Education and Heuristic Discovery Market Analysis

Private Industry Analysis in Relation to DARPA, Military, and USG Initiatives on Education and Heuristic Discovery

PREPARED BY RICHARD J. CORDES
RichardJ.Cordes@gmail.com
May 2019
Published through COGSEC
With Credit to Research Assistant, Sarah Murphy

Contents

Private Industry

This Private Industry Analysis, due to both time constraints and the nature of the subject matter, will read as a more technical document, addressing the market as it stands given the data the report writers have available. This is done with the intent of outlining the market segmentation as it pertains to the interests of the report and the intents with which consumers engage with these segments. This Private Industry Analysis is focuses on companies, segments, and demographics which relate to DARPA, Military, and USG Initiatives and requirements which relate to education and heuristic information discovery.

Market Segments of Interest

These are the identified Market Segments of Interest, companies within them have enough overlap to make listing companies for each section redundant and unhelpful. Instead, the market segments will be listed and companies of interest and the segments they occupy will be addressed later in the document. All statistics listed in the following segment are estimates offered by CrunchBase.

Course sites (MOOCS)

MOOC (Massive Open Online Course) sites offer open-enrollment in static courses at scale. The course content itself is generated internally by chosen experts, by corporate/academic partners, or by users. They're a large segment in the market at the moment but many key players are facing problems with acceptance of credentials by companies and schools. There is a sort of paradox present, wherein schools sometimes publicly approve of the credentials but do not accept them and HR departments look favorably on employees and potential hires using them in

resumes but would not accept them in lieu of a degree (even if the degree they do have is not relevant to the job and the online credentials are).

Worldwide, the sector yields 17b in revenue a year and has been funded for a total of 11b. Sites in this sector attract a cumulative 1b monthly visits.

Focusing on the United States and Canada, the sector yields 10.8b in revenue a year and has been funded for 5.1b. Sites in this sector attract a cumulative 800m monthly visits.

College Open-Courseware

College Open-Courseware is a sub-sector of the MOOC-market. These are open courses offered by accredited universities, sometimes through companies such as edX or through their own platforms. Some colleges accept some courses as credit. It's difficult to find statistics on these companies as the revenue figures incorporate revenue from the college itself.

College Distance-Learning Programs

College Distance-Learning Programs are growing. Many colleges are now offering online degrees and some prioritise it over brick and mortar. It's difficult to find meaningful statistics on these companies as the revenue figures incorporate revenue from the brick-and-mortar business and keywords don't yield consistent results. More focused market research would be needed for a sector-wide analysis.

Resume Posting/Credential Verification/Professional Networking

Companies that allow users to post and verify resume material. Statistics on this area are particularly difficult to compartmentalise as a result of them primarily being within the Recruitment and HR segment, keywords have been unhelpful in differentiating. Therefore, this segment may be best represented

by revenue and traffic statistics of the Recruitment and HR segment.

HR

HR can be generally separated into two sub-segments:

Recruitment

Companies providing HR recruitment services. This is a massive market segment focused on hiring and talent analytics.

Worldwide, companies in these spaces yield 1.4t a year in revenues and have been funded for 19.5b. Sites in this sector attract 3.4b visits each month.

Within the U.S. and Canada, companies in these spaces yield 1.2t a year in revenues and have been funded for 14b. Sites in this sector attract 2.5b visits each month.

Onboarding and CPD

Onboarding and CPD (Continuing Professional Development) is a massive market and it proved difficult to get estimates on its size. Qualitatively, it appears to be somewhat similar in size to Recruitment, but it has been difficult to compartmentalise revenues and traffic. Summed yearly revenue from companies in this space likely amounts to, within the U.S. and Canada, in excess of 500b a year; this is highly dependent on definitions.

Tutoring and Test-Prep

There is a fairly large market for tutoring and test-preparation. For one on one tutoring, costs can be quite high. Test prep programs often cost $1,500 or more.

Worldwide, companies in these spaces yield 4b a year in revenues and have been funded for 2b. Sites in this sector attract 131m visits each month.

Within the U.S. and Canada, companies in these spaces yield 1.1b a year in revenues and have been funded for 698m. Sites in this sector attract 53.5m visits each month.

Question/Answer Sites

Question/Answer sites have been a valuable source of academic assistance for students for some time now. Especially for help with material that is project oriented or requires critical reasoning. Using reputation systems, many offer a means of credentialing expertise in subject matter.

Language Learning Systems

Language Learning Management Systems come in varied degrees of seriousness and efficacy. This market segment is of special interest as they appear to be the most widely accepted form of online learning system by average Americans and Canadians.

Academic Material Aggregators

Academic Material Aggregation is a highly specific market segment in which students and researchers can access and search for academic materials such as books, research papers, and study guides, often by topic or keyword.

Study Tools

This market segment is generally represented by websites which offer flashcard and quiz features to students. This segment has grown a great deal in the last 5 years, but comparable revenue estimates to other segments are not available due to lack of data.

Coding Bootcamps

Coding Bootcamps are generally described as 4 to 10 month programs which take students of varying ability from the basics to working knowledge of programming. They sometimes offer

smaller workshops or 1-week intensives on programming subject matter. They generally assist with employer-student encounters and form partnerships with companies in order to help them get hired. They are of definitive interest as they are one of the few segments experiencing any notable form of adoption in terms of its acceptance in lieu of traditional accreditation.

Classroom and Education Administration/Analytics Tools

Due to the nature of software integration with state organisations, this market segment is as large as it is consolidated. With just a few companies dominating the space, quality has seemed to stagnate due to lack of competition.

Distance/Alternative Proctoring

As Online and Distance education has grown, commercial solutions to distance proctoring have been growing in number. Many require identity verification and webcam-usage for supervised test-taking but results of their tests have yet to be widely accepted by accredited institutions.

University/College

Accredited Higher Education is a segment of interest as it is currently under intense scrutiny and it has generally failed to adjust to new market trends.

Data Catalogues

A la carte data purchasing has been growing a great deal, yet there is no civilian alternative to Palantir. A quick search of Wall Street Oasis, a site meant to help students prepare for interviews on Wall Street, will yield a surprising number of questions regarding where to find data. Despite a few large data banks existing, most of the access is scattered and not standardized to any reasonable measure. This has become a more interesting

market to look at due to increasing interest in machine learning, which has burdensome requirements for large, well-defined, schematized stores of data.

Self-Publishing Market

The last market of interest is the self-publishing and private publishing markets. Defined as sites and communities where people may attempt to monetise their writing without the assistance of larger institutions, this segment has been growing a great deal over the last decade.

Demographics Through the Lens of User-Intent

Hobby Learning

Learning as a Hobby

Many people, old and young, have taken to learning as a hobby in their spare time. Many are in demographics which used to tune-in to cable-channel documentaries on National Geographic, the History Channel, Animal Planet, and the Discovery Channel. Looking at subscriber and view counts on YouTube channels which focus on non-academic presentation of academic information, these user-intents are widely distributed amongst various demographics and is growing rapidly. Many are now looking to (1) catalogue what they've learned and (2) ensure that they remember what they've learned, as the information overload offered by the internet has made people at risk of becoming low-retention, passive observers to information, requiring compulsive re-exposure to the information in order for it to have any staying power.

Hobby-Related Learning

Where many people used to turn to books on their hobbies, they now often turn to YouTube and Tutorial Sites instead for quick

guides on solutions to problems they're encountering as they encounter them. Just as is found in the previous sub-segment, many are looking to properly retain what they've learned in order to efficiently apply it and avoid compulsive re-discovery and exposure to material they've already reviewed.

Academic Assistance

Given the inefficiency of lecture and lack of on-demand peer-to-peer programs to handle learning breakdowns, students have turned to YouTube, Stack Exchange, and similar platforms for academic assistance. There is an undeniably massive population of students and self-learners coming to the web with this intent on a daily basis which is heavily influenced by a seasonality determined by midterms and finals.

Academic Resource Search

Academic Resource Search has been determined to be separable from Academic Assistance despite it often being its precursor on the basis that it also includes search for academic materials without the interest of solving learning breakdowns. Academic Resource Search includes attempts to find research materials as well as news and journal articles. Due to the primitive nature of research keywords and an inefficient cultural market associated with academic material, academic resource search is widely regarded as a painful procedure. This is evidenced by the number of tools used to build private libraries of materials in order to make search effective.

Freelance Income from Course Creation/Tutoring

Providing academic materials in the form of course creation or tutorials is a growing, unregulated, and highly decentralised market. At the moment, it is a market that is highly inefficient in terms of delivery and fair compensation. Providing marketplaces and forums to content creators is a large market in and of itself. The demographics coming to the web with this intent include

celebrity/public personality academics, professors who are looking for additional income, credentialed experts, well-educated private persons, and, unfortunately, individuals who seek to capitalise on the vulnerable state of students looking for alternative credentials by offering quickly assembled courses and tutorials with little substance.

Job-Seeking

Many individuals are coming to the web with the intent of searching for a job. This has slowly been adopted as the primary way to scan job postings and post resumes. Unfortunately, resumes are still generally not machine-readable in a meaningful way, and the market has not addressed solving for false-positives and false-negatives in terms of delivering candidates to companies for potential employment. The market of human capital is inarguably inefficient. The demographics coming to the web with this intent are so broad that it may not be worth addressing them in detail, but it is important to note that the two most notable demographics of interest associated with this intent are recent graduates and self-learners attempting career transition.

HR Admin/Recruiting/Talent Analytics/Data Access

On the other side of job seeking are HR, Recruiting, and Talent Analytics professionals looking to review potential candidates and existing employees for employment and reassignment respectively. This is a massive market of a value that is difficult to estimate. Current data streams for hiring are widely considered insufficient for effective use and discovery of human capital.

Credential and Portfolio Building/Presentation

In order to facilitate job and resume search, many users are coming to the internet for help with credential and portfolio management and presentation. Many of these platforms intend

to make related materials more easily machine readable. Some focus only on government accredited credentials such as professional/vocational licensure and degrees from accredited institutions. Unfortunately, alternative credentials suffer from a slow rate of adoption and little to no general recognition. Users who go to these platforms come from a wide range of demographics, but the demographics of most notable interest are self-learners seeking alternative credentials and graduates who want to work in an industry outside the strict confines of their field of study.

Professional Skill Development, On/Off-boarding

Continuing Professional Development is a massive market of a value that is difficult to estimate. People come to software or web-based platforms with the intent to develop skills associated with their current or target employment in order to be onboarded, offboarded (career transition), and to become a stronger asset to their company. They are motivated to do so either intrinsically or extrinsically:

Intrinsic

Many people now recognise that it is of vital importance to take it upon themselves to expand knowledge and develop skills associated with their career. The nature of employment has changed and in order to adapt to (1) new demands for staying up to date with changing technology and techniques and (2) the degree of specialisation required by modern employment, people are going online to find tutorials and courses.

Extrinsic (CPD)

Many companies, to counter the lack of personal ambition or learning management skills of employees to become better at their jobs, have adopted learning management systems and external systems/companies to assist in the continuing professional development of their employees. These systems

usually provide curriculum, custom or generalised, and tools for analysis.

Companies of Interest

There are thousands of companies occupying the previously mentioned market segments. There many companies of note that are material to the interests of the document, however, given time constraints, addressing all of them simply isn't possible or necessarily useful. A small list of companies was drafted as a best attempt at addressing both the state of the market and the key players and innovators within it.

edX

edX is a Massive Open Online Course (MOOC) platform whose primary focus is to provide free education worldwide. Through partnerships with well-known institutions, such as Harvard and MIT, they aim to create high quality courses. Users can enroll in a course for free or have the option of paying for a certification to verify course completion. The company also offers a number of Distance Education programs through partnered universities where users can obtain Associate's, Bachelor's and Master's degrees online. These programs are close to equivalent in pricing with on-campus programs. edX offers an Enterprise version of their software for onboarding and Continued Professional Development (CPD). This includes analytics tools to measure employee learning engagement and other valuable success metrics.

The edX platform is easily accessible from mobile and tablet devices through their native application. By focusing on centralised course construction from universities, they maintain a range of high-quality courses which users can follow at their own pace.

This, however, has led to a problem with the credibility of the resulting certificates. The individual course certificates are

generally not accepted by employers. There is no continuity of support on the site, access to professors is limited and peer learning is inaccessible. There is no attempt to help students transition from the site to employment. In addition, it has been established by former students of the colleges offering courses, that the online courses are definitively not up to the standards of equivalent courses on campus.

edX is a Non-Profit company with an estimated 21m in yearly revenue. It was funded by MIT & Harvard for a total of 23m and currently has an estimated traffic of 21m visits per month and an estimated 18m users.

Coursera

Coursera, another MOOC site, provides users with the ability to take free courses at a self-paced rate and offers paid options through Certificate programs and Distance Education programs with partnered schools. Coursera offers an Enterprise version of their platform to companies for onboarding and continual training for employees. The business version comes with a small suite of analytical tools to track progress of employees. Coursera has a wide range of quality courses from selected institutions around the world; they currently have 188 partners across 29 countries. Coursera are edX's main competitor with a very similar business model.

Coursera is also available on mobile and tablet devices. The platform gives users access to quality courses in a wide range of subjects. They have similar problems to edX, with students finding it difficult to interact with professors and get the support they need. Students are not able to work with each other, which can be very isolating. The graph below (Figure 14) shows the number of students who make it to the end of self-paced courses, suggesting that this lack of support makes it difficult for students to stay motivated to completion.

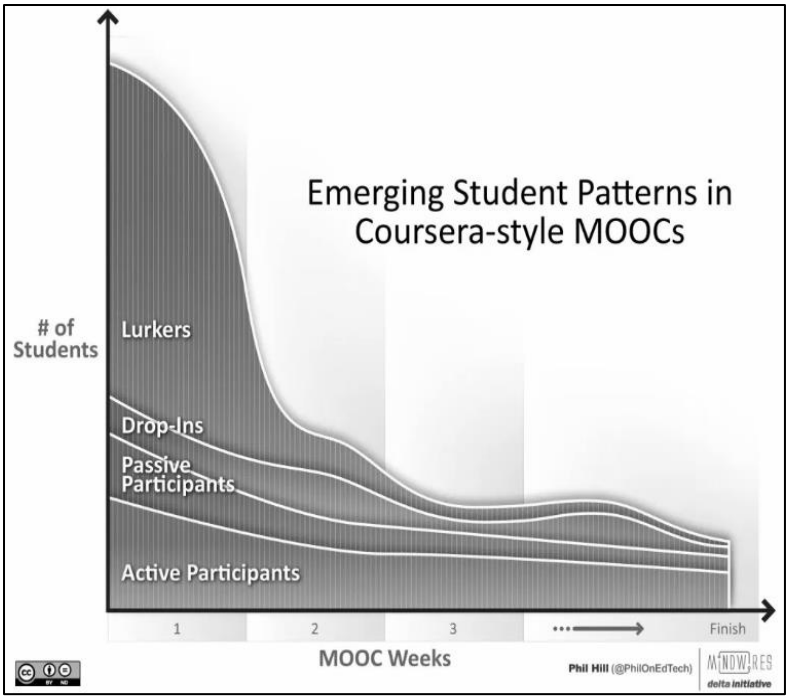


Figure 1 - Student Patterns in MOOCs

Coursera is a For-Profit company with an estimated 140m in yearly revenue. It has received a total of 210.1m in funding from investors such as World Bank Group, New Enterprise Associates, and EDBI and currently has an estimated traffic of 37m visits per month and an estimated 18m users.

Instructure

Instructure is the parent company to Canvas, a Learning Management System for higher education and K-12 schools, and Bridge, an employee development suite built specifically for employees and managers. It has recently acquired Portfolium, a platform for students to create an online portfolio of their progress through their education and careers. Canvas provides features such as resource sharing, teacher-student communication via messaging and video conference, scheduling tools, automated tasking and more. Bridge provides a smooth software suite so managers and employees can better learn and communicate with each other. They focus on manager and

employee one-to-one relationships to give managers a better view of their relationships with individuals under their management. Portfolium, a LinkedIn style platform, intends to be an addition to students' resumes, as a way to showcase projects, extracurriculars and anything else deemed worthy of mention in their education process and beyond. They are currently serving over 3,000 universities.

The enterprise software offered by Instructure is of very high quality. Tools for professors and students seem like they were designed with User Experience in mind. Unfortunately, these tools are only available for schools and businesses.

Instructure is a For-Profit company with an estimated 209.5m in yearly revenue. It has received a total of 89.1m in funding from investors such as Bessemer Venture Partners, Insight Venture Partners and EPIC Ventures and currently has an estimated traffic of 124.4m visits per month, user data was not publicly available.

Udacity

Udacity provides 1 to 4 month programs called "Nanodegrees" specifically focused in the technology sector; they have "schools" covering Data Science, Programming, Business, Artificial Intelligence and Autonomous Systems. The company offers a small amount of free, self-paced content (currently 197 courses) but mainly advocates for their "Nanodegree programs" which gives students support via one-to-one mentoring, career guidance, a set schedule and live sessions. The content is curated by their inhouse team of course creators from various tech companies, specifically working with Google to create partnered programs. Udacity also offers an Enterprise version of their platform and content to business for training staff and tracking employee progress.

They focus on end-to-end support for their students, helping them in their search for a job after completing the program. They offer extra services, for a price, to help students optimize their portfolios and presence on sites like LinkedIn. Their pricing is

reasonable, and they offer segmented payment plans to those who may find it difficult to pay in full upfront. They focus on application through projects that students can use in their portfolios after graduation. There is no barrier to entry on their Nanodegree programs other than price, which is different to more traditional programs available on sites like edX and Coursera (in order to take a degree program very often students must provide an academic transcript or have some previous degree already).

The downside to Udacity is the small scope of the programs they offer. This small scope maintains a certain standard of content but means that they do not push out new programs as often as other available platforms. They only offer online programs, which puts them at a disadvantage as compared with other tech bootcamps available in most major cities from various companies.

Udacity is a For-Profit company with an estimated 67.5m in yearly revenue. It has received a total of 160m in funding from investors such as Andreessen Horowitz, CRV and Bertelsmann and currently has an estimated traffic of 10.8m visits per month and an estimated 8m users.

Udemy

Udemy is a platform where users can take and create online courses. They have both free and paid courses available in a wide range of subjects. Udemy for Business provides companies with price packages for both small and large teams. Curated content is algorithmically suggested by the platform for teams based on various metrics supplied by the employer. Udemy gives businesses access to analytics tools to view how employees are doing and what content they are interested in, making it easy to figure out what areas they may need to focus more on both at an individual and company-wide scale.

Udemy's strengths include the sheer amount of content available and number of instructors; there are upwards of 80,000 courses

users can access on the platform and approximately 35,000 instructors. Anyone can create a course and start making freelance income. Courses are widely accessible; most are free, and many paid courses are low-cost.

Unfortunately, the number of courses and lack of specialized/curated content (anyone can make a course and post it) affect the credibility of courses and the certificates of completion given to students. The courses are self-paced; students are left to their own devices to complete courses successfully. There is no attempt to support students on a pathway to employment or to see them through to their end goals. Course creators can have upwards of 5,000 students enrolled at any one time, making it extremely difficult to form personal relationships with individual students.

Udemy is a For-Profit company with an estimated 28m in yearly revenue. It has received a total of 173m in funding from investors such as Naspers, Stripes Group, Norwest Venture Partners, Insight Venture Partners and Lightbank and currently has an estimated traffic of 110m visits per month and an estimated 24m users.

Teachable

Teachable is a platform that allows users to create their own courses quickly and easily. Users can integrate courses into their existing site or use a Teachable domain if they don't have a website already. Teachable handles payments, emails and comments from students. Tools are available for analytics on students taking the course and allows content creators to be in control of the creation process from start to finish.

The platform is very easy to use and gives creators the option to market their content solely through their own brand, not through Teachable. They provide course creators with the tools to easily create courses, publish, brand and distribute them from one place, without having to interact with code at all. The platform is

also mobile friendly. This is extremely valuable and saves time for creators.

This does, understandably, come with some limitations for users. Simple video, image and quizzes are the only data types available. Instructors cannot host live sessions on the platform, create workshops or have the ability to work on projects with students. Users are also tied to using whatever Teachable decides to use on the backend for payments, email etc. This makes it more difficult to resolve issues when something goes wrong.

Teachable is a For-Profit company with an estimated 12m in yearly revenue. It has received a total of 12.5m in funding from investors such as Accomplice, Naval Ravikant, Learn Capital and Winklevoss Capital and currently has an estimated traffic of 12.1m visits per month, user data was not publicly available.

Knewton

Knewton is an adaptive learning technology provider focused on personalized learning for students. Their latest release, Alta, combines their adaptive learning technology with curated content all in one place for students to use. Courses and course resources are provided through the platform. They focus on finding “Knowledge Gaps” for students, so that they can figure out what exact areas they need to focus their attention on. The company focuses on providing their software at a low-cost to students and they achieve this mainly by creating the content inhouse. Knewton gives teachers analytics tools to view class participation and progress.

Knewton makes sure to comply with existing accessibility regulations so that their platform is available to all students, such as those with hearing or sight impairments. Their learning adaptable software provides students with a unique and tailored experience; it **dynamically diagnoses concept mastery and finds gaps in knowledge** by adapting with each interaction. Students

can take quizzes, interact with their instructor and use resources all in one place.

At the moment, Alta only provides courses in Chemistry, Economics, Mathematics and Statistics. The platform is only available via institutions, so it's not accessible to individuals. The platform does not allow teachers to create their own courses, only to upload resources and create quizzes.

Knewton is a For-Profit company with an estimated 12m in yearly revenue. It has received a total of 182.3m in funding from investors such as **Accel**, Bessemer Venture Partners, Founders Fund, FirstMark and Atomico and currently has an estimated traffic of 0.25m visits per month. User data was not publicly available.

Degreed

Degreed is an online platform that focuses on skill building and verification. Individuals can use the platform for free where they can access content both curated by Degreed and aggregated from elsewhere on the web by other users. The goal is to build an education journey by tracking each interaction a user has with any content they deem worthy of mention; books, articles, courses, podcasts can be marked as "Complete" and are added to the user's profile. "Skill Verification" is available at a cost; this process includes a self-evaluation, feedback from others, input from experts chosen by Degreed, and review of evidence provided by the user. A skill level between 1 and 8 is assigned and a certificate is then issued. Degreed works with businesses to provide learning tools for onboarding and continued training of staff, providing useful analytics to employers.

Degreed offers a browser extension that quickly allows users to mark resources as complete while on the web, without having to post directly through Degreed. Pathways are another feature that allow users to add similar resources to a list and publish it to their profile where others can use it. Pathways help users to define an end goal with their learning and follow it. Degreed has

"Featured Pathways" that users can take and also "Clone", allowing users to copy and edit any pathway on the platform, similar to how people use GitHub. The skill verification is a decent attempt at helping users to evaluate their skills right now in a concrete way, but it does not seem to have gained a lot of traction with employers yet. Degreed provides value to companies through better insights about their employees by curating content that is personalized for each employee based on their current skill set and trajectory.

There is no way of verifying whether or not users have actually read or consumed the content they have marked as complete on their profile, it simply relies on users being truthful. This affects the credibility of the portfolio as a valid and true source of progress and may even give users an inaccurate idea of their current skills. This is called having a "Feeling of Knowing". Suggested content by Degreed is not always well-curated and the search algorithm decides what content is best to show users based on unknown metrics. Users can follow one another, similar to a Twitter model, to see the activity of others on their feed. Suggestions made by the platform on who to follow are not very helpful as many users with little to no activity are often recommended. Support tools for actually learning and retaining the information marked as complete are unavailable on the platform, as are opportunities to use the knowledge obtained in a meaningful way. It seems the platform aims to provide a means of documenting "unconventional" and continued learning, rather than making sure the knowledge is being retained and applied. Once something is marked as complete it is up to the users to revisit old information. For this reason, it seems Degreed is focused on marketing their Enterprise product to companies, rather than recruiting individuals to the platform.

Degreed is a For-Profit company with an estimated 9m in yearly revenue. It has received a total of 78.2m in funding from investors such as Owl Ventures, Rethink Education, Signal Peak Ventures, Jump Capital and GSV AcceleraTE and currently has

an estimated traffic of 0.25m visits per month and an estimated 3m users.

Grovo

Grovo is built around "Microlearning", a modern approach to workplace learning that delivers targeted lessons to employees in their workflows so that they can naturally learn new information over time. The main factors of this are (1) "Single Concept Learning", focusing on one new skill at a time ("little and often"), (2) "Contextual Relevance", content that is interwoven into an employee's current workflow focus, and (3) "Mixed Media", engaging content through video, images and audio. Lessons are provided by Grovo but can also be created by users. "Collections" of micro-lessons are curated by Grovo on particular topics that users can follow, similar to Degreed's "Pathways". Particularly they advertise social topics such as "Addressing Bias" via micro-lessons. The software platform is offered only to businesses, small and enterprise level, and can be integrated into existing LMS's. They were acquired by Cornerstone OnDemand in November 2018.

Employers have cut down onboarding time greatly by using the Microlearning method, and employees feel less overwhelmed by training when it is broken down into smaller pieces. The software is smooth and easy to use and allows employees to work at their own pace, while also allowing employers to set deadlines for topics. Grovo tries to curate content such that employees can apply the information immediately within their work. Analytics tools are supplied to employers to track and view progress of employees, allowing them to identify potential **knowledge gaps**. The ability to track progress is facilitated by **granularity in education modules** (micro-lessons) offered through the platform.

Grovo does not, however, seem to focus as much on ensuring long term retention outside of attempting to suggest relevant lessons. Though the content is easily consumable, it can result in users having a "Feeling of Knowing" rather than actually

obtaining the knowledge by becoming passive observers. The attempt to address this is to attach small quizzes to each micro-lesson, but it does not seem to prompt users to revisit old information. The platform is not available for individuals.

Grovo is a For-Profit company with an estimated 11.7m in yearly revenue. It has received a total of 73.3m in funding from investors such as **Accel** and Greg Waldorf and their website currently has an estimated traffic of around 60k visits per month. The total number of active users was unavailable.

CredentialEngine

CredentialEngine provides an application program interface (API) to companies for access to their cloud-based registry of credentials which can be read by humans or used as a data stream by machines. The registry is intended to include state licensures, college degrees, and quality assurance recognitions. This allows clients to verify credentials presented by potential candidates.

CredentialEngine has a well-connected board and, arguably, their greatest asset is their board members which have granted them access to verify state-given professional licensures. Its largest flaw seems to be that the company's view regarding the nature of credentials is very traditional. It seems to be highly valuable for fact checking resumes but not much more.

CredentialEngine is a Non-Profit company. Revenue, user base and funding information was not publicly available, but they are currently supported by the **Lumina Foundation**, J.P. Morgan, Microsoft and the Northrop Grumman Foundation and are currently working with the Navy and other government institutions.

CornerStone

CornerStone provides cloud-based talent management software solutions to multiple industries, including Higher-Ed. They

supply four specific suites; Recruiting, Learning, Performance and HR. The software suites provide users with expert curated content, the ability to track employee progress, set company-wide goals, and recruit the right talent by supplying marketing and analytics tools to employees making for a seamless experience. Currently serving over 1,000 businesses internationally, with their largest client at 700k users.

Started in 1999, CornerStone is currently providing one of the best software solutions for both small businesses and large enterprise accounts. They do not, however, provide tools for individuals. They recently acquired Grovo, a "Microlearning" platform, that they seem to have integrated into their own LMS. Cornerstone is dominating this market.

CornerStone is a For-Profit company with an estimated 531.6m in yearly revenue. It has received a total of 344.7m in funding from investors such as Bay Partners, ff Venture Capital, Bessemer Venture Partners, LinkedIn, Silver Lake Partners and Meritech Capital Partners and currently has an estimated traffic of 313m visits per month and an estimated 40m users.

LinkedIn

LinkedIn, acquired by Microsoft in 2016, is currently the most popular professional networking and recruiting platform on the market. They provide employers with insightful search tools and facilitate hiring through their platform. Employers can post jobs to the site and search for potential candidates. For individuals, LinkedIn is a place to document professional development, search and apply for jobs, learn online, and network with other users through “connections”. LinkedIn provides a suite of premium tools for both users and companies/organisations, at the cost of a monthly subscription. Premium users can see who has looked at their profile, what skills employers are actively seeking out in their field and many more useful features. Premium companies are given a suite of specialised search and analytics tools.

LinkedIn is very popular, especially when looking for a job - premium tools give users a great advantage as they can see what employers are looking for. There are also learning tools available through Lynda.com (now part of LinkedIn, acquired recently) that allow users to take courses on the platform, with additional features included, for a monthly fee. Employers have access to advertising tools, team training, talent solutions with recommended insights, sales solutions and job posting.

The only downside seems to be the current free access for individuals. Most learning materials are behind a paywall, and many of the useful features that help when applying for and finding job postings are only available to premium members. There is also a feed similar to that of Facebook, which is often used in the same manner. The line between professional and casual can sometimes be blurred in this sense. Needless to say, it is the main platform used, as of right now, by most professionals when connecting online.

LinkedIn is a For-Profit company with an estimated 4.5b in yearly revenue. It has received a total of 154.8m in funding from investors such as Sequoia Capital, Bessemer Venture Partners, Greylock Partners, Bain Capital Ventures, Goldman Sachs and Global Founders Capital and currently has an estimated traffic of 1b visits per month and an estimated 500m users.

Cerego

Cerego is an adaptive learning platform specifically focused on using spaced retrieval practice through their **distributed learning system**, which prompts users to recall information at the optimal time, just before it is lost, enabling the **maintenance of module-competence**. The company allows users to create content themselves, access content created by Cerego, or access content through private courses created by peers in their group or by their instructor. Cerego is mainly being used by universities, small to large businesses and the **U.S. Government** - particularly the **U.S. Army**. Users can access “The Knowledge Bank” which

provides a visualization of how well they know the material in each of their assignments. This tool allows users and stakeholders to **rapidly identify knowledge gaps**. Cerego is focused on marketing towards Businesses, Higher Education and Governments, rather than individuals. Their pricing varies on size and needs of clients.

Cerego offers a mobile version of their software on both Android and iOS with offline capabilities making it very accessible to students. They provide tools for educators to easily create content from existing materials and analytics tools to watch students' progress and be able to quickly help in areas they might have trouble with. They work with government agencies to make sure personnel are always up to speed and can act quickly when needed.

> *"Cerego protects U.S. Government sensitive data by hosting courses containing Controlled Unclassified Information in a DFARS 252.204-7012 compliant cloud. We protect existing training investments by importing existing SCORM-compliant courses and launching from current learning management systems."*

Cerego is very much aligned with current literature but are not focused so much on individuals. Individual users can create an account but can only create their own content, or use the limited content provided for free by Cerego. The lack of access to other users' content or ability to share content and their learning profile greatly limits individuals that use the software.

Cerego is a For-Profit company with an estimated 10m in yearly revenue. It has received a total of 35m in funding from investors such as Brainstorm Ventures (only investor, private equity round) and currently has an estimated traffic of 200k visits per month. The estimated number of users is currently unavailable.

SmartSparrow

SmartSparrow is a company that provides instructors and learners with tools to create their own E-Learning courseware. Their main product, “aero”, is an easy to use development environment that allows users to create any form of E-Learning resource.

> *“If it's on a screen and you learn from it, it's courseware. aero is a courseware development platform. For creating any type of courseware.”*

Aero gives users autonomy and control over their material as compared with traditional publishers. This is a robust tool that integrates into existing platforms, like Canvas, giving users flexibility to use what suits them best. They provide solutions for Higher Education, Publishers, and Enterprise training. Analytics tools are provided to help administrators track the progress of users. Collaboration between admins is another useful tool available. SmartSparrow also has a skilled design team that works with clients to build content for them based on their needs, which makes it attractive to larger businesses who may prefer to have content curated for them.

Overall, Sparrow provides a way for users to have full control over what content they provide to students. The content goes beyond the traditional textbook or PowerPoint and creates the opportunity for students to interact with the content and makes learning much more engaging. They allow for a digital experience beyond a mere video course.

As with most of these platforms, there is not much available to individuals who may want access outside of an institution.

SmartSparrow is a For-Profit company with an estimated 5m in yearly revenue. It has received a total of 23.5m in funding from investors such as ACT, Moelis Australia Asset Management, the Bill and Melinda Gates Foundation and Yellow Brick Capital Advisers and currently has an estimated traffic of 250k visits per month and is currently working with an estimated 700 institutions.

Kaplan

Kaplan Inc. provides educational services to colleges, universities, corporations and businesses, which include curation of higher education programs, professional training and certifications, test preparation and student support services. Kaplan has multiple sub-organizations, the most significant of which being Kaplan University (acquired by Purdue University, now under the name “Purdue University Global”). This organization provides online degree programs through which students can obtain Certificates, Associate’s, Bachelor's and Master’s Degrees. Kaplan Inc. provides test preparation materials and offers one-on-one tutoring online for most recognised exams; SAT, ACT, LSAT, GED etc. They offer the same for professional education in various fields as well as certain licensing exams.

Kaplan’s main target consumers are high school and college students who need help preparing for exams and those in professional fields that require particular certificates and licenses. Support is offered to students transferring or applying to universities and those who need career guidance. They target universities and large institutions by providing these services and education programs for training employees. Study abroad services and the development of online programs for universities is one of the main reasons Kaplan has been successful with institutions across the globe.

Kaplan is one of the world’s largest providers in their three main focus areas; higher education, professional training, and test preparation. Kaplan accredits individuals but only through selected exams mentioned previously. This is the main downside for individuals who wish to accredit skills outside of the selected materials.

Kaplan is a For-Profit company with an estimated 2.1b in yearly revenue. The total funding amount for Kaplan is unknown. They are a subsidiary of Graham Holdings Company and currently

have an estimated traffic of 600k visits per month. The total number of users is currently unknown.

Wyzant

Wyzant is an online marketplace that connects students with qualified in-person and online tutors in over 250 different subjects. Students have the ability to work with the same tutor long-term. **By building a relationship with their tutors, students benefit by having both a mentor and a personalized learning experience.** Wyzant offers their software to universities to distribute access to their students at scale, giving them **access to expert support outside of the classroom**. They have increased student completion rates at multiple universities by giving students **access to personalized support,** decreasing the immense pressure put on professors to provide this support to hundreds of students at a time. Tutors are accessible both online and in person. Individuals have access to a public question and answer forum, similar to Quora or Stack Overflow, where they can quickly search to see if their question has already been answered by someone on the platform or post a question. **Crowdsourcing expert support has allowed Wyzant to scale personalised and on-demand help with learning breakdowns.** Wyzant also supplies sample lessons in popular subject areas where students can quickly brush up on their knowledge for free.

Wyzant is extremely valuable to students. Having access to an actual person that they can rely on for help outside of their professor in class is invaluable. The ability to retain the same tutor long-term creates a personalized experience and makes the **discovery of knowledge gaps** easier. The online question answer forum also provides support outside of their tutor in the case they are unavailable at any time. The platform currently has over 80,000 vetted tutors registered on the site. Their online platform is easy to use and provides tools for both students and tutors to communicate and work effectively with each other. Students can request a tutor or search through existing postings. They also offer a mobile application which makes the platform easily

accessible. Wyzant gives tutors useful tools and handles all payment processing. They give tutors the autonomy to choose the pricing and scheduling that works for them.

Wyzant tutors are available at an hourly rate, ranging anywhere from $10 to $200 plus. This creates somewhat of a price barrier as there is no free access available to individuals outside of institutions. The vetting process for tutors is unknown, but a five-star review system is given to students to evaluate tutors. This is the main metric provided to students when choosing a tutor, and whatever information is provided by the tutor themselves (description of self, background and prior education etc.)

Wyzant is a For-Profit company with an estimated 27.9m in yearly revenue. It has received a total of 21.5m in funding from investors such as **Accel** and currently has an estimated traffic of 3.7m visits per month and an estimated 2m users.

Vedantu

Vedantu's objective is to provide high quality teachers to students across the globe through live, online tutoring. Students have access to "Master Classes", which are scheduled classes in a specific topic lead by an instructor, or they can schedule one-to-one tutoring. The Master Classes are held **live with expert teachers** and are offered for free. The one-to-one tutoring is available between $7-$15 an hour, but limited to CBSE, ICSE, IGCSE, IB and State Board exams, rather than in general subjects. They also have study materials available for download for free pertaining to the particular exams, such as past exams with solutions. Users can also sign up to become instructors but must pass a fairly rigorous process to be allowed to teach.

Master Classes on Vedantu are a major advantage and makes material accessible to those who may not be able to afford private tutoring. By American standards the rates for tutoring are quite low as compared with companies in the U.S., but again the content is limited to particular exams. Vedantu offers great support to students and the platform through which students and

instructors interact online is robust, allowing for easier communication.

The downside is the narrow scope of the content being taught. Despite this, the company is constantly expanding and have seen **very good results with students through their one-on-one tutoring programs.**

Vedantu is a For-Profit company with an estimated 3.9m in yearly revenue. It has received a total of 21.6m in funding from investors such as **Accel**, Tiger Global Management, Omidyar Network and TAL Education Group and currently has an estimated traffic of 11.45m visits per month and an estimated 9.5m users. Vendantu has one board member, Anand Daniel, a **partner at Accel.**

Credly

Credly's digital credentialing platform allows companies to create and issue "badges" representing anything from a set of skills to attendance at an event. Badges are made up of underlying metadata that describes what the badge represents. In order for a user to obtain a badge, the metadata must be satisfied e.g. testimonials or evidence of completed work on a project. Credly has partnered with Canvas to allow for bulk-issuing of badges by institutions to its members. Credly can automatically issue these badges as students achieve milestones in and complete Canvas modules.

Users can share these digital badges across the web, making them much more accessible than a traditional resume. Credly has partnered with LinkedIn to allow users to easily add badges to their profile. The platform has enabled teachers to represent particular skills developed by students in their courses and can be evaluated alongside grades to provide a better picture of a student's progress and skillset. Employers are using Credly to help identify which candidates may be suitable for a particular position, switching from traditional degree-based hiring to a focus on skills. It also gives users a better way to track their

professional development outside of the office. Enterprise clients also gain access to analytics tools to see how their employees are developing their skills, and where there may be gaps in their workforce. Their pricing model is unknown but seems to be based on the size and needs of clients.

Unfortunately due to the wide range of badges that can be issued, it may become difficult for employers to identify the value of each badge; employers do not know the difference between a badge representing completion of a four year course or completion of an hour long training without having to analyze the metadata associated with each. This can be extremely time consuming and does not seem to scale well.

Credly is a For-Profit company with an estimated 2.5m in yearly revenue. It has received a total of 7.1m in funding from investors such as **Lumina Foundation**, New Markets Venture Partners, Lion Brothers Company, City & Guilds Group, University Ventures and Jonathan Finkelstein (CEO) and currently has an estimated traffic of around 90k visits per month. The number of clients using Credly is currently unknown.

Rosetta Stone

Rosetta Stone provides a platform for language learning to individuals, schools and businesses. Individual users have a choice between four payment plans; three, six, twelve and twenty-four month plans all paid at a certain price per month in one payment. They allow users a free demo of the software to try before purchasing. Rosetta is one of the oldest computer-assisted language learning platforms having started in 1992 and have dominated this market since its inception. Rosetta uses what is known as the immersion model, by introducing new words and concepts in a particular sequence that provides context for the material being learned. The software provides instant feedback, speech recognition and revisits older information in order to optimize retainment. **Live one-on-one expert tutoring** enables students to practice speaking the

language they are learning with a true native speaker. The software will iterate exposure to content using a distributed learning algorithm to **optimise concept learning and explicit memorisation as well as to prevent decay of competence**. memorisation Games and activities give users a fun way to sharpen their language skills in grammar and speech. Schools can purchase Rosetta Stone for their students and many use it to supplement classroom learning. Businesses have used Rosetta Stone to provide their employees with the tools to learn at their own pace, anywhere they want through mobile learning.

Rosetta Stone's dynamic immersion system has been proven to be very effective for most customers and seems to be a useful addition to classroom learning. The cross-platform compatibility makes it attractive to businesses as their employees can develop their skills on the go. The platform focuses on giving the user the ability to speak with decent fluency, not simply learning vocabulary. The experience for each user is personalized to their needs. Businesses have access to enterprise analysis tools and dedicated customer service and support representatives. They help companies monitor progress and ensuring their goals are being met. They provide testing so that administrators can figure out which employees may need more attention and support in their learning.

The downside is the cost of the program, which can be in total up to $300 for individuals, depending on the payment plan chosen. Some reviews have questioned the effectiveness as compared with the price, as it does not guarantee complete fluency, rather intermediate fluency and understanding. Despite this it has been used at numerous Fortune-500 companies and U.S. Government agencies including, but not limited to, **CIA**, **the Army, Pentagon, and FBI.**

Rosetta Stone is a For-Profit company with an estimated 173.6m in yearly revenue. Total funding amount is unavailable. Investors include Madison Capital Partners, ABS Capital Partners and Norwest Equity Partners (NEP). The company currently has an

estimated traffic of 2.17m visits per month. Over 8,000 corporations, 9,000 public and non-profit agencies and 20,000 educational institutions and millions of individual learners are using Rosetta Stone's software.

Quizlet

Quizlet is an online learning community for teachers and students focused around flashcard sets. Users can create their own sets or use sets built by the community. The company recently introduced "Premium Content", expert created study guides available for purchase at a relatively low cost. The platform provides multiple interactive features that guide students through their learning in different ways. Their "Learn" feature helps students study a particular set over time, by asking students when they need to know the information by and spreading out the learning material before the deadline to ensure the information is retained (distributed learning). Their "Diagrams" feature allows students to create images with tagged questions to each part of the image and their built-in games create a fun way to practice sets. Quizlet is free to use for individuals, but certain features are offered for a premium membership currently priced at $1.67 a month (charged $19.99 for the year). Premium offers offline material, ad-free studying, personal image upload, custom audio recordings and more. Many teachers have integrating Quizlet into their classroom. Students become more engaged and enjoy studying through Quizlet. Their main feature for classrooms is called "Quizlet Live". Teachers set up a Live session that students can connect to through their devices. Once the session has started, students are put into teams where they compete and work with each other to complete the set successfully.

Quizlet has been very successful due to their application being easy to use and interactive. Users have reported that it made studying fun, and teachers have seen success in their classrooms increase. The free version of Quizlet is very good, and their premium subscription is offered at a low price, making it

accessible for most people. The software is available on mobile devices making it easy to study on the go.

The downside to Quizlet is the ability to search for the best content, it can be difficult to find good sets without creating them yourself. Their search algorithm is ambiguous; there is no rating feature built in for users to evaluate sets built by the community, leaving it up to Quizlet's algorithm to decide what data is good or bad. Their introduction of Premium Content alleviates this a bit, but the amount of Premium Content currently available is limited.

Quizlet is a For-Profit company with an estimated 9.4m in yearly revenue. It has received a total of 32m in funding from investors such as Owl Ventures, Altos Ventures, Icon Ventures, Costanoa Ventures and Union Square Ventures and currently has an estimated traffic of 94.79m visits per month and an estimated 300m users.

Blackboard

Founded in 1997, Blackboard has been the main provider of educational tools to U.S. schools, both at the K-12 and university level. The software consists of seven platforms called Learn, Transact, Engage, Connect, Mobile, Collaborate and Analytics that are offered as bundled software. Students can access assignments, communicate with each other and their professors, collaborate on work, upload and download files, video conference and more. Teachers have access to robust analytical tools that provides insights about their students. They allow for the creation of personalized sites that are branded to the client, along with mobile friendly software so students and teachers can access their work at any time. The company owns a large share of the education market. Tools for assisting continued professional development are provided to businesses. The learning management system includes web conferencing and collaboration, registration and reporting, mass notifications,

implementation and strategic consulting. Blackboard is being used by government clients to train staff using the same tools.

Blackboard have done a very good job of integrating all of the tools required for an institution to succeed in one place. The software is can easily be integrated with other existing software, such as Google Drive and Gmail, making for an easy transition.

Some instructors have found it difficult to work with the platform, create content, and solve errors. Blackboard does, however, seem to continually be updating their software in an attempt to compete with their more modern competitors. It is important to note that Blackboard offers many different versions of its software, and while the best versions are trailered on their site, to the public, and to state colleges, these versions are often not the versions that students and staff actually interact with.

Blackboard is a For-Profit company with an estimated 694.5m in yearly revenue. It has received a total of 122m in funding from investors such as Carlyle Global Partners, Microsoft, Dell, Pearson, @Ventures, BancBoston Ventures and Chase Capital Partners and currently has an estimated traffic of 1b visits per month and an estimated 100m users.

ResearchGate

ResearchGate is a professional network for scientists and researchers to publish, share, discover and discuss work on one platform. Accounts are verified on a case by case basis in order to ensure the data being published on the site is legitimate. Users can create an account if their “role or field of work is connected to science, e.g., you're a lab technician, computer scientist, [or] engineer”. If the user does not meet this criterion, they cannot make an account, but they can browse available research. Users can share publications and access millions of existing publications on the site, connect with others in their field and get data on who has been reading or citing their work. Discussion boards allow users to ask and answer questions, solving research problems in the process. Users can share updates about current

research and keep up with the latest publications. Users also have access to a research-focused job board, through which their profile acts as a living resume. Employers can post jobs based on the type of research they are looking for and ResearchGate connects them with potential candidates.

ResearchGate's data allows for **relationships between papers** to be analyzed and considered, and the citation database allows authority algorithms (on which Google's PageRank was based) to **help determine the authority, reach, and general acceptance (confidence in) research.**

ResearchGate is a For-Profit company with an estimated 4m in yearly revenue. It has received a total of 87.6m in funding from investors such as **Benchmark**, Goldman Sachs Investment Partners, Bill Gates, Founders Fund, A-Grade Investments (Ashton Kutcher is a Partner), Groupe Arnault, Welcome Trust, Xavier Niel, Tenaya Capital and Four Rivers Group and currently has an estimated traffic of 157.199m visits per month. There is currently an estimated 15m users registered on the platform.

CollegeBoard

CollegeBoard develops and administers standardized tests and curricula used by K–12 and post-secondary education institutions to promote college-readiness. They provide tools, resources and services to students, parents, colleges and universities regarding planning for college, preparing for examinations, financial aid and the admissions process. The organization charges assessment fees for the management and application of these examinations. They administer the SAT that are used by most, if not all, colleges in the United States and can be taken outside of the U.S. as well. The company provides search tools on their website where students can search through available universities that accept their exams and also search for scholarship opportunities. Users of the site can "Make a Plan" by looking at career options and saving universities through the search tool. Students can view their scores from various tests they've taken

and apply to take practice tests or register for official tests within the site.

Each exam, along with multiple registration and testing fees, can come out to over $200. The price of the exams has been increasing over time, and many critics say that the tests do not accurately indicate a student's ability in the subjects being tested. Furthermore, critics argue that this lack of accurate indication is creating unaddressed *false-negatives*, leaving many potential university students behind.

CollegeBoard is a Non-Profit company with an estimated 9.5m in yearly revenue. Investors and funding information is currently unavailable. Traffic is estimated at 9.9m visits per month and an estimated 7.8m students took the SAT in 2018.

Duolingo

Duolingo is an online language-learning platform focused on providing free access to all users and is in use by both schools and individuals. Using gamification and adaptive learning techniques, the company aims to make learning a language fun. Each user has a health bar and progresses through their learning journey by passing levels, earning "Lingots" along the way. *Lingots* are Duolingo's virtual currency, awarded to users as they succeed on the platform, and can be spent on various mini-features (extra-health, timed-lessons) at their online store. Users can "follow" friends and see their progress on the platform to incentivise healthy competition.

There are currently 33 languages available on Duolingo, with more being developed through their Incubator program. This program uses a crowd-source creation model by encouraging bilingual users to volunteer to become "Course Contributors" for languages that have not yet been developed on the platform. The company has managed to integrate cognitive science and gamification techniques to ensure users continue coming back to the platform. Duolingo is, quietly, on the backend **helping to**

translate the web by using web-content as practise material for users to translate.

Duolingo is a For-Profit company with an estimated 40m in yearly revenue. It has received a total of 108.3m in funding from investors such as Tim Ferriss, Drive Capital, CapitalG, New Enterprise Associates, Kleiner Perkins, A-Grade Investments and Union Square Ventures and currently has an estimated traffic of 59.3m visits per month and an estimated 300m users.

Problems the Market is Facing

These companies of interest, market segments and user intents, with few exceptions, all orbit around two concepts: education and its link to employment. The market is slowly coming to recognise and address that employment, education, and credentials are changing, and that society and institutions have been slow to adapt and respond. An attempt will be made to summarise key changes in these areas and how and why traditional institutions are failing to adequately adapt and, in a separate section, how new companies and organisations are failing to be widely adopted.

Traditional Systems

The Nature of Modern Employment

Over the last century, the market has slowly shifted from a focus on physical and procedural capability to a demand for employees with strong cognitive, communication, creative and interpersonal skills. This slow shift has become much more rapid in recent years. Generally, it could be concluded that modern employment has changed in three key ways.

Adaptive

In the past, employees were deemed fit for a position based on a set of pre-credentialed abilities. We have now entered a new era, where employees are often expected to be adaptive to changing environments in their area of expertise. This requires a commitment to Continuing Professional Development at a rate that would rarely have been found outside of law or medicine. In order to be an asset to a company, it is now often required that

employees regularly update and expand their knowledge, whatever their role happens to be.

Specialised

Employment has become notably more specialised, adding a layer of complexity to both sides of the hiring process. Most general degrees will not necessarily indicate or require a familiarity with the knowledge required to take on most positions related to the degree; in many fields, there aren't even professional, accredited, and widely adopted certifications which match job requirements. Unfortunately, trying to opt for a more specialised degree can hurt more than it helps, as it limits compatibility with primitive job search algorithms. Finally, to make things more complicated, this specialisation needs to come with a breadth of knowledge that allows the employee to be capable of working with other specialised staff.

Autonomous

The Head of People Analytics at Twitter, Lauren Wegman, while presenting at a talk organised by SIOP (Society for Industrial Organisational Psychology), discussed the findings of her recent study. She found that skilled work was definitively becoming more autonomous and decentralised. This autonomy was an unavoidable consequence of work becoming more specialised and, contrary to her hypothesis, she found that many employees were actually suffering from it. When the report writers had the opportunity to speak with her privately, she declared that in order to counter this suffering and inefficiency, onboarding to this style of labor would have to occur before hiring; education would have to become more autonomous and decentralised in order to prepare students for the workforce.

Modern employees need to (1) be ready to learn on their own, (2) have access to learning resources and tools, (3) be able to learn efficiently and quickly in short periods of time, (4) be able to discover knowledge gaps before tackling new subject matter, and (5) be capable of self-management.

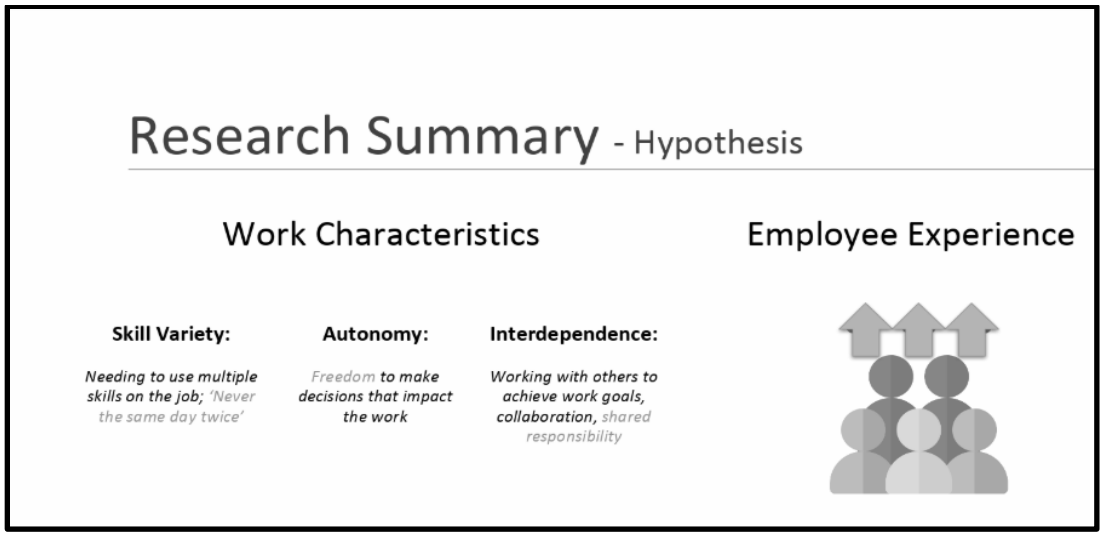


Image 1 - Lauren Wegman at SIOP, Hypothesis

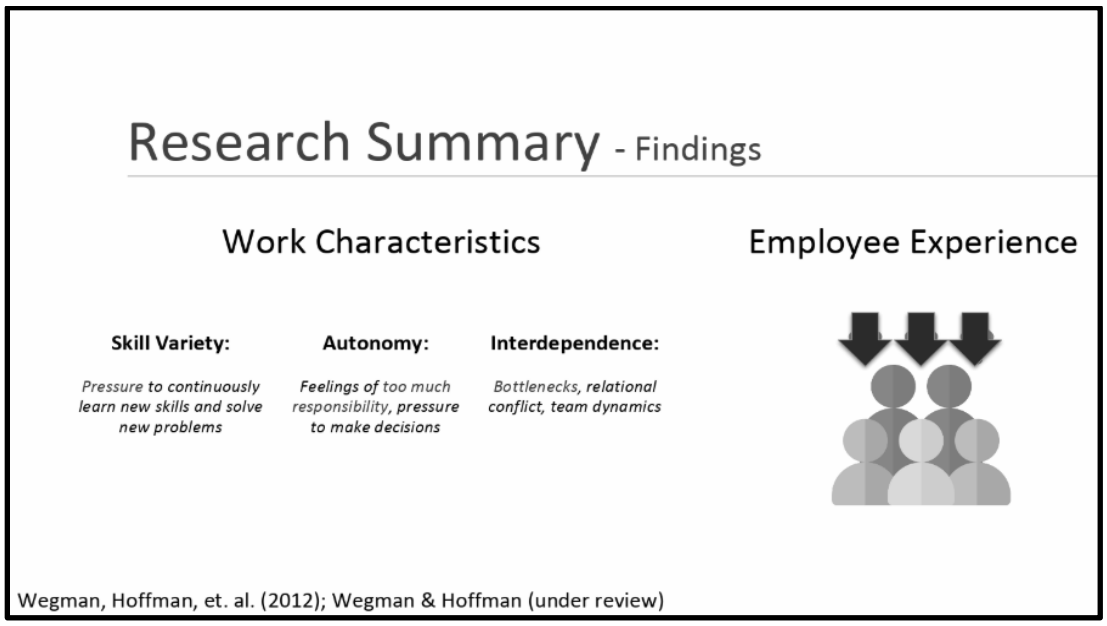


Image 2 - Lauren Wegman at SIOP, Findings

The Nature of Modern Education

Education over the last century has changed little, and the changes that have occurred have not necessarily been for the better. Given the rapid change in the nature of employment, this has represented a concern.

Deteriorating Quality

Coursework has been adjusted, slowly and over the course of years, to accommodate less prepared students. This applies to both compulsory education and higher education. A few notable statistics (from the NAEP, CFR, Dept. of Education and other agencies) show the level of this deterioration at all levels of the education lifecycle in the United States:

- Less than half of 8th grade students can place fractions in ascending order, even with a calculator—yet, well under 10% are held back

- Less than 36% of 8th grade students are considered proficient in math

- 1 in 3 high school seniors score proficient in math

- 65% of college students who take remedial math drop out

- 60% of college students must take at least one remedial course before enrolling

- As many as 60% of college students who intend to study a STEM subject transfer out and the **rates get worse as the college becomes more selective**

- Less than 25% of students score proficient in civics

- Despite years of mandatory, multi-year exposure to language learning classes in compulsory K-12 Education, less than 1 in 5 Americans can speak more than one language, and most of that 1 in 5 learned their language in their childhood home

- Only 22% of high school students met “college ready” standards in core subjects

- Less than 30% of Americans in a recent survey could name all three branches of government
    - 33% could not name a single branch
    - 27% knew only one branch

- 45% of undergraduate students show little advancement in their ability to think critically, reason, or write well after the first two years of college

- Less than 50% of college students in a recent survey stated that they don't enjoy reading books or articles and only do it when they're instructed to

- 60% of K-12 American Sign Language interpreters do not have the necessary skills to do their job, according to Educational Interpreters Performances Assessment data

- Nationwide, less than 34% of students graduate with a degree from a two- or four-year college after enrollment

- Despite these preceding statistics, according to surveys done by CBS news, **71% of college students rated themselves as being in the top 10% of academically capable students**

- In 46 of 50 states, graduating from high school will not qualify a student to attend their state colleges

- J.P. Morgan Chase has formed their own, internal college-level program catalogue in order to ensure that the graduates know what is necessary to be hired

There are a variety of reasons for this deteriorating quality, some of which will be addressed in later sections, as will how college degrees have been affected by it. It should be noted that education reformers within the government are currently arguing that education quality is increasing, they are generally basing

fitness metrics on high school graduation rates, standardised test scores and college attendance.

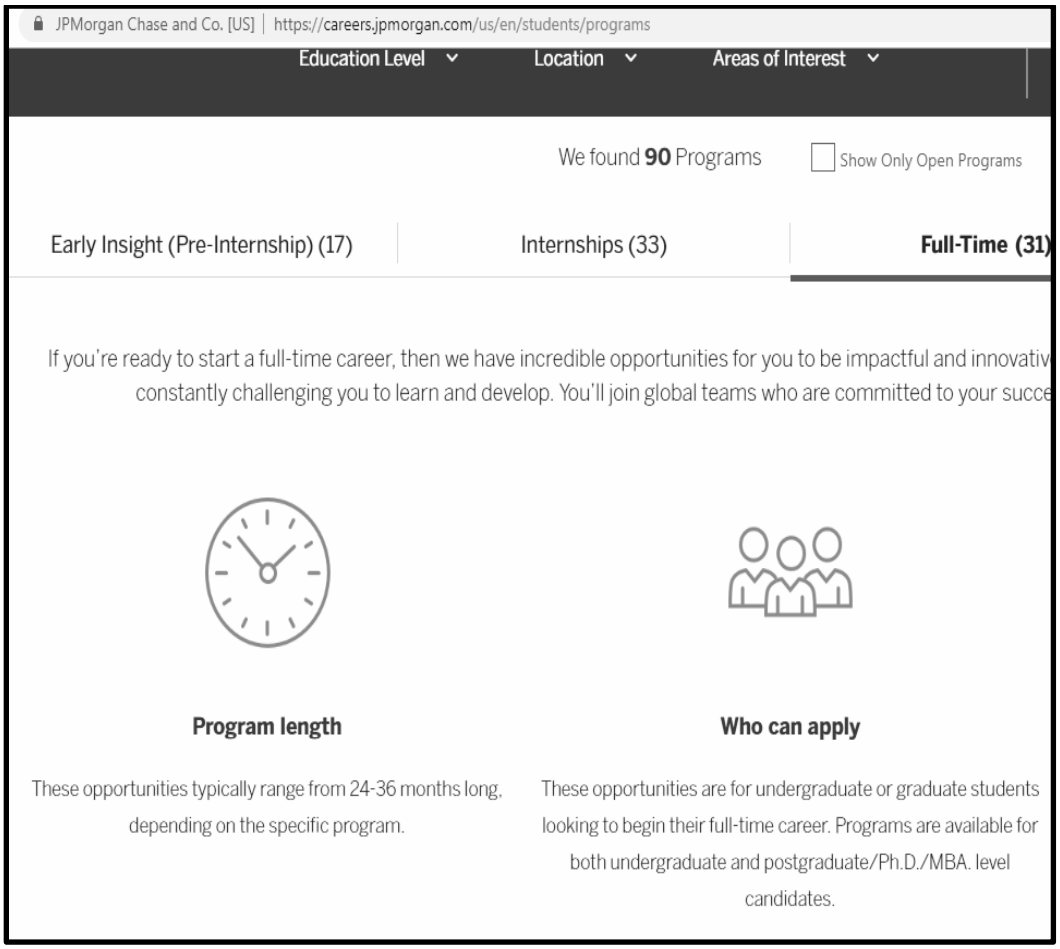


Image 3 - 24-36 month long, full-time JPM programs for students looking to begin full-time careers

Sterile

In an attempt to “pipeline” students to degrees, both higher and compulsory K-12 education alike have become subject to a level of modularisation which prevents the development of narrative, understanding, or expertise. This is in part to accommodate less prepared students, as mentioned above. This modularisation is so pervasive, that new common core English and literature standards often don’t even require reading books. They’ve removed reading books and replaced them with excerpts from

books and even movies about the books. They've removed Orwell's 1984 as a book to read and replaced it with a critical assessment of 2 minutes of the movie based on the book and a single paragraph from the novel.

The standards assume that the teacher cannot even develop the lesson independently, instead opting to give them a script which should be used:

"Today you will read an excerpt from 1984 by George Orwell and watch an excerpt of Michael Anderson's film adaptation of the same title. You will then answer several questions based on the text. I will be happy to answer questions about the directions, but I will not help you with the answers to any questions. You will notice as you answer the questions that some of the questions have two parts. You should answer Part A of the question before you answer Part B, but you may revisit Part A after you answer Part B if you want to. Take as long as you need to read and answer the questions. If you do not finish when class ends, come see me to discuss when you may have additional time. Now read the passage and answer the questions. I encourage you to write notes in the margin as you read the passage."

This is the ***script*** given by common core mini-assessment on Orwell, it is advised that teachers follow it exactly so that students don't get "*confused*".

This is, for lack of a better term, dystopian. It is also a reflection of the worst-case scenario that K-12 and undergraduate education is sliding into. As a consequence of this hyper-modularisation of information and analysis, students are ill-prepared to read complex material and lack the attention span to develop narrative of their own. Worse yet, it often leads to an inability to link knowledge to application, novel or otherwise, or to more complex subject matter. With this style of modularisation, questions are often asked and answered, never giving students time to consider their own intuitions or engage in real problem solving. In interviews with students from all over the world, the report writers found widespread occurrences of:

- Students who were given failing marks for getting the “wrong interpretations” of books and plays
- Undergraduate classes in literature that didn’t require reading a book
- Mathematics courses that only required memorisation of formulae
- Students preparing for the GMAT who had strong misunderstandings about mathematics operations as simple as division
- Students well past Calculus 2 materials who did not understand the value of its application in their field of study
- Only one of twelve students in math related majors could explain how negative exponents worked

As Camille Paglia, an academic and professor at the University of the Arts in Philadelphia, states in multiple interviews, higher education needs to consist of narrative and perspective in order to scaffold new knowledge on top of old knowledge, else attempts to develop robust understanding of necessarily complex subject matter will be largely ineffectual and the knowledge gained (for the little time it will remain) will likely be sterile, inflexible, and fragile.

Inflexible

Because of attempts to standardise from the top down, standards are implemented before they can be tested for efficacy across broad populations. They carry the bias of small groups of professionals often detached from the actual use of the standards outside of controlled environments. Due to department, school, state and federal mandates, teachers are sometimes left little choice in how or what to teach their students. Adding in standardised testing and rating teachers based on student scores exacerbates this. Teachers are heavily incentivised to participate in a process affectionately named “drill and kill”, wherein they simply drill the sterile facts needed to pass standardised exams and pass the children down the pipeline.

The more inflexible the system, the less it can respond to error and change. Though it should be noted that the intent of standardisation is good as it's meant to build credentials for continuing education as well as offboarding into employment. However, this standardisation seems to be producing credentials that have a somewhat illusory value, as students carefully avoid challenges due to the inflexibility of the system in handling errors. Tests, in learning theory, are meant to help with knowledge gap discovery, whereas in the current academic system, tests are meant to establish semi-permanent credentials. The report writers had the opportunity to speak with NASA's Chief Engineer of Organisational Capability on the subject of hiring practise. It was found that many of their highest credentialed individuals were actively avoiding challenges. The system is training students, even at the highest levels of achievement, to actively avoid tackling challenging tasks. The danger of this is incalculable.

Expensive

Education is inflexible not just because of its standardisation but because of the nature of its scheduling and cost. It's exorbitantly expensive to take single classes or return for courses on demand. Due to the cost, it's also prohibitively expensive to fall off schedule as a single semester could, at many schools, be roughly equal to a down-payment on a car or house. At the moment, according to research from Goldman Sachs, the house would likely provide higher ROI over a 10-year period. The Total Student Debt held in the United States is well over $1,000,000,000,000, dwarfing even total credit card debt. The cost of college has sky rocketed hundreds of percent since the 1980s likely due to the introduction of consistent government funding (which is highly correlated with tuition growth) and the demand created by extreme cultural pressure to attend.

The Nature of Modern Credentials

The market is desperate for new forms of machine-readable, meaningful, and flexible credentials. Generally speaking, traditional credentials seem to be antiquated and illusory in what they indicate.

Illusory

What will be noted first is the nature of the credentials that allow individuals to continue their education, rather than offboard from education to employment. The primary credentials used are standardised test scores. However, these scores have long been revealed to be illusory in nature as to what they indicate. To address this in detail would require an additional report but given the nature of the test-prep industry that has been built around these standardised tests, it may be reasonable to assume that the market has optimised *test taking,* not skill in the subjects they are said to test for. Every SAT prep-book of importance has at least a chapter dedicated to eliminating answers, and GMAT prep-books will often spend time teaching probability or statistics *tricks* that have literally nothing to do with understanding probability or statistics. That being said, it is unsurprising that SAT scores correlate more with student-family income than anything else. Families being able to afford more test-specific preparation and more tries at fairly expensive tests will obviously see a reflection in the scores.

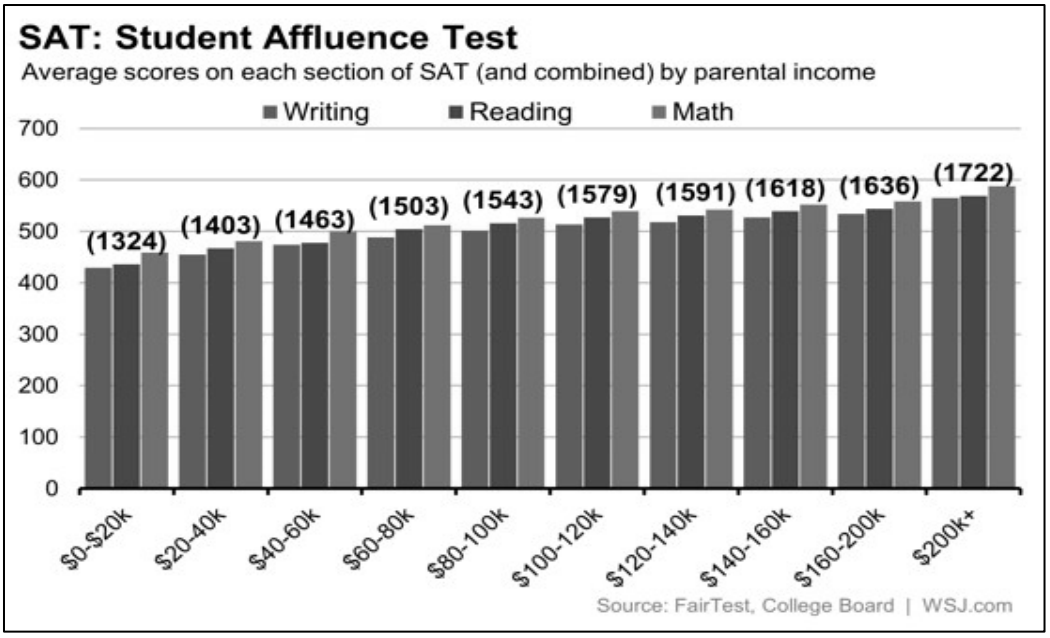


Figure 2 - SAT Student Affluence/Scores

According to research by MIT Writing Director Les Perelman, the tests, beyond providing illusory metrics, may even be damaging standards. Perelman was able to accurately predict SAT essay scores by their length and vocabulary, despite lack of contextual structure and factual errors within the essay. The National Council of Teachers of English along with Perelman have concluded that teachers may be literally training students to be bad writers in order for them to achieve high scores on standardised tests due to the extreme pressure for high scores in order to meet standards for college admissions and the nature of the metrics (length and vocabulary) with which scores are calculated.

Interest in secondary education has been subjected to extreme cultural pressure to the point that many see it as a mandatory endeavor similar to that of compulsory public education. **The degree no longer necessarily indicates developed expertise, engagement with, or even interest in the field of study.** 70% of graduates do not work in a job related to their field of study in college. Cultural pressure to attend college means that

accredited degrees no longer definitively indicate that an individual is ready, capable, or interested in continuing their education or that they're ready to take on challenges.

In addition, although larger private schools are less susceptible, the nature of government funding to education has facilitated the creation of degree mills and incentivised departments to simply push students through a pipeline as quickly as possible, whether they understand the subject matter or not.

The end result of these, and many other factors, is that even the "greatest" companies and organisations hiring from the "greatest" universities and colleges are finding many students thoroughly unprepared for the work they've been considered for. So much so, that the hiring protocols have become byzantine checks over multiple stages to ascertain whether or not they know enough to start learning what they need to know; a degree doesn't get them a job it gets them in the door. This may be for the better at the moment, given the antiquated nature of credentials themselves.

Antiquated

It might be helpful to first ask the following questions: (1) what data streams were HR departments using before and (2) why aren't they working anymore?

The primary data that HR departments have been using for the last 60 years are (1) Accredited Degrees, (2) Professional Certifications and (3) Work History. The report writers have not found any organisation or industry expert arguing in earnest that the data described are still sufficient for most fields, but why they are no longer sufficient is still considered an area of contention.

To start, Antiquated Professional Certifications, and the systems in which they are made and offered, cannot keep up with the rate at which Technology and Techniques change and emerge. The prospects for the future development and use of such certifications is waning. As noted earlier, employment has

become more specialised and more adaptive to new technology and techniques. Static credentials are no longer sufficient.

The next primary data stream is Work History, which presents a notorious catch-22, "you need work-experience to get hired, but you need to get hired to develop work-experience." As the degrees and professional certifications decline in perceived value, work experience becomes more and more important, leaving recent graduates heavily disadvantaged despite being described as the "most educated" generation in human history.

The last data stream of note is accredited degrees. While these have been covered in previous sections, there is a specific aspect to these degrees that is now missing as well. Though it is deeply related to the second axiom of trust within networks detailed in the next section, in the interest of organisation it will be discussed here. Colleges provide evidence of what is referred to as *culture fit*. After the report writers had the opportunity to speak with HR professionals, it seemed very apparent that companies, in general, consider culture fit a top priority. Amazon will apparently even pay severance to employees who don't fit the culture to leave, in lieu of firing them. Companies don't necessarily hire from familiar universities due to elitism so much as they hire from familiar universities because they come to trust the standards, educational and cultural, that were required in order for them to exit. It is apparent that the standards are deteriorating at even the most prestigious universities, such as Yale, London School of Economics, and Harvard, more so from certain programs than others.

New Systems

There are few widely accepted data streams outside of Accredited Degrees, Professional Certifications, and Work History. Most current attempts at providing alternative data streams outside of these three items are primitive or demonstrably ignorant of the science behind credentials or, just

as traditional systems do, offer credentials which are illusory in value.

Trust

Credentials seem simple, but upon trying to get a market to adopt one, it would seem far more complicated than an at-a-glance look would indicate.

There are a few axioms which can be used to analyse trust between complex agents within networks and serious games. There are a few which are material to this section:

(1) We are strongly inclined to consider only 1 to 3 credential artifacts seriously and systems (in which credentials are important) will use this range as what may be commonly referred to as an attractor. This means that (a) industries generally develop between 1 and 5 meaningful certifications or certification hierarchies, (b) we usually look to 1-3 jobs of importance on a CV, and (c) we want to see 1-3 education credentials.

(2) We want to see that the participant in question has "graduated" through complex, nested layers of heuristic trust governed by systems and individuals which have also graduated through complex, nested layers of heuristic trust. That is to say that if someone takes a single class, there is a reasonable probability that they could have had the ability to cheat the individuals and systems which gate-keep the means of graduation from that class, but with each class taken, the compound probability drives the likelihood of consistent success via cheating downward, thus increasing trust in the associated credentials. Ancient Chinese Jinshi bureaucratic testing suggests that this concept is a *universal* and well-rooted in human firmware rather than a result of social construction.

(3) The Acceptance Rate and Perceived Difficulty of the credential is immensely important to determining its value.

MOOC sites and other online alternatives to traditional education, regardless of intent, rarely acknowledge these axioms in their design. At the moment, code bootcamps are the only ones that do, and unsurprisingly they are one of the most widely adopted alternative to college education at the moment.

Numerous articles and studies have come out promoting the use of digital badges, and for good reason. They're a potential solution for set-theoretic granularity in education, or micro-credentialing, something long sought after by the Department of Education, U.S. Government learning initiatives, and colleges alike. However, many of these studies and articles have a great deal of bias. For example, a white paper, called Demographic Shifts in Educational Demand and the Rise of Alternative Credentials, is widely cited, suggesting vast and rapid adoption across private industry and colleges. However, it was co-authored by Peter Janzow, who is a vice president of business development for a Pearson company (offers electronic tests which are slated to offer badges), and the cofounder of Credly, a badge-offering company. Some of the findings of his research clearly contradict that of other similar studies.

The causes of this slow rate of adoption and lack of trust in both badges and MOOC-like certificates are plentiful but well codified.

Organisation and Crowdedness

While some course sites and badge offering platforms have attempted to maintain consistent quality via whitelisting creators and centralising content-making within their respective companies, others have decentralised entirely. This has unfortunately led to some serious problems in terms of acceptance. At a glance, there is no valid means of differentiating between the value of badges or certificates for reading an article named "Accounting General Practise" (these badges are plentiful) and completing a 20-week course on accounting named "Accounting General Practise" without peering into the badge itself. More importantly, there's no way to differentiate between two courses of the same name or to detect fake badges without

doing necessary homework on its value.

Employers and HR professionals do not want to dig through these obscure collections of, often easily attainable, micro-credentials. The widespread abuse of badge and certificate collection has left them even less valuable. In terms of swarm intelligence and algorithmic game theory, there is no current system which utilises crowds wise enough to rate these types of credentials in a way that could meet any standards by HR departments in order to allow them to avoid digging through portfolios or *backpacks*. That being said, companies want micro-credentials so bad they've begun to issue them independently. While this practise is being slowly adopted, it has not been documented to be definitively useful but has been documented to be fairly inefficient and scale poorly.

There have been attempts to organise these systems, but most have used machine learning and failed, as second wave AI does not seem to be capable of forming the heuristically relational schemas necessary to develop context between learning modules.

Lack of Seriousness

Gamification in private industry has been confused for the last decade. At some critical point, there was a misunderstanding that led designers to believe that a system had to *look* like a game in order to be *treated* like a game. This has led to many badge platforms and learning sites to take on an appearance and culture that is hard for industry professionals to take seriously. While adoption has occurred in spite of this, it should be noted that most of the adoption of such systems has been in the tech industry in California and in companies which reflect a more playful culture similar to that of Google, which uses perceived quirkiness as a public relations strategy for recruitment. After speaking to employees of more traditional firms, it was found that credentials which were presented in the form of badge-backpacks would be less likely to be taken seriously.

Hyper-Modularisation

As stated in earlier sections, the hyper-modularisation offered by micro-credentials and a la carte courses leaves it up users learning a new subject to develop narrative on their own. While this may lead to spontaneous expertise in some subjects and individuals, current systems rarely make efforts to connect classes into pathways or degree-equivalencies which might be more useful as single credentials. Where these pathways do exist, the resulting credentials are similar to that of traditional degrees, which do not take advantage of the opportunity to create overlap between credentials, materials, and content of the courses between multiple subject areas.

Optimisation of Development and Indication of Marketable Competence

As per military and private research, it would seem the following is necessary to the rapid development of expertise:

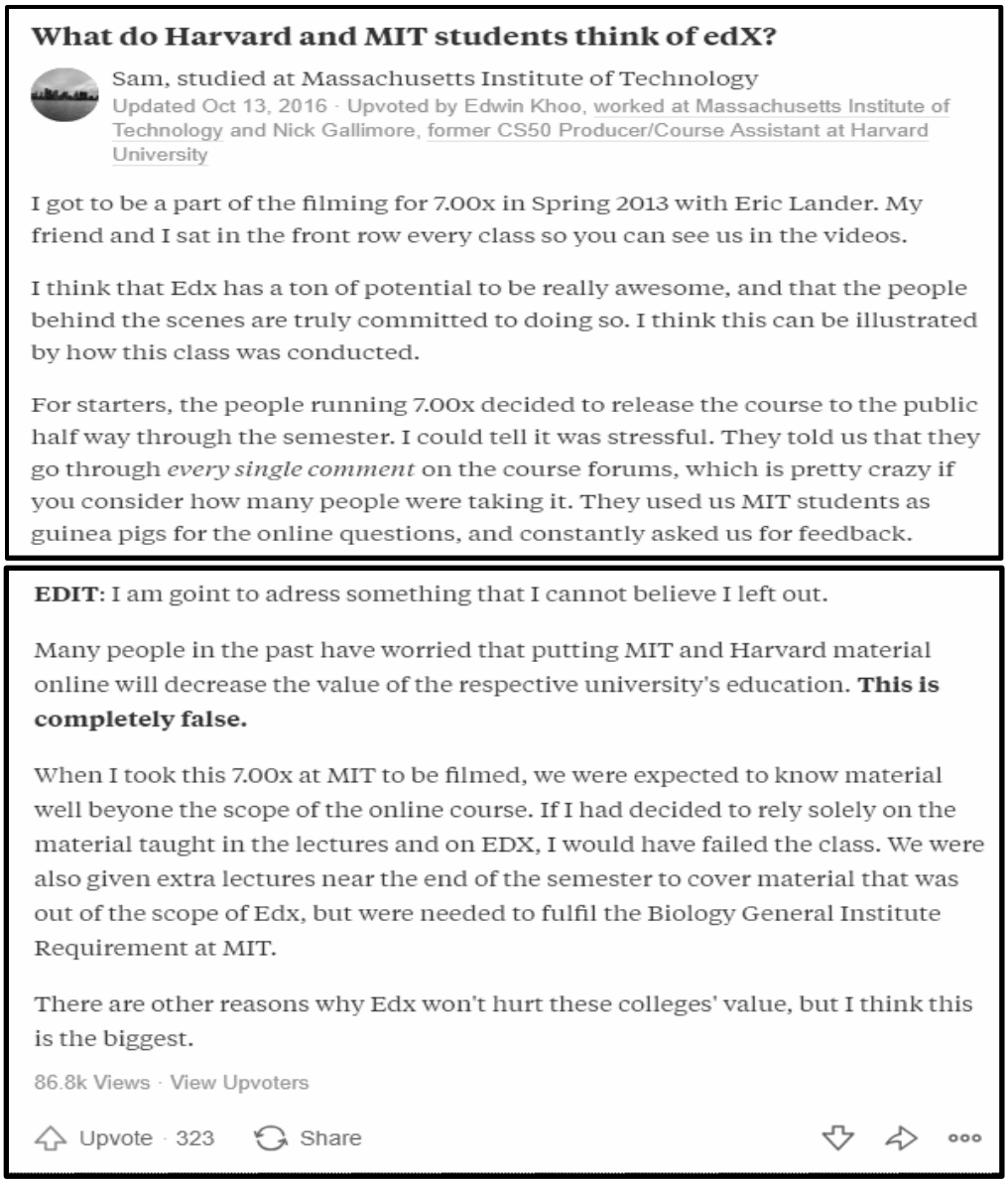
- Handling of learning breakdowns by mentors
- Meaningful and multi-perspective engagement with peers
- Meaningful and multi-perspective engagement with the material
- Knowledge gap discovery prior to engagement with material
- Maintenance of competence, iterative exposure to material

As of right now, these five things are very rarely handled all together or even individually. The course material can be sound, but unless these five things are present, development of expertise will be spontaneous and its attainment unpredictable. This unpredictability of expertise paired with equal resulting credentials is damaging to the market value of all similar courses.

In order to indicate competence, difficult examinations of subject matter must be created, and it must be compared against the status quo. As stated in the previous section on axioms of trust, the value of credentials is based on acceptance rates and perceived difficulty. The lack of difficulty in attaining resulting credentials paired with the lack of indication of cultural fit,

axiomatically prevents a course from having the resulting credential acknowledged in the market. That's not to say the information within isn't valuable, but that the credential itself will mean little in terms of indicating marketable competence except as a supplement to more traditional credentials.

This being said, even completion of MOOCs offered by traditional colleges are not being accepted as a means of credentialing students. Their courses contain valuable information, but it is inarguable that that requirements for completion are not to the standards that are found on campus. Worse yet, they have actively withheld information such that the courses online would produce illusory feeling-of-knowing. Without difficult examinations, mentor assistance, and indication of cultural fit, it is likely that, regardless of the organisation who issues the MOOC, they will never be properly adopted as an equal credential.



What do Harvard and MIT students think of edX?

Sam, studied at Massachusetts Institute of Technology
Updated Oct 13, 2016 · Upvoted by Edwin Khoo, worked at Massachusetts Institute of Technology and Nick Gallimore, former CS50 Producer/Course Assistant at Harvard University

I got to be a part of the filming for 7.00x in Spring 2013 with Eric Lander. My friend and I sat in the front row every class so you can see us in the videos.

I think that Edx has a ton of potential to be really awesome, and that the people behind the scenes are truly committed to doing so. I think this can be illustrated by how this class was conducted.

For starters, the people running 7.00x decided to release the course to the public half way through the semester. I could tell it was stressful. They told us that they go through *every single comment* on the course forums, which is pretty crazy if you consider how many people were taking it. They used us MIT students as guinea pigs for the online questions, and constantly asked us for feedback.

EDIT: I am goint to adress something that I cannot believe I left out.

Many people in the past have worried that putting MIT and Harvard material online will decrease the value of the respective university's education. **This is completely false.**

When I took this 7.00x at MIT to be filmed, we were expected to know material well beyone the scope of the online course. If I had decided to rely solely on the material taught in the lectures and on EDX, I would have failed the class. We were also given extra lectures near the end of the semester to cover material that was out of the scope of Edx, but were needed to fulfil the Biology General Institute Requirement at MIT.

There are other reasons why Edx won't hurt these colleges' value, but I think this is the biggest.

86.8k Views · View Upvoters

Upvote · 323 Share

Image 4 - MIT Student Review of MOOC

Over-Centralisation & Inefficient Compensation/Use of the Community

As mentioned earlier, many companies have decentralised completely, but some have returned to the same style of over-centralisation as traditional institutions. Given the need for rapidly developed degree-equivalency metrics for specific positions based on small modules, said modules will need to be

produced rapidly and accessed at scale. On decentralised platforms there is no shortage of modules, but there is little attempt to find overlap between them. Nor are the modules generally accepted. On centralised platforms, prices are rising, and modules are being introduced slowly, and again, the modules are not generally accepted.

Research in Complex, Self-Organising Systems shows that crowds can effectively be mined to provide solutions to such problems using reward and cultural mechanisms. Wikipedia is one such example. However, it would seem that current platforms have generally failed to do this effectively.

What the Market Wants

Set-Theoretic Granularity in Education Modules

Just like the government, the private market is in desperate need of granularity in education modules. In order to begin developing reliable and trusted metrics for competence and knowledge gap discovery, it seems apparent that granularity in education modules is prerequisite. It solves problems associated with machine-reading resumes, detecting overlap in knowledge, potential goodness of fit with jobs, etc.

Again, this granularity isn't just important to education modules, it's also important to information in general. Granular information may be unioned with other data to prevent overlap, ensure legitimate identification, facilitate knowledge verification, and lead to strong, yet flexible, schemata for the metadata of objects of interest.

Reliable/Trusted Psychometrics for Module/Field Competence

Once some form of granularity has been achieved, reliable metrics for familiarity with those granular modules can be achieved. The harder part is developing metrics for Field or Conceptual Competence. However, there is a science to developing accepted credentials built on well established, historically consistent axioms so long as there is knowledge gap discovery and optimisation in concept learning and explicit memorisation.

These credentials/metrics are required in order to provide the private market with much needed alternatives to current data streams.

Knowledge Gap Discovery

Rapid discovery of knowledge gaps *prior* to engagement with materials is prerequisite to optimisation of concept learning and explicit memorisation, else the student will become frustrated and disengage with the materials. There is content within game theory which explains this well, often noted as *effective elimination* from games. Players need to feel as though winning is possible else they will disengage. All knowledge is built on metaphors which are built on previous knowledge, the proper metaphors must be accessible prior to engagement.

No companies known to the report writers are handling knowledge gap discovery, prior to introduction to material, at scale in any reasonably effective manner as per DoD standards, despite there being a need for it within the private market and government alike. Knewton, a company of interest listed within this document, is the closest to achieving these standards.

Optimisation in Concept Learning and Explicit Memorisation

Research indicates that optimisation in concept learning and explicit memorisation is possible where the following is available.

Machine Assisted Distributed Learning (Iterative Exposure to Material)

A person relying on long term memory to remind them to train long term memory is a paradox. Allowing machines to assist in the scheduling of and choice of content to review solves this paradox. Research on the use of this effectively begins with Polish memory researcher Dr. Piotr Wozniak.

Handling Learning Breakdowns and Expert Support

As described in the government section of the same name, having expert support to help bridge gaps and develop metaphors for learners during “learning breakdowns” is exceptionally important to expediting development of expertise.

Understanding of this begins with Vygotsky's theory on proximal development.

There are very few companies of interest offering expert support alongside learning content as per DoD standards.

Meaningful and Multi-Perspective Engagement with Peers

As described in the government section of the same name:

> *In line with Jean Piaget's cognitive development theory, independent, project-based exploration with peers and peer-tutoring can be a great boon to learning speed. Renowned physicist Richard Feynman is noted for his "Feynman technique" which is to teach a peer (or at his suggestion, a toddler) in order to successfully refine the metaphors used to understand the subject while simultaneously identifying gaps in the technique-user's knowledge. Working with peers helps expose students to multiple perspectives on the subject and if paired with projects, will allow for exploration which enables what is known as depth of processing, a process that is fundamental in the construction of robust and stable memory.*

There are few companies offering learning content or credentials which are attempting to provide meaningful engagement with peers who are studying the same courses as per DoD standards.

Meaningful and Multi-Perspective Engagement with Material

Multi-perspective engagement with the material allows for depth of processing, this is important to building robust, well-anchored memory. This is not being effectively tied to most courses, and if it is, it's often not tested or graded.

Concept Mapping and Gamification

There is no doubt that gamification is wanted by the market, but it has generally failed to follow the **Rosetta Stone Rule**; it shouldn't feel out of place in a kindergarten **or** a CIA desk office. Many companies working heavily with gamification have effectively marked themselves as untouchable by many serious

agencies. Though concept mapping is a term in use, the concept mapping introduced by the Advanced Distributed Learning initiative has not been introduced to the market in any notable manner.

Maintenance of Competence

Once competency has been established, it is essential that it stay maintained. No company found by the report writers is making any attempt to maintain the competency underlying the credentials of learners. Given the information-rich culture, providing this in a non-intrusive way may bring new marketable value to credentials.

Data Cataloging - Heuristically Relational Schemas

Current systems providing search for academic resources fail to make connections between concepts and often use archaic keyword systems. More related to education, being able to find resources which tackle exactly the topics a user needs at the time they need them is essential. After interviewing self-learners, the report writers found that a larger portion of their time is spent searching for quality materials than it is spent actually learning. With granularity in modules and objects comes new opportunities for coreference.

Just like the government, the private market has attempted to solve this problem. Most attempts have been made using machine learning and have not been capable of making these connections with meaningful, auditable context. Unfortunately, endeavors which did not use machine learning, such as Wikipedia, were too heuristic and vulnerable to threat actors. Freebase, the more schematized alternative to Wikipedia, was bought by Google and converted into *knowledge-graph* which was changed to rely on machine learning. While what it does is nothing short of incredible, its ability to pick up on meaningful context is limited and is widely considered dangerously biased.

Detection of False Information and Bias in its Removal

The market has a massive problem with false, low quality, and misleading information. Centralised, second-wave AI is being used to counter it on social media and is failing so badly that the government is strongly considering regulation. Granularity and competence in modules and object coreference may provide a valuable opportunity to detect and allow wise crowds to act as the whole-of-nation defense described by Dr. Rand Waltzman in his testimony to congress on the weaponisation of information as well as to develop a more efficient cultural market in information and educational resources.

Efficient Culture Market and Compensation/Use of the Community

It is inarguable that the community is a resource that has not yet been properly mined for its value outside of what it is willing to pay for education. Content creators are rarely being fairly compensated for their work, and the market of cultural signals on content is highly inefficient on the internet in general. Credentials of field and module competence, just as they provide opportunity to assist in monitoring networks for false information, may also help direct network participants to valuable content. There is a wide variety of methods to make use of these networks in more efficient ways.

Conclusions

As evidenced by the content of this report and the preceding reports: “DARPA Initiatives in Focus” and “Problems Unsolved”, the following list represents an overlapping set of needs that both the U.S. Government and private industry desperately need fulfilled:

1. Set Theoretic Granularity in Education-Modules
2. Reliable Psychometrics for Conceptual/Module Competence
3. Knowledge Gap Discovery
4. Optimisation in Concept Learning and Explicit Memorisation
5. Maintenance of Competence
6. Data Cataloguing and Heuristically Relational Schemas Between Objects
7. Detection of False Information
8. Efficient Cultural Market and Use/Compensation of the Community

Announcing a serious attempt to solve all eight of these problems has the potential to draw funding and attention from a wide variety of agencies and companies. Just small references to solving these problems has drawn attention to the team from employees of varying status from the following organisations:

- The World Bank (Education and Translation)
- NASA
- Twitter
- The Intelligence Community

The report writers have focused for the last three years codifying these problems and looking to find ways to solve them. If there is an interest in integrating the report writers’ solutions, in-

progress, it is exceptionally important to understand this perspective on the market and what solving these problems might mean.

Providing for these eight needs on one platform could lead to (1) a necessary revolution in education that can work with colleges and other content sites, not against them, (2) a whole-of-nation defense against the very real threat of widespread political destabilisation, (3) a repository of human knowledge without dependency on donations, and (4) a civilian Palantir that could revolutionise academic research.