Learning companies in 2018 (102 in the US). The vast majority of the firms were corporate-facing companies in the US, but there were investments made to consumer and PreK-12 suppliers. ***An astonishing $3.67 billion was invested in 120 AI-based Learning companies in 2019.***

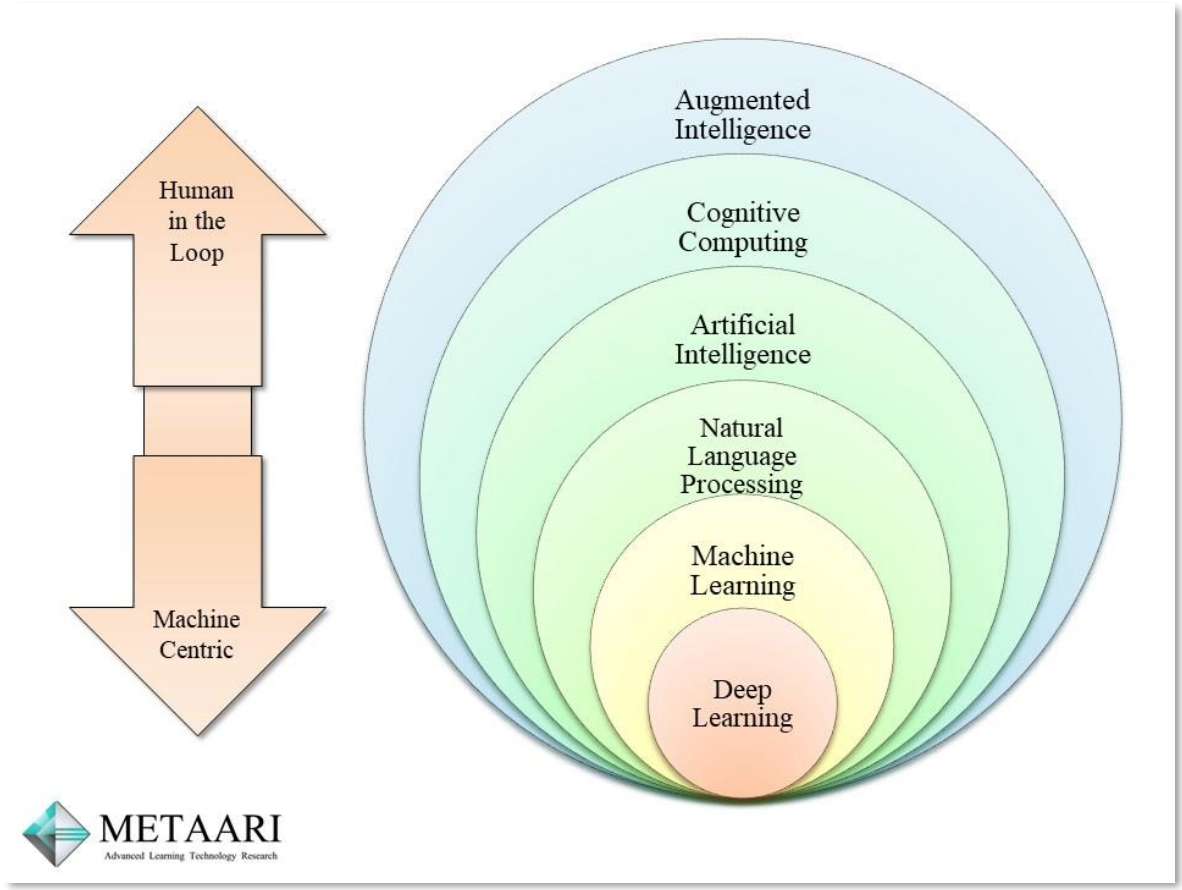
This is a dramatic change from previous years. Over $1.81 billion was invested to 124 AI-based Learning companies in 2017, a record at the time. Barely $122.4 million was invested in this type of company in 2016 and that was only to seven companies. A mere $2 million went to a single AI-based company in 2015 and there was no investment in this type of company prior to 2015.

Metaari's Advanced Learning Technology Taxonomy defines AI-based Learning as education and training products that enable personalized learning via Natural Language Processing, Machine Learning, and Deep Learning.

Very new types of AI-based Learning products are the AI-based virtual avatars (sometimes called visual AIs or conversational AIs) now used in consumer healthcare education, corporate customer service, and IT support helpdesks. These virtual avatars function exactly like the AI-based physical humanoid robots except they do not have physical forms.

The key characteristic of all AI-based avatars is that they are adaptive and have some capacity for self-learning. They are now considered a major component of conversational AI, a specialized form of Natural Language Processing (NLP).

Figure 8 – Metaari's Artificial Intelligence (AI) Array



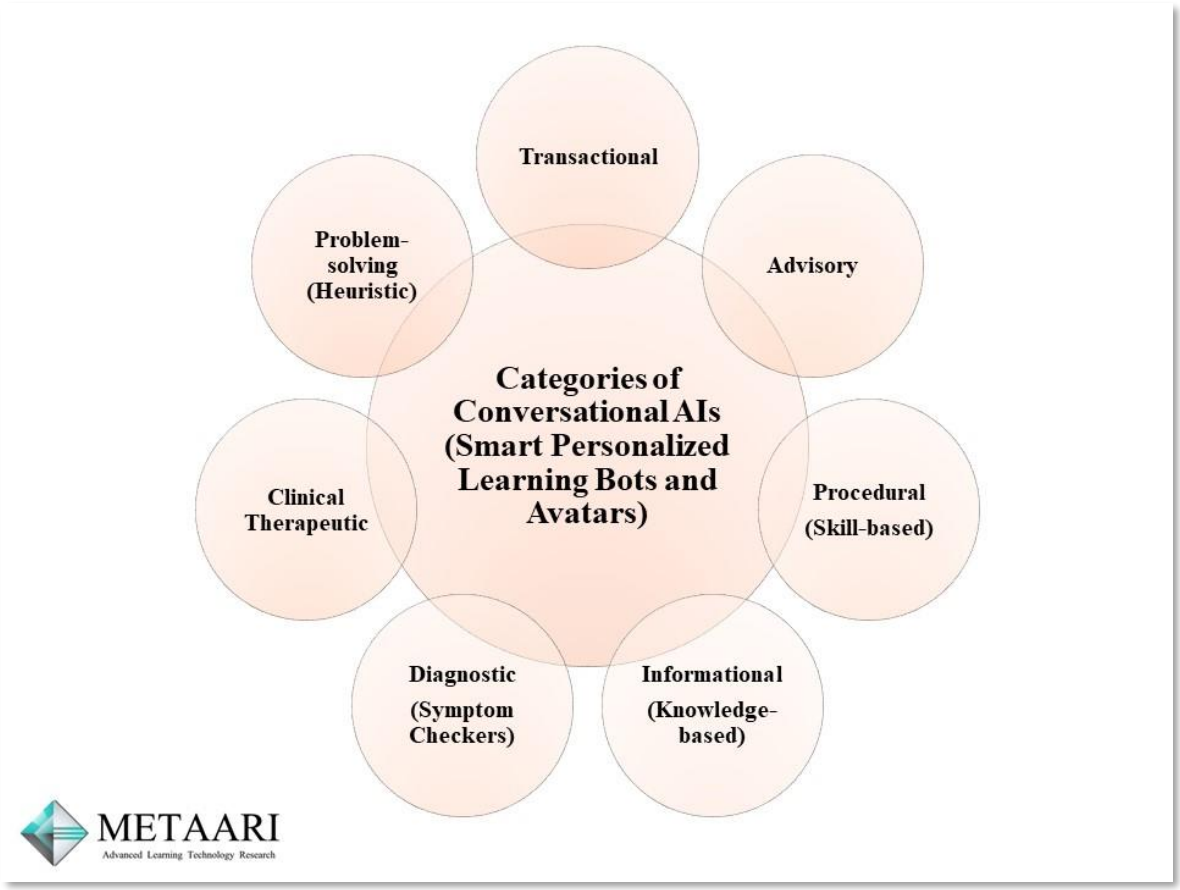
(Source: Metaari's " 2019-2024 Global AI-based Learning Market" report published in March 2019)

Conversational AI is a specialized form of Natural Language Processing (NLP). Conversational AIs adapt to individuals and engage in natural communication via text and speech with humans. They learn as they interact with users. ***Conversational AIs are the foundation of smart AI-based Learning***. There are several categories of conversational AIs including advisory, problem solving (troubleshooting), procedural,

transactional, informational, educational, diagnostic (symptom triage), and clinical behavioral therapy. All of them enable personalized learning.

Conversational AIs are the foundation of smart AI-based Learning products. They are self-learning "conversational agents" that provide personalized learning to users in text and voice conversations. There are at least seven categories of conversational AIs that enable personalized learning including transactional (in the psychological sense), advisory, procedural (skill-based), informational (knowledge-based), diagnostic, therapeutic, and problem-solving (heuristic).

Figure 9 – Metaari's Categorization of Conversational AI-based Education and Training Bots



(Source: Metaari's " 2019-2024 Global AI-based Learning Market" report published in March 2019)

The AI innovations in the corporate learning market revolve around AI-based decision support and intelligent knowledge management that utilize natural language processing (NLP) and "smart chatbots" that essentially provide ad hoc performance and decision support to employees.

AI-based Learning companies in the US raised the vast majority of funding. In 2018, 102 AI-based Learning companies in the US garnered a combined total of $1.78 billion. That was 61.5% of all funding to AI-based Learning companies across the planet. In 2019 there were only 70 AI-based Learning companies funded, but the garnered a combined total of $2.65 billion in investment. Almost all of them were corporate-facing companies although consumer and academic edtech are starting to get investments.

Eight AU-based Learning companies in India obtained a combined total of $85.7 million in 2019. Fractal Analytics in India obtained an impressive $200 million in funding in June 2019. "Fractal Analytics helps global Fortune 500 companies power every human decision in the enterprise by bringing analytics and AI to the decision

Rather surprisingly, one AI-based Learning company in China obtained funding and that was GENIUS (UBGenius) that raised $14.2 million in November 2019. Twelve AI-based Learning companies obtained funding in 2018 in China. They garnered a combined total of $299.7 million, a mere 10.3% of all global funding in 2018.

Three AI-based Learning companies in Canada raised a combined total of investment of $181.7 million with the lion's share going to Element AI at $151.4 million in September 2019. They have a sophisticated tool called Knowledge Scout that has an "Easy-to-use interface that allows users to ask questions in simple, plain language and returns responses based on the system’s analysis of both structured and unstructured data."

A combined total of $106.1 million went to three AI-based Learning companies in Singapore. A company called Near obtained $100.0 million in July 2019. "Near provides insights into human behavior by analyzing where people are, and combining that with a multitude of data points to predict and influence behavior."

Ten AI-based Learning companies in the UK raised a combined total of $196.7 million in 2019. The highest amount went to a company called Healx that raised $57.2 million in October 2019. They develop an extraordinary knowledge graph technology that dramatically speeds up the treatment discover for rare diseases. London's Eigen Technologies garnered $37.0 million in November 2019. Their platform can troll through massive data repositories to ferret out business intelligence in near real time. " Link data points together with mapping rules to construct and answer complex questions seamlessly. Eigen’s logic interface lets you apply your domain expertise at scale."

An Exeter startup called Sparx sells an AI-enable math product for the schools called Sparx Maths. They raised $26.2 million in investment in September 2019. "Our debut product Sparx Maths combines world class, rigorously tested Maths content;

intelligent data science; and a simple-to-use technology platform to enhance and support the teaching of Maths in schools. Every student has a personalized learning experience. Sparx is completely adaptive and searches thousands of questions to deliver the right level of challenge."

IBM Watson a Major Catalyst

One major catalyst for the AI-based Learning product trend is the use of IBM's Watson cognitive computing platform in the educational sector. Watson is a cloud-based "pay as you go platform that had lowered the barrier-to entry for AI-based Learning developers. Academic-facing companies are adopting Watson; Sesame Street, Pearson, Harcourt Mifflin Harcourt, Scholastic, Edmodo (now owned by China's NetDragon) and Blackboard are now selling education apps running on Watson.

- Pearson and IBM jointly developed the IBM Watson Tutor "originally developed for Pearson's use with college students. It is a chatbot that allows questions to be posed in text, with responses delivered in various formats, including media or video."

In June 2018, an executive in the IBM Watson Education division stated in the press that "Our goal is to use AI to improve learning outcomes and to personalize content for learners.

In March 2018, IBM launched their new Watson Assistant (formerly Watson Conversation) designed for corporate and government buyers. Watson Assistant is an enterprise platform that "will function as the behind-the-scenes brains for a variety of new digital helpers made by a variety of businesses." As of mid-2018, HARMAN, Munich Airport, Motel One, Chameleon Technology, Kaon, AirWire, Royal Bank of Scotland, and Autodesk have adopted Watson Assistant. Watson Assistant is what is known as a "pretrained" AIs enabling organizations to build out AIs very fast.

Synthetic Knowledge Engineers: All Along the Knowledge Graph

Knowledge graphs are data representations. AI-based knowledge graphs are intelligent decision support platforms. Decision support platforms have long been a staple of the training and education industry, but AI-based knowledge graphs have put a whole new spin on the technology. As a knowledge engineer would say, "it's a matter of semantics." They are most often deployed in the healthcare, finance, IT, telecommunications, publishing, industrial, and government sectors.

Knowledge graphs have been in use for over a decade but the recent innovations that integrate AI have essentially evolved knowledge graphs into digital coaches. They have become self-learning synthetic knowledge engineers. AI-based knowledge graph

technology has reinvented the knowledge management industry. Knowledge graphs have become quite sophisticated in the last few years and startups have attracted the attention of investors.

According to the Austrian startup PoolParty, "A Knowledge Graph is a model of a knowledge domain created by subject-matter experts with the help of intelligent machine learning algorithms. It provides a structure and common interface for all of your data and enables the creation of smart multilateral relations throughout your databases." Pearson is a PoolParty client. "The PoolParty Semantic Suite uses innovative means to help organizations build and manage enterprise knowledge graphs as a basis for various AI applications. The software supports enterprises in knowledge management, data analytics and content organization,"

An AI-based knowledge graph company called Stardog garnered $9 million in investment in October 2019. Stardog's enterprise customers include Fortune 500 companies in finance, healthcare, life sciences, energy, media, and government. Their clients include Morgan Stanley, Dow Jones, Siemens, NASA, and the US Air Force. According to Stardog, " The value proposition of a Knowledge Graph for the enterprise is that all data, data sources, and databases of every type can be represented and operationalized by the Knowledge Graph." They describe the process as "putting knowledge in a graph".

San Francisco's Dgraph garnered $11.5 million in investment in July 2019. " Graph data structures store objects and the relationships between them. In these data structures, ***the relationship is as important as the object***. Graph databases are, therefore, designed to store the relationships as first class citizens."

The UK's Adarga is a knowledge graph company. They raised $6.55 million in investment in September 2019. "Adarga allows organizations to convert human knowledge processes by investigating large amounts of data more quickly and precisely." The UK government is one of their clients.

India's Frontdesk AI develops ai-based virtual assistants for businesses. "They are powered by a set of proprietary algorithms, a proprietary database of B2C natural language interactions, and knowledge graphs." The virtual assistants are used to answer product questions and "remember details about each and every customer." They raised $2 million in funding in March 2019 on top of the 2.2 million they raised in two rounds in 2018. "To create human empathy, Frontdesk AI provides a second layer of intelligence comprising human trainers to groom the AI assistant to speak in the style and tone of the customer brand. The AI assistant becomes independent over time building knowledge and experience from all its interactions."

Healx is based in Cambridge and develops an extraordinary healthcare informatics platform. "It is the world's leading AI platform on rare diseases and integrates scientific literature, clinical trial results and proprietary data in the form of a biomedical knowledge graph, pinpointing the potential therapeutic relationships between drugs and diseases." They obtained $57.3 million in investment in October 2019.

California's TigerGraph garnered $32 million in funding in September 2019. They have raised $91.7 million since the launched in 2012. "The company supports applications such as IoT, AI, and machine learning to make sense of ever-changing big data. It also provides personalized recommendations, fraud prevention, supply-chain logistics, company knowledge graph, and other features."

Neo4j has operations in the US, the UK, Sweden, France, and Germany. They have raised $160.1 million since they launched in 2007 including an $80 million round in November 2018. "The Neo4j graph platform helps organizations make sense of their data by revealing how people, processes and digital systems are interrelated. This connections-first approach powers intelligent applications tackling challenges such as artificial intelligence, fraud detection, real-time recommendations and master data."

Enigma has obtained $129.6 million in investment since they launched in New York in 2011 including a $95 million round in late 2018 and an undisclosed round in July 2019. "Our knowledge graphs transform tables of data into a rich representation of real-world relationships, enabling businesses to ask and answer complex questions with data."

In May 2019, GraphPath launched to offer its "knowledge-graph-as-a-service" platform "to help scaling businesses leverage data into actionable insights. GraphPath creates and manages enterprise-scale knowledge graphs tailored to an array of industries, providing partners with real-time insights and unprecedented awareness that are essential for operational intelligence. GraphPath is a technology platform that gives you AI-powered advice driven by a vast network of connected data. "

Reliance Industries Limited is a large conglomerate in India. They acquired a controlling interest in an educational knowledge graph company called Embibe in June 2018 for $180 million. "Embibe's extensive three-dimensional knowledge graph hosts over 40,000 concepts with seven lakh interconnections. All learning content is available in the form of best of the web videos and question banks, with interactive 3D slideshows and e-books to be featured soon. Embibe leverages a unique mix of Artificial Intelligence and Machine Learning to understand the learning patterns of students and existing knowledge to build on, which is unique to every student." Reliance's Embibe division acquired a controlling stake the AI-based education

company Funtoot in December 2019. Funtoot develops a mobile personalized tutor app for PreK-12 kids.

Norway's Iris.ai has raised $2.5 million since they launched in Oslo in 2015. They have developed an extraordinary ai-based knowledge graph engine that "reads" millions of scientific papers in seconds and then outputs a knowledge graph that maps to the researcher's query.

An astonishing product is now on the market from a company called Diffbot. The company claims to have "web-scraped" the content ***from the entire Internet*** into a single knowledge graph. "Diffbot's Knowledge Graph contains highly accurate data about people, places, organizations, articles, products, and discussions on the web. No matter how unique your data needs are - if the answer is on the web, it's in the Knowledge Graph. Perform detailed searches on 10+ billion entities and get rich structured data from every web page in the world. Knowledge Graph provides the accurate, complete and deep data from the web that business intelligence needs to produce meaningful insights."

Diffbot has a tiered subscription model and essentially rents out levels of access to their knowledge graph. The company has garnered $13 million in investment since they launched in California in 2011. They launched their global knowledge graph in August 2018, which they claim is "the world's largest structured, enterprise-ready database of human knowledge ever created."

In December 2019, Microsoft announced the limited availability of its new Project Cortex platform that runs on their Microsoft Graph API. They refer to Cortex as a knowledge network. "Project Cortex uses artificial intelligence for information processing, the Microsoft Graph for searching Office 365 data, and SharePoint Online for pulling content together. Cortex generates a map of related topics called the "Knowledge Graph." Knowledge graphs have gone mainstream.

The Rise of Blue-Collar Geeks: AR-based Decision Support Platform Devplopers Attract Investment

A relatively recent trend is the focus on manufacturing and industrial buyers by AR services and platform suppliers. Augmented reality (AR) technology is evolving at a fast pace and new commercial innovations are coming on the market at a rapid rate. Mobile AR is an ideal technology for Mobile Learning and there are dozens of successful products on the market.

A major innovation in learning technology is the real-time augmented performance improvement and performance support (also known as decision support) products

designed for field and industrial workers. These products integrate physical reality with augmented reality (AR) and Mixed Reality (MR). Mixed Reality Learning is very effective at improving performance, decreasing training time, and increasing productivity. ***They also produce impressive empirical performance improvement.***

Numerous commercial companies have focused on providing experiential training in real-time using AR with task-based applications. They sell packaged decision support content products and real-time performance support platforms called remote assistance. Examples of the providers include Upskill, PTC, Scope AR, EON Reality, FuelFX, GeoSafety, NGRAIN, Wikitude, Atheer, Augmentir, Optech4d, PetroEd, TigerGeneral, Ubimax, Siemens, TeamViewer, Epson, Vuzix, Trimble, XMReality, RE'FLEKT, Schneider-Electric, and Honeywell Process Solutions.

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 via the device's camera; most AR content is interactive.

Scope AR is one of the best-known industrial augmented field service support provider. "Scope AR are the pioneers of utilizing AR for industry support and training. Work instructions and remote assistance on a single AR knowledge platform." They obtained $9.7 million in investment in March 2019.

Shanghai's HiScene raised three rounds of funding in 2019: $2.2 million in April, $17.7 million in May, and an additional $35.0 million in August. They develop AR-based performance support products. HiScene launched their AR platform called HiAR Workplace in August 2019, "that integrates AR hardware such as AR glasses together with an information transmission and coordination system called HiLeia and HiAR Cloud. The company claimed that it has more than 1,000 paying clients in sectors such as manufacturing and public security surveillance, including home appliance maker Gree and the Guangzhou Municipal Public Security Bureau."

Munich's RE'FLEKT sells a remote assistance platform called RE'FLEKT Remote. "Consisting of a multi award-winning content creation platform and a remote expert solution for maintenance, training and operations, the RE'FLEKT ecosystem intelligently projects step-by-step instructions directly onto complex machines and systems using Augmented Reality. The RE'FLEKT platform helps machine operators and maintenance personnel eliminate mistakes and significantly increase uptime." They raised $5.6 million in early 2019 on top of the $4.4 million they raised in 2018. Bosch had invested in the company in 2015. They opened an office in Silicon Valley in early 2018.

In a major business model pivot. The AR headset maker Magic Leap changed their business model to target corporate buyers instead of consumers. Magic Leap has raised

billions of venture capital and garnered an additional $280 million in April 2019. After burning through funding and experiencing dismal headset sales in the consumer segment, they pivoted to the business segment in late 2019.

Magic now has dozens of corporate-facing reseller and development partners (mostly field-based performance support and remote expertise developers) that compete in the corporate segments across the planet including Arvizio, EON Reality, Immersion Analytics, Immersiv, Flow Immersive, Nomtek, Minsar, Obsess, PTC, RoOomy, Spatial, Spatiate, Taqtile, Verses, and VIM. Many of these companies develop training and education products for industrial clients including EON Reality, Immersive, and PTC. Magic has rebranded their platform as Spatial Computing for Enterprise.

Smart Thinking: Investors Bet on Cognitive Learning

A major investment pattern that first appeared in 2015 was the investor interest in next-generation Cognitive Learning (behavior modification) companies developing products based on Cognitive Behavior Therapy (CBT), neuroscience, and artificial intelligence. Investors are gravitating to products with strong scientific and cognitive engineering foundations.

The presence of concentrated investment activity in specific learning technology types or in products that target particular buying segments indicates that investors are banking on a significant return on their investment in those areas. The vast amount of funding provided to Cognitive Learning companies between 2015 and 2019 went to US-based companies.

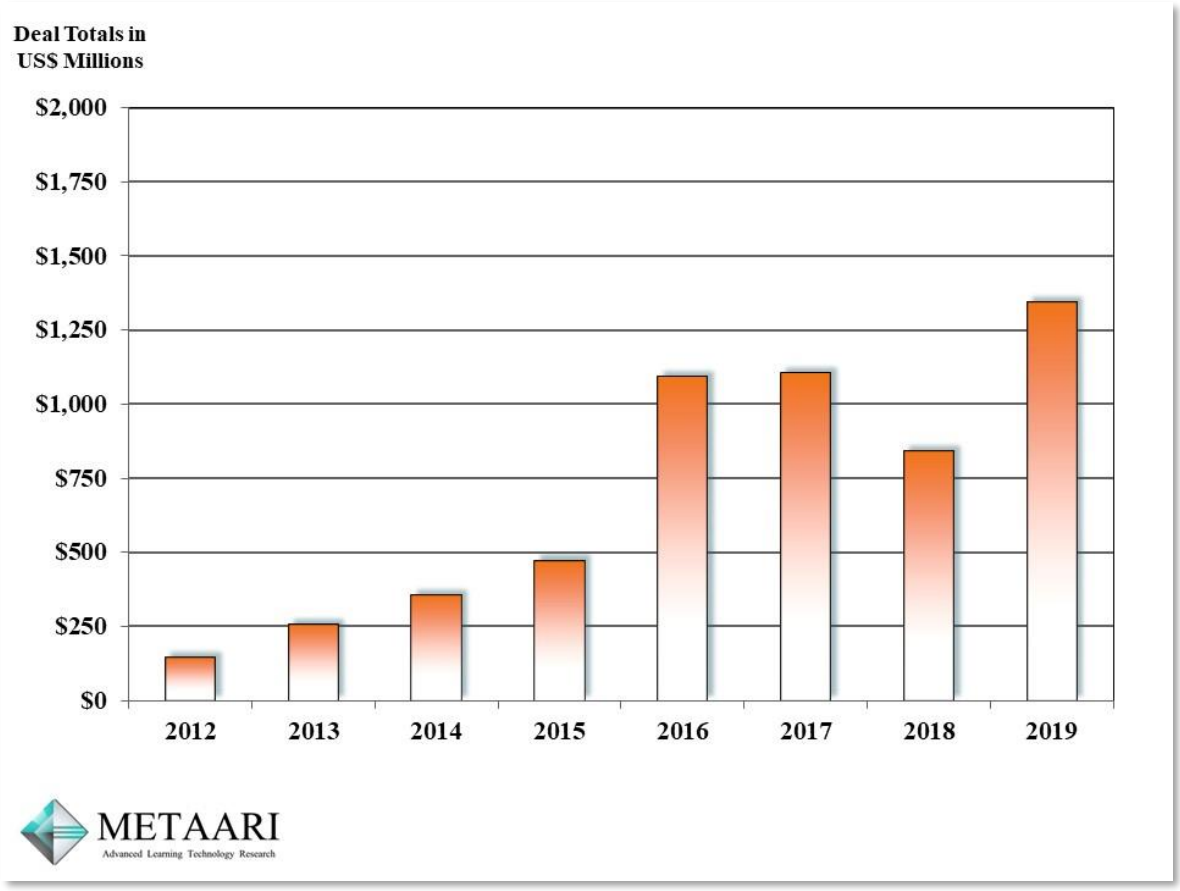
Just under $3 billion was invested in Cognitive Learning companies between 2015 and 2019. ***This is nearly ten times the funding that went to this type of company for the fourteen-year period between 2000 and 2014.*** There were no investments made to this type company prior to 2001.

Investments made to Cognitive Learning companies spiked in 2019. Just over $1.34 billion was invested in 96 Cognitive Learning companies across the globe in 2019. Funding declined slightly for Cognitive Learning companies in 2018. In 2018, $839.1 million was invested in 77 Cognitive Learning companies. In 2017, $918.9 million was invested in 84 Cognitive Learning companies. Cognitive Learning companies that provide behavioral modification and health and wellness programs are attracting the highest investment amounts.

Funding declined slightly for Cognitive Learning companies in 2018 compared to 2017. In 2018, $839.1 million was invested in 77 Cognitive Learning companies. In 2017, $1.10 Billion was invested in 84 Cognitive Learning companies. Funding to this

type of learning technology reached $1.09 billion in 2016. Cognitive Learning companies that provide behavioral modification and health and wellness programs are attracting the highest investment amounts.

Figure 10 - 2012-2019 Global Private Investments Made to Cognitive Learning Companies (in US$ Millions



(Source: Metaari's "2018-2023 Global Cognitive Learning Market" report published in October 2018 and updated in May 2019)

As can be seen in the knowledge graph, investment in Cognitive Learning is a relatively new trend with investments breaking the $1 billion threshold in 2016, more than double the funding in the year before.

Click Therapeutics announced a breathtaking $300 distribution and investment agreement with the Japanese pharma giant Otsuka. Click Therapeutics was founded in 2012. They have developed a product called the CT-100: CLICK Neurobehavioral Intervention (CNI) Platform, "The adaptive data science platform continuously personalizes user experience to drive cognitive and behavioral outcomes."

- "As part of the deal, Otsuka will be funding the development, first giving Click up to $10 million for regulatory and upfront costs, according to a statement from the companies. This will be followed by up to $20 million in development costs. When the product hits commercial milestones the digital health company will be getting $272 million from the pharma company, plus royalties.

There were interesting investment patterns in 2019 for this type of learning technology. Mindfulness, wellness, and cognitive behavioral therapy companies are now attracting significant investment.

Pear Therapeutics obtained $64 million in January 2019. They develop an online Cognitive Behavior Therapy product. Pear Therapeutics says it is “the first prescription digital therapy designed to treat opiate dependence. Its digital therapies, called E-formulations, are mobile digital therapies that provide patients with a set of rewards linked to abstinence and completion of software modules. One such product is reSET, a treatment tool used in conjunction with face-to-face therapy to treat substance abuse disorders." The product was developed in cooperation with Sandoz and won US Food and Drug Administration (FDA) approval in late 2018 becoming the first digital therapy product to achieve this.

A startup called Calm raised $115 million in funding in two rounds in 2019. Calm has raised $143.1 million since they launched in 2012. " Calm is the #1 app for Sleep, Meditation and Relaxation. ... Calm is recommended by top psychologists, therapists, and mental health experts. Calm is the perfect mindfulness app for beginners, but also includes hundreds of programs for intermediate and advanced users." One of Calm's founders, Michael Acton Smith, is no stranger tot the learning technology industry. He founded the enormously popular Moshi Monster that developed early childhood learning games.

One of the leading mental health therapy companies is Talkspace. The garnered $50 million in finding in May 2019 and another $110 million in October 2019. "Talkspace is a telebehavioral healthcare company. Its signature psychotherapy product connects individual users with a network of over 5,000 licensed therapists through an easy-to-use and HIPAA-compliant web and mobile platform." They have raised $216.7 million since they launched in New York in 2012.

Perhaps Talkspace's leading competitor is a company called Headspace. Headspace has raised $75.2 million since they launched in California in 2010 and claims to have over 30 million users. In June 2018, Headspace launched their Headspace Health division, "which aims to launch the first prescription meditation app. The company is seeking FDA approval of meditation programs specifically designed to treat a range of chronic diseases. So, it's going to be a separate product that's developed in collaboration with patients, physicians, patient advocacy groups."

- In April 2019, Headspace announced a three-year deal with US Soccer and Major League Soccer, promising to provide 'thousands' of app subscriptions each year to US Soccer and MLS players, coaches and staff "to help strengthen their mindfulness and meditation skills."

In October 2018, SAP North America announced that they would make the Cognoa Cognitive Learning app available to over 19,000 employees. The app is designed for very young children and helps "children reach their full potential - socially, emotionally and developmentally. Cognoa empowers employees with clinically validated and personalized resources to assess, track and support their children's unique developmental growth." Cognoa has raised $20.4 million since they launched in California in 2014.

Akili Interactive Labs announced a funding deal with another large Japanese pharma called Shionogi in January 2019. Under the terms of the deal, Shionogi will sell Akili's products in Taiwan and Japan. Akili received $20 million up front and will get an additional $105 million as the partnership proceeds.

Noom has garnered $114.7 million since they launched in 2008 including a $58 million round in May 2019. They provide a mobile wellness platform that matches users to personalized content and online coaches. They advertise as a weight loss company. "Leveraging the success of their ground-breaking health and fitness programs, Noom developed a behavior change platform to treat chronic and pre-chronic conditions." They have offices in New York City, Tokyo, and Seoul.

VR Revolutionizes Healthcare Education and Training

Mixed Reality Learning is having a profound impact on healthcare education and training. For example, in April 2016, a UK surgeon performed an operation that was live streamed in VR using technology from the London's Medical Realities. Nearly 55,000 medical personnel across 142 countries experienced the surgery as if they were operating on the patient. The VR-based operation was repeated in April and October of 2017.

Medical Realities' product is called Virtual Surgeon. The company says that it "puts you inside the operating theatre overseeing an operation through the eyes of the consultant surgeon." They are building out an extensive collection of VR-based operating room experiences. "The Medical Realities Platform delivers high-quality surgical training using Virtual Reality. Become immersed while world-class surgeons teach in our interactive modules."

New companies with sophisticated Mixed Reality Learning solutions for the healthcare sector continue to come on the market and they have attracted the attention of investors. Boston's Vicarious Surgical raised $10.0 million in investment in January 2019. "We virtually transport surgeons inside the patient using a combination of robotics and VR. With our innovative technology, we seek to improve the lives of patients, enhance the ability of surgeons, and expand worldwide access to high-quality care."

A similar experiential product is sold by Italy's Surgery Academy. They also record first person operations in AR and VR. "Surgery Academy uses Meta (AR side) and GoPro (VR side) cameras then renders the video themselves in order to create an augmented and virtual reality experience for medical students and professionals who are watching surgical procedures. A student can then watch this footage with a virtual reality headset: the stereoscopic 3D and the wide field of view create a striking immersive effect. The student can then replay the surgery in detail and watch it through the eyes of the surgeon (POV)." They have raised $74,100 in seed funding since they launched in Milan in 2014.

In January 2017, London-based Touch Surgery announced that they had created more than 200 training programs for surgical procedures delivered on a mobile phone or tablet. "Touch Surgery allows surgeons to practice operations ranging from heart surgery to carpal tunnel operations by breaking down complex operations into their component steps – and scores are awarded for accuracy and knowledge. Using sophisticated technology, Touch Surgery is creating accurate and valuable surgical content, disseminating the best techniques and procedures to improve the quality of surgery worldwide." The company garnered $20 million in funding in November 2017.

London's FundamentalVR produced the world's first VR brain surgery experience in September 2017. FundamentalVR recorded the brain operation by neurosurgical team at the Royal London Hospital. The experience "begins with the patient being wheeled into the operating theatre, transferred to the operating table, having their skin cleaned and the procedure started. Detailed views of the procedure, captured on head cameras are shown on a virtual screen in the operating theatre and it's possible to look around the entire theatre in 360-degrees."

- Fundamental garnered their first round of $1.3 million in funding in October 2017. They released their Fundamental Surgeries platform in August 2018 that has integrated haptic technology. "The FundamentalVR Surgical Haptic Intelligence Engine (SHIE) is a proprietary system that allows us to create compelling sense of touch and tissue interaction within our VR simulations across a range of haptic hardware devices."

- In October 2018, FundamentalVR announced a three-year deal to jointly develop surgical VR simulation and education products with the Mayo Clinic. FundamentalVR has obtained an additional $1.4 million in financing by its existing investor Tern. The raised an additional $5.7 million in October 2019 bringing their total funding to date to $8.15 million.

Canada's Conquer Mobile sells a VR-based training simulation product called PeriopSim. "PeriopSim enables surgical staff to practice safely before surgery. Using video of real surgeries and voice prompts, users are guided through a surgery and prompted to use the correct tool at every step. It is designed to be purchased by educators, as part of a hospital education program, as an institutional purchase." In September 2017, the company obtained $200,000 in funding from the Canadian government to build PeriopSim. Conquer was acquired by Appnovation in late 2017.

VR-based educational products that import medical imaging data are coming on the market at a steady pace. These products generate volumetric 3D virtual imagery from CT, MRI, and ultrasound scans and are very high-fidelity models of a patient's anatomy. Companies that sell these products include CAE, Xenco Medical, BodyViz, ImmersiveTouch, and EchoPixel. ImmersiveTouch garnered $21.0 million in investment in April 2019. EchoPixel has raised $14.3 million since they launched in California in 2012.

London's Oxford Medical Simulation (OMS) specializes in evidence-based VR-based medical training experiences. "Virtual reality simulation has been widely adopted in surgical training where it has been shown to “decrease injury, increase speed of operations and improve overall outcomes. It can teach clinicians complex procedures, is effective in CPR training, can improve communication skills, enhance critical thinking, and improve clinical decision-making." OMS raised $65,500 in seed funding in Julye 2019.

Giblib is a medical education streaming service with offerings that include VR and traditional videos of lectures and surgeries. In April 2019, they raised $2.5 million in seed funding led by the Mayo Clinic and Wavemaker 360.

US-based SimX sells AR and VR simulated patients (a healthcare term for a human who pretends to be a patient for training purposes or for a mannequin-based patient) claims to have the "most advanced simulation product on the market, at less than 1/10th the cost of traditional mannequin simulation. SimX’s software allows you to reproduce patient presentations with unprecedented visual fidelity."

VR-based educational experiences are also used for patient education. Boston Children’s Hospital uses a product called HealthVoyager developed by Canada's Klick Health. "Hospitals have started using VR in healthcare, most notably, to distract

hospital patients as part of pain management. That's important but it's only scratching the surface of what's possible in patient care. Customizable patient education experiences like HealthVoyager have the potential to directly impact the course of a patient's illness in a major way."

In March 2019, Medivis launched their new app for medical students called AnatomyX "targeting universities and teaching hospitals for the purpose of anatomy, physiology, and pathology studies." The company previously launched their SurgicalAR app, "the first end-to-end surgical imaging solution leveraging the latest breakthroughs in augmented reality (AR) and artificial intelligence (AI) - allowing operators to have superior understanding, confidence, efficiency, and precision for every patient." They raised $2.3 million in February 2019. The app won FDA approval in May 2019.

The University of Cambridge has been deploying VR-based therapy for the UK's National Health Service (NHS) across 15 facilities as part of their Oxford VR spin out company. "Oxford VR is treating patients in 10 NHS clinics around England while carrying out clinical tests to treat conditions like depression. It's backed by science. We know what we do works. The potential for large-scale benefits is exciting." One of the most successful treatment packages developed by the team is designed to treat people with a fear of heights. ***More than two-thirds of those treated have reported a total reversal in their fear***. Oxford VR garnered $4.1 million in funding in September 2018 to commercialize the platform.

Munich's Brainlab develops learning-based spatial computing solutions for the healthcare industry. They have over 13,000 installations across over 100 countries. In November 2019, Brainlab launched their Brainlab Mixed Reality Viewer that operates on the Magic Leap AR headset. "It is based on the company's Elements 3D Viewer software which is already in use in thousands of hospitals around the world. The system provides high-fidelity, gaming-quality graphics that allow medical professionals to experience data as never before. With these case-specific hyper-realistic 3D visualizations, medical students can gain valuable knowledge and patients a better understanding of their specific anatomy and the planned surgical approach. ***Thanks to an exclusive partnership with Magic Leap***, Brainlab is bringing significant advancements in spatial computing to a broad range of medical procedures in the fields of general surgery, spine, trauma, vascular, craniomaxillofacial (CMF) and neurosurgery as well as radiotherapy and radiosurgery."

The publishing giant Elsevier acquired Dublin's 3D4Medical in November 2019. "3D4Medical makes digital tools that let students and medical professionals study 3D anatomical models. The tools include gross anatomy and microscopic models. Students using the tool also have access to system models, including models for the muscular, lymphatic, and nervous systems. The company has also developed 3D tools

that professional health systems can purchase for their workforce." 3D4Medical had raised $16.4 million since they launched in 2004.

Osso VR develops extraordinary VR-based medical training products. "Osso VR's virtual reality surgical training platform is designed for surgeons, sales teams and other trainees to address complexities in learning common procedures and to use new medical devices." Osso VR was awarded a $215,545 grant from the National Institute of Biomedical Imaging and Bioengineering and in early 2019 received a $222,596 grant from the National Science Foundation (NSF) for research and development to advance the company's surgical assessment platform marrying motion capture and artificial intelligence. In November 2019, Osso announced that they had won a Small Business Innovation Research (SBIR) contract by the US Air Force. "The first phase of the project includes a feasibility study to determine VR surgical training's benefits and application within the Air Force." Osso has raised $2.0 million in private equity since they launched in Boston 2016.

Location Intelligence All the Rage: Major Money Flowing to Location-based Companies

A total of $659.0 million went to 37 Location-based Learning companies in 2019, up from $507.3 million in 2018. Innovation of Location-based Learning (LBL) is now occurring at an exponential rate, being driven by advances in both mobile technology and Mixed Reality. Location intelligence is also known as spatial intelligence. Magic Leap refers to it as spatial computing.

- First-generation Location-based Learning (LBL) ***emphasize the position of the object*** tagged with triggers, markers, beacons, and anchors. The user initiates the LBL experience by activating the triggers. Locations and objects can also be tagged with geotags and the user's GPS position near tagged objects triggers the augmented content.

- Second-generation LBL ***emphasize the position of the user*** located via smartphone GPS chips and smartphone sensors. Sensors used for LBL on the phone include the gyroscope, compass, altimeter, and the accelerometer. They are instrumental in enabling very accurate indoor positioning.

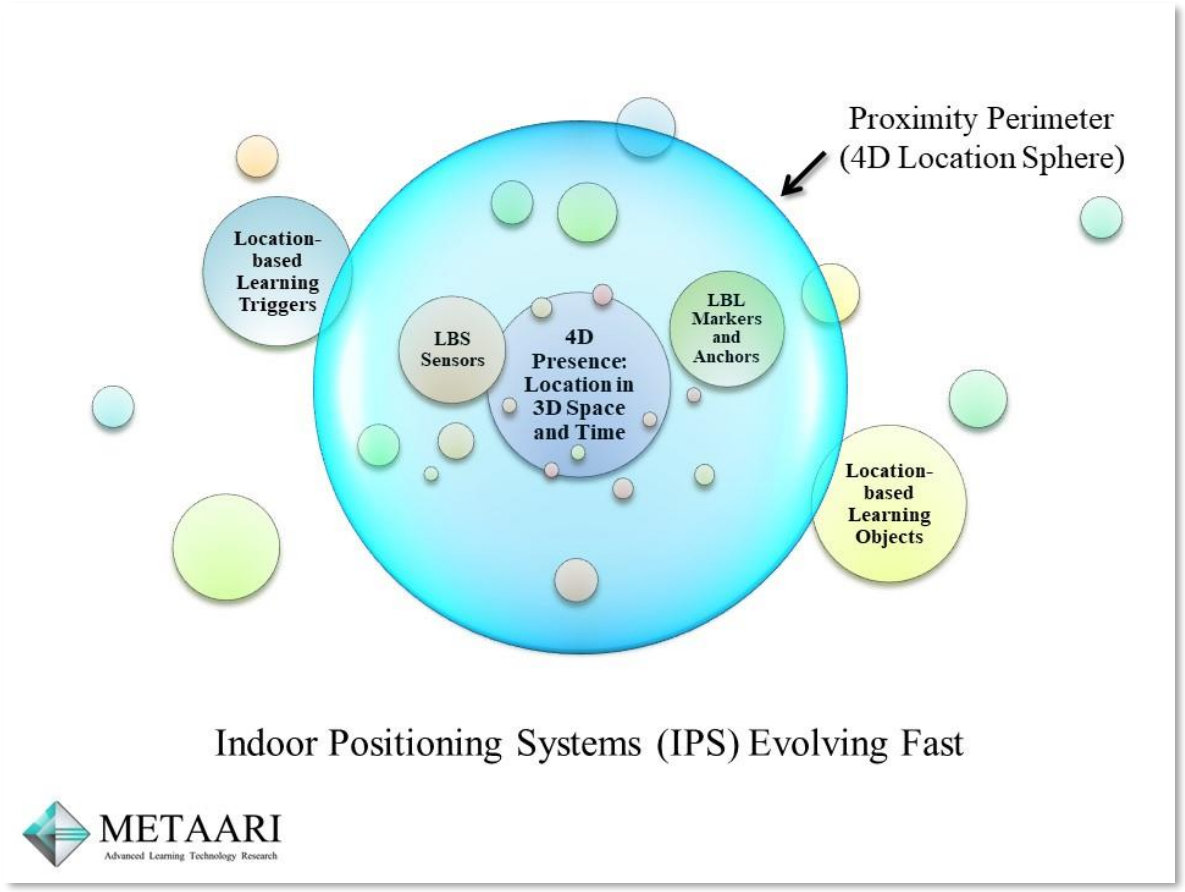
Location-based Learning can occur in physical locations and in virtual locations. It can also occur in a past or future time. Many products on the market combine all three modalities.

GPS does not work inside buildings and a new wave of mobile technology is now on the market called Indoor Positioning Systems (IPS). IPS location coordinates are

significantly more accurate than GPS. The American Museum of Natural History in New York City and the Royal BC Museum both use IPS for their exhibitions.

The Royal British Columbia Museum uses the IPS location technology from Wifarer. Wifarer automatically updates your location in real time, within three to five feet. "As you move, you can have access to multimedia information about each exhibit, essentially giving you a glimpse into the stories behind the collections as you move through the museum."

Figure 11 - Mobile Location-based Learning (LBL): Proximity Triggers the Learning Experience



(Source: Metaari's 2020-2025 Worldwide Mobile Learning Market" report published in January 2020)

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.

Location technology is becoming increasingly sophisticated. There is a wave of new location-based products coming on the market that utilize LEDs. Philips' Visible Light

Communication technology uses what are called luminaires (light emitting units). "Using this, the light produced by each luminaire transmits a unique code that is undetectable to the human eye." GE Lighting and a company called Acuity sells a similar luminaire-based IPS.

The Museum of Science in Boston uses ByteLight's LED system. The museum has installed an array of LEDs throughout the facility. "Within each LED light bulb is a chip that flashes a pattern, pulsing too fast for humans to see but the perfect speed for the camera lens of a mobile device." The mobile device "sees" the light signal transmitted by the LED bulb and tracks the user's location "with incredible accuracy and speed- within one meter and in less than a second."

Israel-based Museloop has developed an augmented reality gaming platform that allows museums "to easily create a mobile app for their visitors. The game-based tour experience puts the focus on the art and uses the games to deliver relevant, interesting, and contextual content. Museloop provides the museums with templates of games and a CMS. Once they input content, an app that provides a unique experience can be generated immediately. The SaaS platform works for any type of exhibition (permanent or temporary) and lets the museum collect vast amounts of data on its visitors."

The geospatial augmented reality platform Aireal enables developers to place digital content indoors or outdoors based on latitude, longitude, ***and altitude*** instead of markers or computer vision. The company started selling a content management system (CMS) and software development kit (SDK) in early 2018.

Israel's Vayyar Imaging obtained $109.0 million in investment in November 2019. "The company's sensors can see through walls and objects and track and map everything happening in an environment in real-time." Vayyar is a unique company that develops chip-based sensors that enable location intelligence. They bundle the sensors with sophisticate software that reads and interprets the resulting images providing accurate information about what is going on a specific place, even if it's behind a wall or another object." Their smart home device "sends out signals that scan the environment using harmless radio waves a thousand times weaker than a cellphone. Vayyar HOME detects a person's body position, a fall, or health problems. Powerful 4D imaging sees through most bedroom and living room furniture – even some walls!"

Humatics Computing raised $28.0 million in January 2019. They call their platform a microlocation solution. It is essentially a location-based decision support system. "Humatics solutions provide precise and reliable location data to eliminate your operational blind spots, gain visibility and make better decisions." One of the verticals they market the platform to is "Research and Education".

Mapbox has support for Apple's ARKit, Google's ARCore, and Unity. Developers can create AR-based maps and directions on top of real-world images. Using a smartphone, a user can literally "see" the directions to a location. For city guides, this is extraordinary as it provides what is known as procedural learning. "Mapbox gives you easy access to information about streets, building footprints and heights, land use, parks, water, and many other layers of data that describe the world around you." Mapbox obtained an impressive $164 million in investment in October 2017. They have raised $227.2 million since they launched in Washington, DC in 2010.

Learning in Mixed-Reality Spatial Computing

There is rapid adoption of Mobile Learning in the industrial sectors. Technicians and field workers are using handsfree performance support, decision support, and remote expertise assistance as they work in a specific location in real time. These are classic examples of spatial computing. In educational psychology, there are two phases of learning: knowledge transfer (data provide to the learner) and learning transfer (the ability to demonstrate mastery in a real-world setting. Learning with spatial computing accomplishes both phases simultaneously.

Since they pivoted away from the consumer segment to the industrial business sector, Metaari now categories Magic Leap as a learning technology provider. They launched their new business platform in late 2019 with partnership with the leading industrial AR field service support providers. They have raised a near unfathomable $2.6 billion since they launched including a $280 million round in April 2019.

According to Magic Leap, spatial computing is "digital technology that interacts with us in the places we live, work, and play. A spatial computer, like Magic Leap 1, ***knows where it is in space***. It uses a variety of sensors and cameras to build an understanding of both its environment and its user. This enables immersive, mixed-reality experiences that seamlessly blend the digital and the real world."

- "When we talk about spatial computing, it is really the idea that the digital world and the physical world are fully interacting. They are aware of each other. There are things like persistence so if you believe something in the digital world, it will be there when you come back and there is this interactivity between the physical and the digital world. That’s how we try to define and differentiate it. We see it as a new computing platform using things like computer vision to make this merger of the physical and the digital possible."

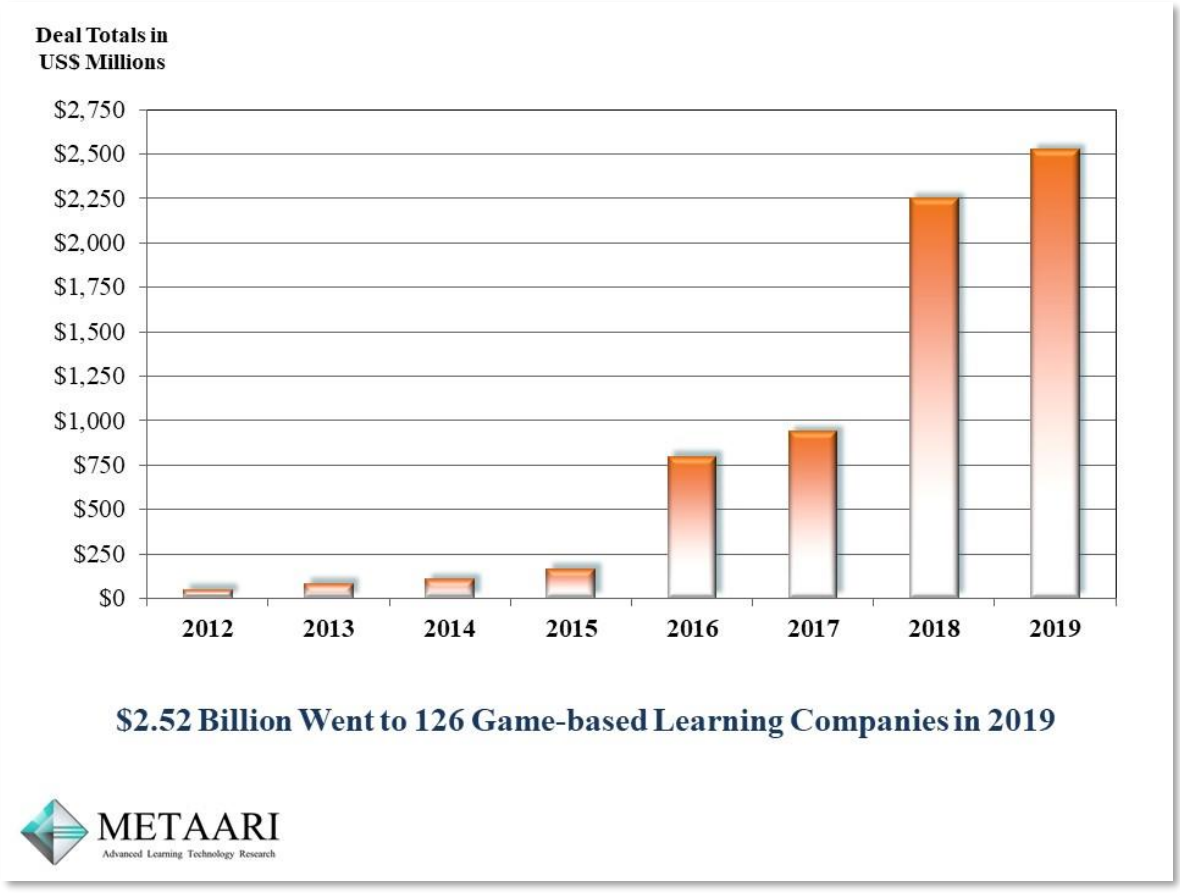
According to Infinite Retina, a spatial computing consulting and development startup that launched in March 2019, "Spatial Computing is a series of technologies that can 'see' and map the real world, understand it, and predict the next moves of objects

within it, while doing the same for digital worlds that may or may not have ties to the real, physical world, all the while helping humans and/or machines navigate either. Our thesis is that for the next 24 months the first places you'll see successful deployments of Spatial Computing are mostly gaming or enterprise uses, like surgery, logistics, mining, architecture, and car design, training, and many more."

Investors Leveling Up: Game-based Learning Companies Raking in Funding

Investments in Game-based Learning companies is a relatively new phenomenon. There almost no investment made to these learning technology companies prior to 2012. Only $51 million was invested in these companies in 2012 and increased modestly to $85 million in 2013.

Figure 12 - 2012-2019 Global Private Investment in Game-based Learning Companies (in US$ Millions)



In 2015, funding reached $166 million but exploded in 2016 to $797 million. Investment breached the $2 billion threshold in 2018 with funding reached $2.25

billion. ***In 2019, investment increased to $2.52 billion***. One consistent pattern in Game-based Learning investment in 2019 was the investor interest in games for kids.

A Chinese online English language learning platform for very young kids called DaDa (formerly DaDaABC) raised the highest amount at $255.0 million in January 2019. The round was led by the online education juggernaut TAL Education. DaDa (also known as DaDa English) is the first online English education company in mainland China to partner with the American TESOL (Teaching English to Speakers of Other Languages) Institute. DaDa launched as DaDaABC in Shanghai in 2013. They have raised an impressive $860 since they launched. While their students are mostly from China, they also have enrolled kids from Taiwan, South Korea, and Japan. They hire native English-speaking tutors.

India's BYJU's raised $193.8 million in three rounds in 2019 including $150 million given to them in July 2019 by the Qatari government. They raised an astonishing $640 million in two rounds in 2018. They announced plans to expand outside of India and acquired US-based Osmo (Tangible Play) in early 2019 for $120 million. Over 90% of Osmo's user base is in the US. By mid-2018, Osmo had over a million families and 2,000 schools using their iPad game platform.

Two patterns that stand out in China is the investor interest in developers creating commercial learning games for young kids and the powerhouses that are investing:

- Codemao (Bian Cheng Mao) is a coding instructional game for small children. They raised $57.0 million in November 2019. The round was led by the Russia-China Investment Fund (RCIF). They have raised $121.9 million in funding since they launched in Shenzhen in 2015.

- A Chinese company called Hetao101.com (Hetao Biancheng) obtained $67.7 million in two rounds in 2019. They develop coding games for very young children. The rounds were led by China Renaissance (a large investment bank in China) and Hillhouse Capital (a global Asia-focused private equity firm).

- Kaishuo Jianggushi (Kaishu Story) is another learning game developer for kids. They garnered $50 million in June 2019 with funding led by the Internet giant Baidu (known as China's Google).

- Onion Math (Yang Cong 345) develops math games for kids. They obtained $44.5 million from Tencent in April 2019. Tencent is the world's largest gaming company in terms of revenue.

- VIPThink also develops math games for kids. They raised $47.0 million in two rounds in 2019 in rounds led by the giant online education company New Oriental.

- Baidu invested an undisclosed amount ("hundreds of millions of yuan") in the online English language learning company for kids called Qkids in August 2019. Qkids delivers online English lessons to Chinese kids between the ages of four and twelve. Qkids had obtained $12.5 million since 2015 prior to Baidu's new funding. They hire native English-speaking tutors from North America.

- Xigua Chuangke (City) garnered $22.5 million in funding in August 2019. They develop coding games for kids. New Oriental led the round. Their games are designed for kids between the ages of seven and twelve.

The US language learning app developer Duolingo obtained $30.0 million in December 2019. They are one of the most popular language learning game developers in the world and their app consistently ranks in the top-selling educational apps in the commercial app stores. They have raised $138.3 million since they launched in Pittsburgh in 2011. They claim to have a valuation of $1.2 billion and intend to file an IPO in the 2020-2022 timeframe.

Epic! has obtained $51.5 million since they launched in San Francisco in 2013, including a $30 million round in January 2019. "Epic! encourages kids to explore their interests and learn in a fun, safe, kid-friendly environment. Kids love Epic! because it's fun, and parents and teachers love Epic! because it's educational."

HOMER for Learning is a BEGIN (Speakaboos) brand and develops learning games for kids. They obtained $28.6 million in investment in September 2019. "HOMER's mission is to provide the best educational start possible by offering personalized, fun, and proven learning products for children ages 2-8." HOMER was acquired by BEGIN in early 2017. They have raised $32.0 since they launched in 2013.

India's Eduisfun Technologies obtained $28.08 million in December 2019. "Our Mission To make learning fun, easily accessible to everyone through games." They launched what they call their Gamified Learning Ed-Tech app, STEPapp in December 2019. "We have to make education acceptable and enjoyable for students by transforming teaching. The entire education system has to change towards storytelling and gamified learning."

The Measure of Intelligence: Investors Attracted to Psychometrics

A brand-new type of serious games came on the market in just the last two years. They are psychometrically-based educational games (usually mobile) designed to assess and evaluate potential job candidates and recruits. They are now also used to assess current employees. Legacy assessment vendors like Revelian and cut-e are migrating rapidly away from written tests to game-based assessment with integrated psychometrics.

The demand for this new educational game is heavily concentrated developed economies (particularly global enterprises) in the 2019 market, and gaining rapid traction across the planet in developing economies. The growth rate for this new type of educational game across the globe is 46.2% ***and revenues will spike over six times to $2.0 billion by 2024.***

Global revenues for this new game type reached $311.4 million in 2019. This may not sound like a great deal of revenue, but with such a high growth rate, this product type will generate significant revenues within a relatively short timeframe.

Psychometrics is the science that focusses on statistical measurement of psychological states. Psychometric instruments measure knowledge, abilities, skills, attitudes, and personality traits. Psychometrics are the foundation of all IT certifications and healthcare licensure.

The adoption of psychometric-based assessment and evaluation games used for pre-employment assessment of job candidates is growing rapidly in the corporate segments across the planet. It is now a major catalyst driving the uptake of educational games in the corporate segment. Very sophisticated products have come on the market that include advanced psychometrics, AI, and behavior analytics. Most of the new products are game-based and in mobile formats.

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

However, the major inhibitors that previously dampened the widespread adoption of Game-based Learning are now fading fast. Pre-employment assessment and evaluation games are now in high demand in the corporate segments across the planet.

There are dozens of developers that are now selling these pre-employment assessment and evaluation games including Pymetrics, Ipsemet, Revelian, Knack, Scoutible, SHFuse, RoundPegg, Talent Litmus, Arctic Shores, HireVue, MindX (now owned by HireVue), Debut, Cogstate, Shaker, and High Voltage Software.

Startups specializing in these new serious games are coming on the market at a rapid rate and they are attracting significant venture capital. In September 2017, a company called Pymetrics raised $8 million. They have obtained $56.6 million since they launched in 2013 including a $40 million round in September 2018. New York's Pymetrics has obtained $56.6 million in funding since they launched in New York in 2013. They reported $5.7 million in revenues in 2018. "Pymetrics applies proven neuroscience games and cutting-edge AI to reinvent the way companies attract, select, and retain talent." Their corporate clients include Unilever, Nielson, and LinkedIn."

Arctic Shores "creates immersive mobile games, using neuroscience and applied psychology, covering topics such as innovation, resilience and general mental ability." They garnered $5.65 million in investment in September 2019.

- They have a distribution agreement with the global assessment provider cut-e now owned by Aon Assessment Solutions. "Under the new partnership, cut-e will exclusively distribute these games globally, outside of the UK. The two companies will also work together to develop a new breed of gamified assessments for pre-application attraction and candidate selection."

Corporations are buying packaged pre-employment assessment products designed to measure behavioral traits and soft skills and they also license the tools to clients that want develop assessments in house. All of the new assessment game companies provide custom game development for clients. So, this new game type is a catalyst for packaged content, tools, and custom services.

Until recently, these games were primarily being used for pre-employment assessment in the HR departments of companies. They are now being used internally as performance evaluation in the other so-called "horizontal" departments such as sales, IT, marketing, product development, training, and finance.

Skills evaluation and assessment games have many pricing models including monthly subscriptions, pricing per candidates, and/or pricing per games played. Companies also sell the games to individual coders and then sell the scores and rankings to their corporate clients that can then contact the coders for interviews.

While many of these companies are located outside the US, they generate a significant amount of revenues in the US. Australia's Revelian opened their US offices in June 2019. In September 2019, the UK's Arctic announced that 48% of their revenues were being generated outside the UK.

Koru was founded in 2013 in Seattle. They have raised $15.6 million in funding since launch including a $3 million round in October 2017. Their assessment game is called

the Koru7 Impact Skills and identifies seven job candidate skills: “Grit, Rigor, Impact, Teamwork, Curiosity, Polish, and Ownership.”

In May 2018, Utah's HireVue, the AI-based talent assessment developer, acquired London's MindX, a developer of game-based candidate assessment.

- "Cognitive traits evaluated include: problem-solving, mental flexibility, learning agility, attention, creativity, and quantitative aptitude. Candidates can rapidly demonstrate their competencies and personality traits within a highly engaging experience. Instead of simply uploading resumes and filling out online forms, candidates can answer some job-relevant questions and play a set of scientific mini-games to more effectively show their range of professional and cognitive strengths."

- MindX is a next-generation predictive hiring and talent analytics platform. The company's software tools integrate the latest advancements in game technology, psychometrics and machine learning, empowering employers to attract, identify, engage and develop the best talents.

In October 2018, HireVue released their HireVue Pre-Built Assessments "tailored to specific job roles and competencies. Each includes a combination of video questions, game-based challenges and -- for technical job roles -- coding challenges. For candidates, the experience is faster and more engaging than with traditional or other game-based pre-hire assessment approaches. When used at the beginning of the hiring process, on-demand interviews and AI-driven assessments enable talent acquisition teams to quickly identify and focus on the best candidates, replacing legacy screening methods." They garnered $50 million in investment in October 2019.

Scoutible develops "a game-based hiring platform, using immersive mobile games to pinpoint perfect-fit candidates for jobs. Scoutible’s patent-pending technology identifies players’ unique cognitive and personality traits through gameplay, then spots opportunities where players’ attributes match those of companies’ proven top performers." The company has garnered $6.5 million since they launched in San Francisco in 2015.

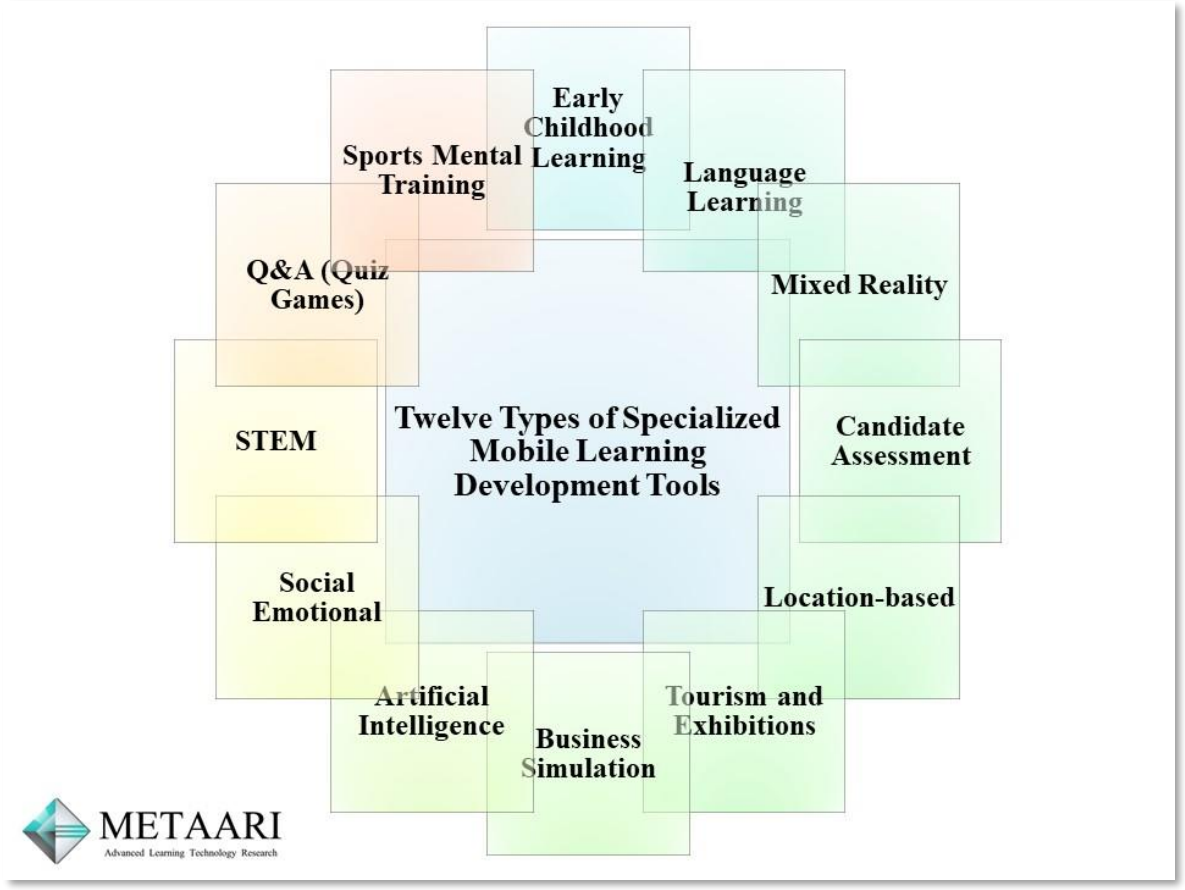
Seattle's Litesprite obtained $84,750 in seed funding from Bayer in November 2019. At that time Bayer announced that Litesprite had been selected to participate in their Bayer G4A (Grants4Apps) program. "Litesprite makes apps for people with chronic conditions that use games to increase patient engagement." A Canadian company called NeuroTracker was also selected by Bayer.

Flood of Well-funded Mobile Learning Startups Entering the Market

A major trend in the current learning technology market is the steady flow of startups entering the market with native Mobile Learning products. They are being launched in every region of the world and in both developed and developing economies. They are particularly prominent in mobile-only countries in Asia and Africa.

They are attracting significant amounts of venture capital. On average, 4-5 startups are entering the market somewhere in the world each week. This holds true for every region of the world. That is a leading indicator providing strong evidence that there are now lucrative revenue opportunities in the global Mobile Learning market.

Figure 13 –Twelve Specialized Types of Mobile Learning Authoring and Development Tools



(Source: Metaari's 2020-2025 Worldwide Mobile Learning Market" report published in January 2020)

In 2019, $2.97 billion went to 176 Mobile Learning companies in the world. Test prep companies in the Asia Pacific region obtained the highest amounts. China's Zhihu obtained an impressive $434.0 million in August 2019. Beijing Kuaishou (a large

short-video streaming app company with over 200 million daily users), Tencent, and Baidu participated in the round.

Mobile Learning is unique in that tool and platform developers almost always sell specialized tools designed for specific purposes. There are now hundreds of startups selling specialized tools to build specific types of Mobile Learning apps and games including: tools to build early childhood learning, sports mental training, tourism and museum games, pre-employment assessments, Mixed Reality Learning apps and games, business simulation games, STEM. artificial intelligence, social emotional intelligence, quiz games, and Location-based Learning (Location Intelligence). The proliferation of new tools is a strong indicator of the high demand in the organizational segments. This is very different from legacy eLearning authoring tools where general-purpose tools are used to develop any type of course.

Tourism sites, exhibition venues, and government tourism agencies are paying developers to create custom mobile apps. The demand is quite high and startups are coming on the market at a steady pace to meet the demand. The availability of new rapid Mobile Learning tools enables developers to create apps for clients very quickly.

New tools and platforms designed explicitly to design native Mobile Learning apps and games are coming on the market at a rapid rate. They tend to be designed to create apps for particular purposes or for specific demographics like young children, secondary students, higher education students, and military personnel. The demand for tools in the global Mobile Learning market is quite unique.

The corporate segments across the planet are adopting pre-employment assessment and evaluation games at a steady pace. The startups that have come in the market in the last few years have attracted large sums of capital. They sell packaged apps, provide custom services, and also license their platforms to clients that want to create their own assessment apps.