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User Research in Online Education: The Challenges of Accurately Understanding Student Needs in a Global Classroom

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Abstract:

"Edtech" has become a buzzword in the technology industry in the past 10 years as technology companies like Google, Khan Academy and Coursera have promised to "revolutionize" education. One potential barrier preventing these technologies from having a larger impact on education might be the distance and knowledge gaps between the creators of online education and the educators and students. The beliefs and assumptions that employees of online education companies hold about schools, about students and teachers, and about what an ideal education should look like, will impact the types of products they build and the issues in education that they prioritize. What sources of information, research methodologies and company processes shape and inform the beliefs that online education employees and companies hold about education and the needs of users? To what extent do online education companies try to research and understand their users' needs? This project uses three different methodologies to explore these questions: an analysis of best practices in innovation in Silicon Valley, interviews with employees in the online education industry, and an analysis of the websites of several online education companies.

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User Research in Online Education:
The Challenges of Accurately Understanding Student Needs in a Global Classroom

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Introduction

"Edtech" has become a buzzword in the technology industry in the past 10 years as technology companies like Google, Khan Academy and Coursera have promised to "revolutionize" education. This grand claim is largely motivated by the fact that technologies such as the internet, laptops, smartphones, machine learning, robotics, and virtual reality have opened up opportunities to teach differently and to do things in classrooms that were not possible before. For example, robots are enabling disabled and chronically ill children to attend school using a digital surrogate (Klairmont, 2017), Google's cheap virtual reality headsets are allowing students to take virtual field trips to the locations that they learn about in school ("Google Expeditions"), and Massive Open Online Courses (MOOCs) have shown the huge potential for the internet to increase access to high-quality education through free online platforms with full courses of educational material.

While the potential impact of online education is exciting, there is a growing sentiment that online education is not reaching its potential (Harold, 2015; Cuban, 2016a).[1] As with any new industry, it has encountered a variety of challenges. These challenges have occasionally manifested themselves in infamous mistakes such as Apple's partnership with the LA school district in 2013, during which the district spent over 1 billion dollars on iPads and an electronic curriculum from Pearson, only to ask for a refund due to technical issues and the fact that the curriculum was incomplete (Lapowsky, 2015).

The excitement around the potential of online education, coupled with the feeling that current projects are not as effective or impactful as they could be, has inspired numerous research projects that focus on studying the efficacy of online education, and potential barriers to its implementation and success. Interestingly, while this research contains a lot of studies analyzing the ways in which school districts and teachers use the technology and the potential barriers to implementation in classroom environments, few have focused on the creation process of these online education products. Although the reason for this gap in literature is unclear, one potential explanation is the fact that while Education Studies is an academic discipline with scholars who research schools and students, many of the online education products are built by private companies (both for-profit and nonprofit). These private institutions have little incentive to publish any of the analyses they do on their own products and product creation processes, and

[1] What people mean exactly by online education's potential will be discussed in depth in the literature review.

even when they do make results publically available online, they have little reason to spend the time necessary to do research of high enough quality to meet research publication standards. Many companies keep their internal processes private, and only analyze them for the purposes of making internal improvements.

Regardless of the reason for this gap in literature, only researching barriers to online education from the school and teacher perspective completely misses half of the picture. The entire creation process and distribution of these products offers numerous opportunities for errors or misconceptions that might influence the impact and efficacy that these products have. As a software engineering intern at Khan Academy last summer, I had a unique opportunity to observe this creation process and to see the challenges that an online education company such as Khan Academy faces on a day-to-day basis. After a summer of working on the product, there was one fact that I found particularly striking. Every day, my team would make small changes to the user interface and experience of Khan Academy's website, and these changes would affect the education of millions of students around the world. This was an enormous responsibility.

Yet, many of the people I was surrounded by, including the employees responsible for making much larger changes to the product, did not have degrees in education or a significant level of experience working in education. The teachers Khan Academy hired to develop the instructional content generally had years of teaching experience and extremely impressive resumes and backgrounds. But Khan Academy's teachers were not the only ones affecting students' education. Designers and product managers heavily shaped the user experience. High-level decision makers decided what kind of features and curricula to prioritize. Product analysts looked at user data and tried to create metrics to measure learning progress, and then fed those study results back to the design and product management teams. The decisions of people across the entire company impacted the educational experience that Khan Academy delivered. Furthermore, even among those who did have experience in education, almost nobody had experience teaching students from across the globe. Pioneers in online education, such as Khan Academy, are the first to have been able to do such a thing so easily, and so it is no surprise that most people do not have this experience.

This experience highlighted two interesting challenges within online education that are especially relevant to online education companies that develop the instructional content themselves. First, online education has shifted decisions of curriculum and pedagogy from

teachers and schools to private companies that are sometimes run by people with more experience in technology than education. Second, although the global reach of the internet is a strength of online education, the geographically concentrated nature of the technology industry means that a small, relatively homogenous group of people in Silicon Valley are making educational decisions for students all over the world. As a result, one could imagine that the companies building these products might sometimes have trouble understanding and meeting the educational needs of all of their users.

This has led me to hypothesize that one potential barrier preventing these technologies from having a larger impact on education might be the distance and knowledge gaps between the creators of online education and the educators and students. The beliefs and assumptions that employees of online education companies hold about schools, about students and teachers, and about what an ideal education should look like, will impact the types of products they build and the issues in education that they prioritize.

This project seeks to explore my hypothesis by examining the degree to which employees in online education engage with and try to understand the field of education.

The core research questions of this project are:

(1) What sources of information, research methodologies and company processes shape and inform the beliefs that online education employees and companies hold about education and the needs of users (students, teachers, parents, and schools)? How do these sources of information, research methodologies and company processes shape those beliefs?

(2) To what extent do online education companies try to research and understand their users' (students, teachers, parents, and schools) needs and problems in education during the product creation process?
    - What types of user research are typical in the industry?
    - What depth of user research is typical in the industry?
    - To what extent do online education companies engage with and try to stay up to date with related research in the field of education?

(3) How likely are the information sources, methodologies and processes used by online education companies to yield an accurate understanding of the field of education, and the needs of users (students, teachers, parents and schools)? In what ways might these sources of

information mislead or introduce bias? How might this influence the types of online learning products that are built and the ability of these products to help educate students effectively, both at home and when used by teachers in brick-and-mortar schools?

This project uses three different methodologies to explore these questions: an analysis of best practices in innovation in Silicon Valley, interviews with employees in the online education industry, and an analysis of the websites of several online education companies.

Limitations to Scope

The term "Edtech" covers a large product space, encompassing technology in education that helps with all kinds of things, including school administrative functions, classroom management, teacher training, testing, teaching content, and more. This paper focuses on a subspace of Edtech, called online education, which consists of the set of websites capable of teaching educational content on their own. Although precise definitions of online education vary, the term generally encompasses everything from the more recently developed MOOCs that offer material that is directly accessible to students online, to the older and more established state virtual schools such as the Florida Virtual School, which work with states and districts to provide online education options within the public-school system (Gemin & Pape, 2017, p. 10-13).

This paper will limit its analysis to "open" online education websites that are directly accessible to students, and that are developed by companies in Silicon Valley. There are several reasons for this focus in scope. First, the concern about a knowledge gap between the producers of online education products and educators is most relevant with the open online education products developed in Silicon Valley. Because these products are open and available directly to students online, there are less opportunities for the knowledge and feedback of people in education districts to influence the product development process compared to virtual schools, which have close relationships with school districts and in some states have the educational content developed by teachers within the district itself (Gemin & Pape, 2017, p. 12). Silicon Valley is also primarily a technology hub and is therefore driven and run by technologists rather than educators. Studying companies in that region will make it easier to see how the larger culture of innovation in technology, which is most concentrated in Silicon Valley, has affected the online education industry. Lastly, the lack of research on the creation process of online education products that was discussed earlier is most apparent in MOOCs and other open online

education products that are developed by private organizations and that are directly available to students. There is a much larger body of research available on the operations and outcomes of virtual schools, likely because they operate within the public-school system and because many virtual schools are roughly ten years older than MOOCS. Therefore, these state-run virtual schools, as well as online education companies outside of Silicon Valley, are out of the scope of this paper.

Literature Review

Given the widespread belief that online education has not reached its potential, and could be improving education more than it is currently (Harold, 2015; Cuban, 2016a), this project is motivated by the hypothesis that the knowledge gap between the technology and education communities might be one factor preventing online education platforms from being more effective. In the paragraphs below, I first review the literature surrounding the impact and potential that many people believe online education could have. I then discuss the areas of research that focus on factors preventing the full potential of online education from being realized and how this project fits into that research. Lastly, I review the literature on online education usage and regulation to demonstrate the relevance and need for research related to the efficacy of online education.

The Potential of Online Education

When people talk about the "potential" of online education, what are they envisioning? One primary driver of the interest, excitement and concern around online education is the potential size of the impact. The internet enables people to reach large groups of students quickly and affordably. As of 2016, the World Bank estimates that over 45.91% of the world's population has access to the internet (The World Bank, n.d.), and that percentage will likely continue to increase as companies such as Google and Facebook search for scalable and affordable ways to spread internet access around the world ("Project Loon", n.d.; "Our Mission", n.d.). Consequently, online education may one day have the potential to affect almost every student on the globe. Online education platforms today already have students from over 190 countries ("2016 Annual Report", 2017). This means that if someone were to figure out how to teach effectively online or to provide supplemental online resources that generate positive

student outcomes, that educational opportunity could help millions of students. This potential for online education to improve access to a high-quality education is probably the most obvious and agreed-upon benefit of online education. While the internet and search engines have helped to equalize people's access to information, online education websites have dramatically improved equality in people's access to high-quality instructional content across the globe (Vander Ark, 2011, p. 64). In the case of higher education, students do not just have access to better educational content, they have access to class material at some of the highest-ranked universities in the world ("Coursera", n.d.).

While online education has increased access, blended learning models, which combine online education and brick-and-mortar schools, are where many people believe that online education could completely change the traditional classroom model and enable benefits such as personalized and mastery-based learning. While there are numerous blended learning models that make up a spectrum from entirely online to entirely traditional brick-and-mortar education, the flipped classroom model is probably the most famous model and is able to illustrate many of the ways in which people envision online education changing the traditional classroom format.

In a flipped classroom, the lecture material of the course is recorded and uploaded online for students to watch at home after school. This enables teachers to use classroom time for more interactive activities, such as practice problems, discussions, and group activities. Depending on how this model is implemented, it produces a variety of different advantages, but three key benefits are a shift from teacher-centered learning to student-centered learning (Harold, 2015), increased personalization of students' education, and a switch to mastery-based learning (Bergmann & Sams, 2012, p. 6-9). By moving the lectures out of the classroom, learning no longer involves focusing on the teacher for hours at a time as they lecture, and instead is more student driven. If a student does not understand a topic, they can pause, rewind, or rewatch it, and if a topic already makes sense, they can skip ahead. In class, students can work through activities and practice problems, asking classmates or the teacher for help when they need it (Khan, 2012, p. 116-7). The personalization of education also becomes easier, as teachers can use class time to cater to each student's individual needs (Bergmann & Sams, 2012, p. 6-7). Lastly, if the practice material is also online, then students can work through the lectures and practice content on their own or in small groups, and mastery-based learning becomes more feasible (Khan, 2012, p. 42). The entire class no longer needs to move at the same pace, and

therefore students can direct their own learning and move onto the next unit only once they understand the current one (Bergmann & Sams, 2012, p. 9-10).

The example above only begins to scratch the surface of what people hope for in online education, but it provides a sense of the kinds of classroom transformations that people are imagining online education could enable. Models like the flipped classroom are actually some of the tamer, less "revolutionary" models that people have come up with. As Salman Khan puts it, the flipped classroom is "just an optimization within a Prussian assembly-line model of education" (2012, p. 118). Many people in online education have much more ambitious visions for technology's place in the classroom. However, in practice, even models feasible with today's technology, such as the flipped classroom, are not improving education in the way many had hoped (Harold, 2015).

Barriers to Online Education

One of the most common reasons people use to explain why educational technologies have not taken off in schools, and why most teachers are still using technology no more advanced than projectors and Microsoft Office, stems from the perception that schools move slowly. For example, Salman Khan claims that the current classroom model "has not been fundamentally rethought in 120 years" (2012, p. 80). Sebastian Thrun, the founder of Udacity, makes a similar point, stating that "The academic school year is based on agrarian times when during the summer students had to return home to work on their farms" (Chung, 2014). Zach Sims, the CEO of an online education company called Codecademy, wrote a popular article titled "Education Needs to Change as Fast as Technology" (2014). It is not just technologists that have noticed the slow speed of change in schools. Larry Cuban, an emeritus professor of Stanford's Graduate School of Education, also examines this phenomenon in his book *How Teachers Taught: Constancy and Change in American Classrooms 1890-1980*, in which he questions why teaching in the 1990s appeared "almost unchanged" from the 1950s, despite the fact that there have been many "reform efforts to move classroom practices toward instruction that was more student centered" (1984, p. 1-2).

Although many people seem to agree that education is adopting new technology too slowly, it is also worth questioning what the ideal pace is, and whether education needs to move as fast as educational technologies are currently. When you consider some of the other barriers to

implementing online education and blended learning models that have been identified, such as the fact that there is little research on the efficacy of blended learning models in peer-reviewed journals (Vanderkam, 2013, p. 88), one could argue that online education companies might be moving too fast. By analyzing the process of innovation used in Silicon Valley, I hope to get a sense of the speed and degree of user research that is common in the online education industry, and to explore whether this speed makes sense when building educational products.

Inertia in education is not the only barrier people have identified. Numerous flaws have also been identified in the process that school administrators use to choose which technology products to purchase. One study, funded by a non-profit called Digital Promise, and conducted by researchers at Johns Hopkins University, surveyed and interviewed school district leaders and Edtech company officials, and found that although most district officials and superintendents were satisfied with the purchasing process, most Edtech executives were not. The reasons for their dissatisfaction included complaints that schools' purchasing processes were "bureaucratic", slow, unwelcoming to small startups, varied too much between districts, and provided little information and transparency on what districts were looking for (Cavanagh, 2014; "Improving Ed-Tech Purchasing", n.d., p. 23). One takeaway from this was that companies may end up avoiding the K-12 industry, or not selling to school districts if the process is too difficult (Cavanagh, 2014). The key findings and conclusions of the study included the need for schools to be more organized and specific when assessing their needs, companies to have more evidence and studies on product efficacy, schools to include teacher opinions in the purchasing process, schools to use a more equal process that does not hurt small companies, and schools to run more formal pilot programs ("Improving Ed-Tech Purchasing", n.d., p. 22-23). Most of these conclusions focus on ways in which schools could improve their purchasing decision process. It is almost as if the fact mentioned earlier, that companies could just choose not to sell to K-12 schools, means that it is only worth critiquing the processes *schools* use in order to solve the problem, rather than also examining the advertising processes that Edtech companies use during the procurement process. Todd Oppenheimer explores this viewpoint briefly in his book *The Flickering Mind*, claiming that technology entrepreneurs have found ways to "capitalize on educators' innocence" and that "students' academic experiences [are] often precisely the opposite of what technology's promoters… say is occurring" (2003, p. xv-xix). Although his claims are quite strong, they highlight a need to critique the processes and beliefs within online

education companies, rather than only identifying faults within the school environment, which this project hopes to help address.

Lastly, in addition to critiquing the culture and decision-making structure of school districts, a large amount of the research on barriers to implementation of online education and blended learning models has focused on the classroom environment and factors preventing teachers from implementing these models successfully or "correctly". Researchers have noticed that even if school districts get technology into classrooms, in many cases the technology still does not transform the way teachers teach. Instead, Cuban in his book *Inside the Black Box of Classroom Practice: Change Without Reform in American Education* observes that "most teachers have 'domesticated' innovative technologies by incorporating them into their existing repertoire of teacher-directed practices" (as cited in Harold, 2015). Research suggests that this happens for a variety of reasons, including the fact that teachers do not have the time to learn how to completely change their classroom format, do not understand the technology well enough to do so, and do have not access to the training that would help them to do so (Harold, 2015). Even when these problems are not present, Peggy Ertmer has identified teachers' pedagogical beliefs as another key barrier that discourages teachers from implementing technology in their classrooms (Albion & Ertmer, n.d., p. 34; Ertmer, n.d., p. 2).

Again, the analysis of barriers to implementation in all of this literature is focused on the school side of the process. If teachers are not implementing classroom technology correctly, the problem could be caused by two different factors. As much of the research discussed above argues, it could be due teachers' limited knowledge of how to use technology and the lack of training programs available. But it might also be due to limitations in the product and how easy it is to use. Perhaps the problem is that the online education companies do not understand their audience or the difficulties and needs within a classroom environment, and consequently the instructions are not as informative as they should be or the product is not easy enough to use in a classroom environment. Rather than one of these reasons being the sole source of the problem, it likely varies depending on the teacher and the product in question. Just as Ertmer's analysis of teacher beliefs has been helpful in illuminating challenges to implementation, there seems to be a lot of potential in analyzing the beliefs and assumptions of the creators of online education as well and considering the ways in which these beliefs might also be a limiting factor.

To clarify, the problem is not that online education companies have not been critiqued at all. Many opponents of educational technology question whether technology even belongs in a classroom. For example, Oppenheimer discusses how distracting technology is, claiming that it has hurt children's attention spans and resulted in "flickering minds", and also questions the intentions of the "charlatans and unscrupulous profiteers" in Edtech companies (2003, p. xv, xviii, xx). Other opponents worry about things like data privacy and the ways in which online education companies might violate or abuse children's privacy (Singer, 2017). However, most of these critiques stem from doubt and suspicion regarding whether technology should be present in classrooms at all. Few researchers have examined the processes and beliefs in the online education industry and tried to identify the ways in which those beliefs and processes might need to change in order to produce better online education products.

Audrey Watters is one exception to this. In her book, *The Monsters of Education Technology*, the chapter "Against 'Innovation'" begins to analyze the differences between the cultures in the education and technology industries, what "disruptive innovation" means, and what it means to "innovate education" (Watters, 2014, p. 33-41). However, Watters primarily critiques the culture of innovation within Silicon Valley. This paper, on the other hand, examines how the culture of innovation might influence the type of research that online education companies in Silicon Valley pursue. Digital Promise also released a report detailing their recommended best practices in user research in online education ("Using Research in Ed Tech", 2015). However, this project, rather than focusing on best practices, will focus on understanding current practices, and the strengths and weaknesses of those current user research practices.

What if this potential is mistaken?

One might also argue that perhaps the reason online education has not reached the potential expected of it is because the expectations were unreasonable or overly ambitious, and therefore we should not be wasting our time on research that is trying to understand how we can improve the efficacy of online education. Many have pointed out that technology cannot be a "silver bullet" that single handedly transforms education, and that just like older technologies such as the television and radio, it's possible that the internet will not "revolutionize" education. However, even if online education never lives up to that potential, research exploring its efficacy is still important. One cannot deny that online education has offered many students an education

that they otherwise would never have had access to, and for some this opportunity has been life changing ("How the World Learns", n.d.; "2016 Annual Report", 2017; "Success Stories, n.d.). Therefore, exploring its limitations and how effective it can be made is worth the investment. Additionally, the reality is that internet-connected devices are quickly becoming a larger and larger part of our lives. For example, smartphones now allow us to be connected to the internet at all times of the day, rather than only when we have a computer in front of us. As technology and the internet become more central in students' day-to-day lives, they will likely become more central to classrooms as well.

Despite the fact that there is not yet a lot of conclusive research on the efficacy of online education or blended learning models, the speed with which the technology industry has developed and the individual success stories of online education in the media mean that online education is entering students' lives quickly, regardless of whether it is good or bad for education. For example, in 2000 the number of K-12 students who had taken an online course was only 45,000, but by 2009, that number was more than 3 million (Godsey, 2015), or 6 percent of the 50 million children enrolled in K-12 school at the time (National Center for Education Statistics, 2017). A more recent survey of teachers in higher education suggests that roughly 73% of higher education faculty already use a mix of online and face-to-face teaching (Rhea, 2017). Consequently, even people against the use of online education should agree that it is still worth researching in depth, because it is affecting student educational experiences, and therefore we should understand its risks and benefits in order to protect students.

Another reason there is a need for a deeper understanding of the potential risks of online education is the fact that the rapid development of the industry means that current regulation to protect students and guarantee a base level of quality in online courses is somewhat limited. Described as "muddled" by one author, state policy on K-12 online education varies significantly across the country (Tucker, 2010). The regulation in place to monitor the quality of online education also varies depending on the type of online education product in question. Two main distinguishing factors are whether the online education service offers an official degree such as a high school diploma, bachelor's degree or master's degree, and whether the product is at the K-12 level or the higher education level.

In general, the quality of online education services that offer official degrees is slightly more regulated than the services that only offer supplemental educational resources. For

example, K-12 virtual schools operate through state or local school districts, and do not give the high school diploma themselves. Instead, students can only participate in virtual school programs that have been approved by their school district or state, and then the diploma is awarded by the district. Consequently, the courses in these virtual schools end up being regulated by many of the same rules that regulate regular public schooling. For example, the teachers teaching the online courses have teaching certifications in that state, and many of these online virtual schools need to meet the same state and national testing standards as public schools (Borthwick, Hansen & Spinella, 2015). At the higher education level, the accreditation system offers students some information on the quality of education they are getting. Unfortunately, accreditation mills and student confusion around international, national and regional levels of accreditation mean that many students have been misled about the quality of education they were paying for (Haynie, 2013). Therefore, although there is some level of monitoring of the quality of online courses that offer degrees, there appears to still be a need to develop this monitoring further.

However, the regulation governing online education products that do not operate within the public school system or offer official degrees is even more limited. For example MOOCs, most of which do not offer degrees, generally fall into two different buckets, one which is somewhat regulated and one which is not. The quality of MOOCs that use courses developed by higher education institutions is regulated because higher education institutions are required to comply with state and federal education laws. Therefore, even though companies like Coursera are not necessarily regulated, when universities publish MOOCs on Coursera's platform, they are required to make sure their online courses are complaint with state and federal laws (Jaschick, 2016; Thompson, 2017). However, the MOOCs produced by private companies like Udacity and Khan Academy, neither of which offer degrees, are not required to meet any of those state and federal regulations. Teachers for these companies do not necessarily need state teaching certifications, and courses do not have to meet any specific standards or accountability requirements.

Is this lack of regulation on supplemental, open online education resources a problem? The recent crackdown on for-profit higher education institutions that have misled numerous students does highlight a need to protect students from misleading educational products. However, it is worth noting that companies like Udacity and Khan Academy do have factors incentivizing them to create effective online courses even without regulation in place. Firstly,

MOOC websites that charge tuition and are trying to make a profit have an incentive to create a good product because a strong product reputation can help them gain investors, grow their customer base, and increase profits. It has been pointed out by Pauline Abernathy that the recently investigated fraudulent for-profit higher education institutions did not have this kind of pressure because they received so much federal funding (Wong, 2015). Consequently, the manipulation and fraud seen recently in some for-profit higher education institutions might not be a problem with the newer MOOC websites that are being developing in Silicon Valley and that are funded primarily by private investors. It's also possible that companies such as Khan Academy, which are non-profits and do not charge their users for their resources, have even less incentive to mislead students, as they are held accountable by donors who likely aim to maximize educational impact, rather than profit.

All of these open online education products are promising their users an education, and many have developed strong reputations and are seen as legitimate educational resources by students. As a result, it is worth trying to verify that the quality of these resources, which are taken seriously by students, is sufficiently high. Regulation may not be the answer to monitoring the quality of MOOCs and other open online educational resources. In fact, some have pointed out that because online education is used disproportionately for high achieving students and students that need to catch up on credits, regular accountability standards might not make sense, because so many students are starting behind grade level (Watson & Pape, 2015, p. 6). Additionally, the international audience of these products also means that regulation might not address the problem very well, as US regulation would not protect users in other countries.

However, it is still possible to research the quality of these products and to understand the degree to which these online education companies ground their products in research on education and a deep understanding of their students, which is what this project aims to do. By better understanding the information and company research methodologies that shape beliefs about education within online education companies, hopefully this project can start to identify ways in which companies can revise their processes to make more effective products, thereby helping online education reach its potential and better protect students who consume this content already.

Methodology

The goal of this project is to get a sense of the sources of information and research methodologies used by online education companies to understand their users, and the likelihood of these different methodologies to contribute to an accurate understanding of student needs. In order to explore these questions, I used three different methodologies: an analysis of best practices in innovation in Silicon Valley, four interviews with employees at three different online education companies (Khan Academy, Coursera and Udacity), and an analysis of the content in the websites of those three online education companies. The goal of analyzing best practices in innovation in Silicon Valley is to identify possible industry-level trends in user research in online education that are the result of Silicon Valley's philosophy around innovation. The interviews and website analysis of Khan Academy, Coursera and Udacity then aim to supplement this industry-level analysis with an analysis of several concrete examples of real company processes, with the hope that these specific examples can also shed light on how other companies in online education might also approach user research.

Part 1: Analysis of Best Practices for Innovation in Silicon Valley

Given how central problem solving and innovation are to the identity of Silicon Valley (Cuban, 2016b), which is the center of the technology industry, this project starts by analyzing the best practices in innovation within Silicon Valley. Although the actual practices used by individual companies likely vary quite a bit, the goal of this analysis is to get a sense of the general philosophy around innovation in Silicon Valley and to explore how these beliefs about innovation within the technology industry as a whole might influence the degree to which online education companies research and learn about their users, the types of information sources they engage with, and the efficacy of their approaches.

Data Source 1: Literature written by leading experts in innovation

In order to analyze best practices in innovation in Silicon Valley, this project explores two pieces of literature written by three key researchers on innovation: Clayton Christensen and Joseph Bower, who first defined the term "disruptive innovation", and IDEO, a leading design firm in Silicon Valley that is known for their use of "design thinking" and for having a unique product development process that consistently yields innovative solutions (Bower & Christensen,

1995; Kelley, 2001, p. 4). I chose to focus on these two pieces of literature because of the strong reputations of these researchers in the industry, and the fact that many of the ideas and best practices around innovation originated from Christensen, Bower and the founders of IDEO. After summarizing this literature, the project then analyzes the innovation processes described in this literature through the lens of how these processes are likely to help or hinder the development of online education products.

Part 2: Case Studies on Khan Academy, Coursera, and Udacity

After a broad analysis of the industry-level philosophy on innovation, this project then takes a case-study approach to three specific, prominent online education companies, Khan Academy, Coursera and Udacity, in order to examine some examples of more concrete processes that real online education companies use to understand their users. These case studies use two different methodologies to try to understand the sources of information that contribute to online education employees' understanding of students, teachers and schools. The first is data from four interviews with employees at these companies, and the second is a high-level analysis of the themes and education research present on each of these companies' websites.

Data Source 2: Interviews

I conducted and analyzed four phone interviews (see Appendix for interview questions) with employees at three prominent online education companies (Khan Academy, Coursera, and Udacity), ranging in length from thirty minutes to one hour. All four interview participants were either contacts from my time working at Khan Academy, or were identified through snowball sampling, beginning with my contacts at Khan Academy. Out of the four interview participants, two were from Khan Academy, one was from Coursera, and one was from Udacity. The participants from Khan Academy and Coursera were all software engineers, while the participant from Udacity was a product manager. All of the interview participants were female.

While looking for interview candidates, explicit interest in people at Khan Academy, Coursera and Udacity was expressed. These three companies were chosen based on the quantity of users (a higher quantity was preferred), the area of education (K-12, higher education, pre-professional training), and whether or not the website developed its own educational content, which is illustrated in the grid below.

	K-12	Higher Ed	Pre-Professional Training
Internal content	Khan Academy	----	Udacity
External content[2]	----	Coursera	----

Data Source 3: Analysis of Website Content

To supplement the data from the four interviews, I analyzed the language and content of the websites of all three companies, looking to identify educational themes that were heavily emphasized either within the product itself or in their marketing material and official public relations statements. The goal of this analysis was to help identify the degree to which these products are grounded in user research and relevant research in the field of education. I also analyzed the team pages of all three websites in order to get an estimate of the number of employees that had education-related work experience or degrees. The website analysis was done after most of the interviews had been conducted.

Limitations to the Methodology

There are several limitations to this methodology. The first is that while analyzing IDEO's best practices in innovation can offer some insight into the philosophy that online education companies might have towards innovation, there is no way to measure the number of companies that are informed by IDEO's philosophy and the degree to which they ascribe to it. As a result, the generalizability of those findings is quite limited.

Another limitation is that rather than interviewing a large number of employees at a variety of different companies and doing a comprehensive, high-level analysis of all of the companies in the industry as a whole, this project is instead deeply analyzing a small collection of companies. Consequently, the findings from this project may not generalize across the entire industry. Instead, they are best seen as three case studies, whose results might point to possible trends within the industry that should be examined across a wider sample of companies in the future. However, it is worth noting that given the reputation of these three companies as industry leaders, it is likely that they have a disproportionate influence on industry best practices.

[2] Internal content refers to companies that develop their educational content "in house", while external content refers to companies that obtain content from other sources (for example, Coursera partners with universities).

The small sample of interview participants also has the potential to bias the results slightly, as the four people interviewed are not representative of the employees in the industry as a whole. All of the people interviewed are within product development. Nobody in marketing, strategy, content development, or elsewhere in these companies was interviewed. Additionally, all of the participants that I ended up being able to get in touch with were women.

Lastly, it is worth acknowledging that my previous work experience at Khan Academy makes it very difficult to be impartial in my analysis, as I have a much greater level of knowledge about Khan Academy compared to the other two companies being analyzed. However, I chose to keep Khan Academy in the project for two main reasons. The first was that it was the most promising and feasible place to start finding interview contacts. The second was that, because Khan Academy is such a strong leader in the K-12 open online education space, it seemed necessary that it be included. In addition to working for Khan Academy, I have also been a student on all three of these websites and have benefited from their classes. My previous participation in the industry as both a student and a software engineer makes it more likely that I might have a positive bias towards the industry.

Results

This project aimed to understand the various research methods and sources of information within online education companies that inform and shape their beliefs about education and their understanding of users' needs, and to analyze whether or not these sources of information and research processes are likely to yield an accurate understanding of user needs. However, most online education companies in Silicon Valley are private companies, and do not publish much information about their development practices. Additionally, it can be difficult to get in touch with specific people who work at these companies, and non-disclosure agreements and internal public relations rules also sometimes make it more difficult for employees to openly talk about internal processes. In anticipation of the lack of transparent information about the specific operating procedures and methods that these companies use, and the difficulties in tracking down interview candidates, this project does not try to build a comprehensive picture of user research within online education. Rather, this project evaluates the limited information available through a variety of methodologies (discourse analysis on innovation, interviews, and analysis of company websites), with the goals of:

(1) piecing together some understanding of the factors that shape beliefs about education within the online education industry
(2) identifying concrete areas and questions for future research and evaluation, as well as hypotheses regarding the quality and reliability of the various factors shaping beliefs about education and student needs within the online education industry

Part I: Philosophy of Innovation in Silicon Valley

Innovation is central to the identity and success of Silicon Valley (Cuban, 2016b; Martins, Dias & Khanna, 2016). Consequently, Silicon Valley's philosophy of innovation can shed light on how people in Silicon Valley try to problem solve and create products. Therefore, understanding best practices in innovation might help illustrate the degree to which people in online education use user research, as well as the types of user research they employ, to try to understand the needs of students and schools.

While there are many different conceptions of what it means to be innovative, and various philosophies on how innovative products should be developed, one idea that is referred to frequently in the technology industry in Silicon Valley is the idea of "disruptive innovation". Disruptive innovation is a term that was first defined by professors Joseph Bower and Clayton Christensen of Harvard Business School. They used the term to define a phenomenon that they had frequently observed, particularly in the computer industry, in which established technology companies were often overthrown by younger, smaller, new technology companies (Bower & Christensen, 1995, p. 43). In trying to understand why this happened so frequently and consistently, they noticed a pattern. While large, well established technology companies were focusing on the needs of their current and most profitable customers and markets, a new company would come along offering a cheaper and lower-quality alternative. Mainstream customers, being used to a higher quality product, would not be interested in the new technology the small company offered. As a result, the smaller company would focus on less mainstream, emerging markets. However, over time the small company would improve the quality of their technology, slowly moving upmarket until eventually mainstream customers saw the value in the new technology. By this time, the new "disruptive innovation" offered by the small company would have both a high quality and a lower price, enabling the small company to overthrow the large, established technology company (Bower & Christensen, 1995, p. 44-47; Hutt, 2016).

Although this original definition of "disruptive innovation" refers to a very narrow and specific pattern of how the major players in an industry could change, over time it has taken on a much wider meaning in Silicon Valley that refers to all kinds of new innovations (Hutt, 2016), with only pieces of the original idea remaining. For example, in the traditional definition of disruptive innovation, one of the reasons the large established company misses the opportunity to invest in this new, disruptive technology and market, is because they are much more focused on meeting the needs of their current customers (Bower & Christensen, 1995, p. 44). In Silicon Valley, parts of this idea have remained, with some expressing the belief that staying close to customers might prevent companies from identifying truly innovative ideas. Steve Jobs is famous for saying "It's really hard to design products by focus groups. A lot of times, people don't know what they want until you show it to them" (Valentino-DeVries, 2011). While issues around interpreting results from focus groups are likely quite complex, this quotation resulted in articles with headlines such as "Why Steve Jobs Didn't Listen to His Customers" (Ciotti, 2014). In reality, Steve Jobs is reported to have also said, "That doesn't mean we don't listen to customers, but it's hard for them to tell you what they want when they've never seen anything remotely like it." (Valentino-DeVries, 2011). However, this slightly distorted perception of "disruptive innovation"–involving a small outside party willing to build something which is completely different and which customers aren't asking for–seems to have evolved into the perception that customers don't know what's best for them and that companies seeking to be innovative should not listen to them.

While the beliefs of Steve Jobs carry a lot of weight in Silicon Valley, a Palo Alto based design firm called IDEO is considered by many to be the leading expert on innovation (Kelley, 2001, p. 4). IDEO has been the topic of numerous news articles and investigations because of the firm's ability to *consistently* produce impactful and innovative products using their design thinking methodology (Kelley, 2001, p. 4-5). IDEO's history and reputation in Silicon Valley make it a great place to start to try to understand best practices in innovation in Silicon Valley. IDEO's methodology has five core stages:

1. Understand the market, client and problem they are trying to address.
2. Observe carefully real people and environments relevant to the problem.
3. Brainstorm and visualize potential solutions.
4. Rapidly iterate, evaluating and refining prototypes.

5. Implement the solution (Kelly, 2001, p. 6-7).

The first two steps in this methodology are where they focus on really understanding the user problem and the users. Interestingly, just like Steve Jobs, IDEO does not believe that focus groups and user interviews are particularly helpful. For example, Tom Kelley, a partner at IDEO and the brother of its founder, writes that "we believe it's not even enough to *ask* people what they think about a product or idea" (Kelley, 2001, p. 26). However, the firm's conclusion is not to ignore the customer. Instead, it heavily advocates close observation, arguing that "seeing and hearing things with your own eyes and ears is a critical first step in improving or creating a breakthrough product" (Kelley, 2001, p. 28). IDEO also emphasizes the need to do this for a variety of different types of people (Kelley, 2001, p. 33). Only once the designers at IDEO have developed a deep understanding of the user and the problem do they then go to the next step and start brainstorming and visualizing potential solutions.

Steps three and four are focused primarily on the use of prototyping to explore numerous ideas, iteratively refining them until an effective solution is reached. IDEO's philosophy in this stage is to move fast, and to try and test and rule out as many things as possible. During the brainstorming phase, IDEO recommends moving as fast as 100 ideas per hour (Kelley, 2001, 58). After brainstorming, the prototyping phase is also all about speed. In the prototyping phase, the team quickly makes a version of the product they're imagining out of cheap and easily accessible materials. They then quickly test it, either on themselves or people nearby, and iterate, revising and changing their creation based on the problems they see (Kelley, 2001, p. 105-113). Kelley writes that "Quick prototyping is all about acting before you've got the answers, about taking chances, stumbling a little, but then making it right" (Kelley, 2001, p. 107). At the end of this process, ideally the team has been able to quickly rule out all of the weaker ideas and has iteratively refined the strongest idea to the point where it is ready to be implemented.

What implications does this philosophy of innovation have for online education?

Assuming that at least some online education companies are influenced by attitudes around innovation in Silicon Valley, the question then is, what might be some of the implications of this process on the efficacy of online education products? Based on the misunderstandings around "disruptive innovation" and Steve Jobs' quote, it's possible that some people believe that customers should not be listened to at all, or that they should place very little weight on any feedback and opinions from customers. In online education, this could result in some companies

completely missing what students or schools actually need. However, it is difficult to measure how many companies actually buy into the belief that to innovate one must ignore what people say they want, and it is unlikely to be a large portion of companies.

The philosophy that is more likely to have an influence on online education companies is IDEO's design thinking philosophy. While it is unclear as to how many online education companies use ideas from IDEOs methodology, and the degree of influence likely varies from company to company, there are several reasons to believe that IDEOs methodology is likely to have at least some level of influence on online education. First, pieces of IDEOs philosophy and methodology appear to have influenced many technology companies in Silicon Valley. For example, their philosophy of quickly and iteratively testing things, and constantly trying to move forward with each of these iterations, is seen in startups, and even in larger companies such as Facebook, whose original motto was "move fast and break things" (Kushner, 2011). Second, as IDEO provides consulting services, many companies in Silicon Valley have worked directly with them to improve their own product design processes (Kelly, 2001, p. 5).

While there's no question that IDEOs methodology has been widely successful, not all industries are identical, and not every aspect of this methodology necessarily lends itself to building successful education products. For example, while observation can be useful, it also has the potential to introduce bias when working on online education products with a global user base. Overall, the emphasis that design thinking places on deeply understanding users through observation seems valuable to the creation process of online education products. Encouraging people to observe students and schools, and to go straight to the source for information rather than basing product ideas on internally held assumptions about education, is likely a good thing, as often people's assumptions can be wrong, and people's personal educational experiences can vary significantly. However, this emphasis on real-life observation is not always practical or feasible, depending on the problem. Tom Kelley's book *The Art of Innovation* opens with an example of a time IDEO tried to redesign the grocery store shopping cart. One of the first things they did was go to a grocery store to use shopping carts themselves and to observe other people using them (Kelley, 2001, p. 9). This works quite well in the case of a shopping cart, as most people use shopping carts in a similar manner, and therefore their observations were unlikely to vary significantly depending on the type of grocery store they went to, or where in the world they went. Education on the other hand, varies significantly from school to school. Observing a

middle school math classroom would yield very different observations depending on what part of the world the classroom was in, whether it was a private school, public school or charter school, and many other factors. Therefore, while observing classrooms is likely able to offer valuable information during the product development process at online education companies, it is also important that the people observing those classrooms are aware of how the specific classroom they observe might bias their results. While companies may be able to have some of their employees travel to different regions and observe a variety of classrooms, it is likely that the most frequent observation trips will be to schools nearby, in Silicon Valley.

Similarly, although rapid prototyping has proven valuable in a variety of engineering contexts, the education industry is not quite analogous to many of the examples that Tom Kelley discusses in his book about IDEO's methodology, because of differences in how project success is defined and measured. For example, in his shopping cart example, evaluating whether a prototype is accomplishing its job just involves testing whether or not a customer can easily and efficiently wheel through a grocery store, store the items they want to buy in the cart, check out at the cash register, and then transport the items to their car or into bags to take home. The definition of success when it comes to education, and how to measure it, is much more complex. The process of learning and understanding a concept takes time. Even in well managed classrooms with experienced teachers, a child might not understand something after the first lesson, through no fault of the lesson. Asking a student whether they felt they understood the material offers some information, however it does not guarantee that the student actually understood the lesson deeply and is able to now use that information. Additionally, while tests offer a quick way to test understanding, they only test particular types of understanding and information processing. Consequently, there is no obvious way to rapidly test a prototype of an online education product and quickly determine whether a particular iteration of the product was able to teach students effectively. In industries such as education, where product success or failure cannot be quickly determined, it is worth questioning whether it makes sense to rely on this rapid prototyping process.

The analysis above primarily serves to point out ways in which some of the assumptions and processes in the standard innovation methodology might break down when applied to online education. However, each online education company likely has a slightly different product development process, and many of them probably do not follow IDEO's specific process

identically. As a result, the next section serves to understand and analyze the specific processes that three prominent online education companies use to try to understand their users and inform their product development.

Part II: Case Studies - Examining the methods that Coursera, Khan Academy and Udacity use to understand the needs of students, teachers, parents and schools

While best practices in innovation can suggest big-picture trends that might be common in the online education industry, these three case studies offer concrete examples of what three industry leaders do in practice. Before analyzing the results of the interviews and website analyses, and what those results tell us about how Khan Academy, Coursera and Udacity try to understand their users, below is a brief summary of all three of the companies and their products.

Khan Academy

Khan Academy is a K-12 online education website that offers free instructional content and practice questions in a wide variety of subjects, including math, science, humanities, grammar, history, economics, test prep, career guidance, and more. Khan Academy was founded as a 501(c)(3) nonprofit with the mission "to provide a free, world-class education to anyone, anywhere" ("Khan Academy", n.d.). They have over 50 million users in more than 190 countries, and their resources have been translated into over 36 languages ("2016 Annual Report", 2017; "Our mission", n.d.). All of their content is developed internally, by Khan Academy employees ("Meet the Team", n.d.). Although their material is at the K-12 level, their users vary significantly in age ("Stories", n.d.). Their users are also a mix of students learning independently on their own, and teachers implementing Khan Academy in their classrooms ("Our mission", n.d.).

Coursera

Coursera was founded in 2012 and offers a variety of MOOCs through partnerships with higher education institutions ("About", n.d.; "Coursera", n.d.). The courses they offer are developed by their partner institutions and are primarily at the undergraduate and graduate degree levels, in a variety subjects including computer science, data science, business, arts and humanities, language, math, health, and more ("Coursera", n.d.). While much of their course

content is available for free, students are required to pay for the full course experience and certificate, as well as their other products. In addition to standalone courses, Coursera offers "specializations", which are a collection of courses in a particular subject area, and online master's degrees ("About", n.d.). With roughly 25 million users, over 2000 courses, and 149 university partners, Coursera is the largest MOOC provider ("About", n.d.; Shah, 2016).

Udacity

Udacity was founded in 2011, and offers online courses in computer science, data science, business and entrepreneurship, and science ("Courses and Nanodegree Programs", n.d.). Rather than align their courses with high school or university curricula, their courses are focused on teaching students the skills they need to make a career shift or to get a new job ("About Us", n.d.; "Udacity", n.d.). Their courses are developed by Udacity employees, with the help of partners such as Georgia Tech, Google and AT&T ("Udacity", n.d.). Their course content is available for free, however for the full course experience, which includes support such as mentoring and feedback on course assignments, students are required to pay. Students can also pay for a "nanodegree", which is a collection of courses in a specific content area and also offers additional content, support and connections with hiring partners ("Get Job Ready", n.d.). As of 2016, Udacity had 4 million users, making it the 5th largest MOOC provider (Shah, 2016), and was also one of the MOOC providers that helped MOOCs first gain widespread recognition in 2012 (Thrun, 2016).

Case Study Results

An analysis of four interviews with employees who worked at either Coursera, Khan Academy or Udacity, as well as an analysis of the websites of these companies, revealed seven common sources of information and processes typically used for user research and developing an understanding of student, teacher and school needs:

(1) user interviews
(2) student and school observations
(3) quantitative studies of user behavior
(4) bug reports and tickets from customer support
(5) employees' personal education experiences

(6) employees' previous work experience in education

(7) reading research on education

The sections below will describe how these various user research methods work and how these different sources of information are used, as well as analyze the reliability and potential sources of bias of each of these methods. In all of the discussions below, the term "user" encompasses several relevant parties, including students, teachers, parents and school administrators, depending on the company in question.

As mentioned previously, of the four people interviewed, two were from Khan Academy, one was from Coursera and one was from Udacity. All of the participants from Khan Academy and Coursera were software engineers, while the participant from Udacity was a product manager. As a result, all of the people interviewed at Coursera and Khan Academy were not directly responsible for conducting user research, and at times were not fully aware of the processes their companies used. However they were able to offer some information on how user research worked within their companies. The participant from Udacity was a product manager that was responsible for conducting user research, and therefore was able to offer detailed information on how user research worked on her team.

1. User Interviews

People involved with the user interview process:

One of the most commonly discussed types of user research in the four interviews was user interviews. Depending on the company and the specific need, user research efforts are run by people in product management, design, marketing, business development, content management, community management, user research, or a mix of these teams. Coursera, Khan Academy and Udacity also all had teams with a title similar to "teaching and learning team" that were responsible for engaging with and interviewing students and teachers.

Although other employees in these companies do not play a role in organizing and conducting the interviews, Khan Academy, Coursera and Udacity all offer opportunities for engineers and other team members to participate in user interviews. In fact, all three of the engineering employees interviewed had been given at least one opportunity to hear user feedback in person, although the amount of exposure did vary significantly.

Accessibility of user interview information within the company:

In addition to allowing other employees to watch these interviews live, both Coursera and Khan Academy record their user interviews and make them digitally accessible to the entire company when the interviewee gives consent. At Khan Academy and Coursera employees also periodically share recordings or the results of user interviews with the company as a whole through company-wide meetings or email announcements. This practice of widely disseminating user interview data seems less prevalent at Udacity. The product manager at Udacity did not mention any central place where the entire company, or large portions of the company, can access reports or recordings of user interviews. Instead, she reported that she generally writes up the results of the interviews, discussing key findings and takeaways, and then shares the write-up with the people working on that product or feature, and sometimes with other product managers.

User interview frequency:

The frequency with which these user interviews occur varies significantly depending on the company, the specific team within the company, and the stage of product development or feature development they are at. Interview participants at both Khan Academy and Udacity reported interviewing at least one person per week, while the Coursera employee interviewed said that the product manager on her team likely interacted with users in some manner at least once a day. These interviews are conducted through a variety of different mediums. One of the Khan Academy employees interviewed mentioned that some interviews are remote (over the phone or video chat), while others are in-person. The participant from Udacity said that most of her interactions with users were remote. The interview participant from Coursera did not specify which mediums were used for Coursera's user interviews.

User interview participant selection:

As all of the people from Khan Academy and Coursera that were interviewed were engineers, they were not familiar with the full process their companies use to find and choose interview subjects. However, they were able to discuss some of the specific channels and types of people that get interviewed. Both companies supplement their regular interview outreach process with a fixed cohort of teachers that they recruit to offer more rapid teacher feedback when necessary. Khan Academy does this through the Khan Academy Ambassadors Program,

which recruits teachers interested in learning more about Khan Academy. These teachers are supposed to be active and experienced Khan Academy users with at least 10 students that average a certain amount of Khan Academy usage per month. However, the usage requirement is flexible if there are other teachers interested in participating. The program lasts one year, and offers opportunities for Ambassadors to interact with each other, as well as with Khan Academy when needed. According to one of the employees interviewed, the program is one way that the people who organize user research identify people to interview, as it offers a more readily accessible set of potential interviewees. Coursera uses a similar idea with their Advisory Council, which contains around 10 instructors or university administrators at their partner institutions, that they are able to easily talk to and ask for advice as needed.

The participant from Udacity was able to discuss in much more detail how interview subjects were selected for user research, as she was responsible for doing it. When asked how she picked people to interview, she said:

> *It usually depends on what the problem is that we're trying to address at any given moment. So if I'm going to be building a new feature, I want to figure out who is the intended audience for it. And it might not be all of our students, it might be only students who are looking for jobs right now. And so [that] might be something we want to filter down for. We're a global company, so we offer curricula in a lot of different languages and countries, so we'll want to think about: is this feature intended primarily for the US market? Is it intended for a different geographic market? Are there certain age brackets that we might be interested in? Men vs. women? Do we care which nanodegree they're in? Do we think this is going to be more interesting to people in machine learning or digital marketing? So a lot of it is about, who do you think the audience is for this feature. [That] is how we will design who it is we're reaching out to.*

Similar to Khan Academy's Ambassador Program and Coursera's Advisory Council, Udacity also uses its alumni community as a pool of users that employees can more easily and frequently reach out to for user interviews. Many of Udacity's alumni are also beta testers, who are able to see new features early and then give feedback on those new features.

User interview participant diversity:

When asked about the diversity of people that are interviewed, there were mixed results. At Khan Academy, one of the interviewees reported that based on her own experience attending and watching interviews, as well as the interview schedule of their team, Khan Academy seems to interview people that vary in level of experience using the product (anywhere from no experience using Khan Academy to highly active users), subject (math, history, science etc.), level of instruction (elementary school, middle school or high school), type of schools (e.g. public schools, private schools, charter schools and magnet schools), and location in the United States. When asked about the degree to which international users get interviewed, the interviewee was unsure, as her team's product focused on U.S. users, but mentioned that Khan Academy had sent employees on trips to Brazil and India.

The employee at Coursera was not sure how diverse the interview subjects were but noted that a user panel held on Coursera's campus confirmed for her how "homogenous the population of the Bay Area is". Three or four of the people in the panel had Bachelor's and Master's degrees, one had multiple Master's degrees, and they were all "people who have already figured out the education system and understand the importance of lifelong learning and understand the importance of having a constantly renewable source of knowledge… in line with their career progression".

The product manager from Udacity said that she interviews a mix of current students, alumni, and people who have never used Udacity before. When asked whether interview participants were representative of the geographic diversity of Udacity's users, she said that Udacity is easily able to find students to interview from a wide range of places. She attributed this to the fact that students are "remarkably nice about being flexible with time" and very "accomodating", which makes some of the typical barriers like time difference easy to handle.

2. Student Observations

Although user interviews seem to be used more frequently, all three companies supplement this research with observations of students using their product. Employees at both Khan Academy and Coursera mentioned that their teams observe students through school visits, where a mix of different employees go to visit a classroom, watch the students use the product, and talk to students and teachers. While the Coursera engineer that was interviewed had not been on a trip herself, the two Khan Academy engineers had. One of them had been on between two to

three classroom visits in the past year, while the number of visits that the other engineer had gone on was unclear. However, the language they used suggested that they had gone on more than one trip. All of the trips that the interview participants had gone on were in California. However, both Coursera and Khan Academy have occasional school visits outside of California. At Udacity, because the product does not serve classrooms, employees rely on remote screen sharing and video chat software in order to observe students using their products. The product manager at Udacity said that she schedules these observations every time they launch a new feature or piece of the product.

When asked about whether these observations were helpful, a variety of benefits were brought up by the three interviewees who had been able observe students. One interviewee at Khan Academy said visiting a school was "super helpful to get a sense of the pain points and what things really work and what things really didn't work". She also said that "it was definitely much easier to figure out themes and general sentiments more so than looking at bug reports or crash reports" and that "it gave us some things to anchor our work on" and "help us prioritize". She also mentioned experiencing a strong and painful feeling upon seeing, in-person, when bugs or challenges with the product get in the way of students' learning, even if the issues were extremely minor, saying "those kinds of things, you can hear about them, but to see them is a different feeling". While the other Khan Academy employee did not go in depth into her specific observations, her discussion of the school visit was the one time she mentioned talking to a school administrator. All of their other engagements with user research at Khan Academy were focused on teachers and students. The interviewee from Udacity discussed other benefits of student observations, saying:

> *Doing user research with our students and actually watching them use our product is one of my favorite things to do. Because I think that it's so easy as a company and a product to kind of, you know, we get all excited about something that we're building and… you get wrapped up in your own vision and it's very easy to… get sort of tunnel vision. And I think it's always incredibly insightful to watch our students actually, you know, use our product. Things that you think may be super intuitive may turn out to be confusing and challenging or you'll [see] them doing these really complicated workarounds to try to get something out of your product that it's not currently offering.*

Overall, the experience of watching students use these online education products seemed to be helpful, exciting, and emotionally rewarding for the employees interviewed.

3. Quantitative Studies

Quantitative studies that use data analytics to analyze user demographics and behavior seem to be another common method that employees in online education companies use to understand students, and was mentioned by three of the four interview participants. At Khan Academy, one form this takes is through the use of partial launch experiments, where a new feature is launched to a subset of users, and then the response and usage on the website are analyzed. The product manager from Udacity also mentioned looking at user behavior statistics, saying that her team is able to observe which particular sequences of steps users tend to go through, and will investigate if some users start dropping off between particular steps. The participant from Coursera mentioned using data science to look at the demographics of the new users they were attracting after they released a new feature on their website.

Additionally, the infographic Coursera posted on their website, titled "The Way the World Learns", highlights numerous ways in which data science allows Coursera to understand user demographics, course demands, and how different types of users interact with the product. For example, the study that contributed to that infographic was able to break down how mobile usage of the website varied by country, and what times of day were most common for students to learn depending on the country ("How the World Learns", 2016).

4. Customer Support Channels

All four employees interviewed mentioned bug reports and customer support channels as a useful stream of information for understanding users. The three engineers interviewed discussed the value of bug reports and customer support tickets in more detail than the product manager that was interviewed. One interview participant mentioned that bug reports and support tickets help engineers get a good sense of how confusing certain aspects of the product are, which then helps inform their attempts to address those problems in the future. Another interview participant mentioned that bug reports and support tickets are a great way to get a sense of what users want and need, mentioning that people will put in feature requests and that teachers are "very vocal about things that they would love to see". She also mentioned that this

feedback from support channels is a particularly crucial part of the process when new features of the product are first released, and really helps engineers understand how people are reacting to the product or feature.

5. Personal learning experiences

During the interview, participants were asked to discuss their own educational experience, and how that experience has played a role in their work in the online education industry. This question produced extremely varied responses. One of the Khan Academy interview participants said that her personal experience in education "doesn't explicitly inform any of [her] thinking" but has played a role in her interest in the field and in improving access to education. The participant from Udacity had a similar response, primarily discussing how her own personal experience using online education to help her change careers has really inspired her interest in the industry and in Udacity in particular. She did not mention whether or not her personal experience as an online student directly influenced the product decisions she made at work. The participant from Coursera also mentioned that her personal educational experiences, particularly in college, helped shape her interest in improving access to education. When asked about what sources of information she uses to try to understand the learner perspective, the participant from Coursera mentioned that personal experience is a really useful source of information for her, and one that Coursera encourages employees to use. All employees have access to a program called "Coursera for Courserians", that she said, "helps [them] be reactive learners in [their] own programs". However, the other participant from Khan Academy, when asked how her own personal experience in education informs her work, said "I actually try my best not to draw on my personal experience with education… I am trying my best to not introduce bias into what otherwise should just be me reacting to user feedback".

6. Previous work experience in education

Surprisingly, three of the four people interviewed (two engineers and one product manager) had some amount of previous teaching experience, which was part of what shaped their decision to work in online education. One participant during her time in college developed her own introductory computer science curriculum and taught it to a middle school class. Another participant interned as a teaching assistant during college through a Teach for America

program and also worked as an after-school counselor for two years during college. The third participant had spent a fair amount of time in college tutoring, grading and working as a course assistant. That participant, who was from Udacity, also mentioned that Udacity has "so many people within the company that are coming from education backgrounds: education research, or education policy, or having been a teacher, or just a lot of different backgrounds". Although none of these participants explicitly mentioned drawing on their previous teaching experience while working on their company's products, it's possible that those teaching experiences do help to inform their work in some ways.

Statistics on the number of people in the online education industry that have previous experience in education (either as teachers, school administrators, professors etc.) are not available. However, the team pages on the websites of Khan Academy, Coursera and Udacity offer some insight into how many employees are likely to be able to draw on previous work experience in order to better understand the needs of students. Both Coursera and Udacity have short descriptions of the backgrounds of their leadership teams. Out of the twelve people listed online as part of Coursera's leadership team, one mentioned an education-related degree and seven mentioned previous work experience in education ("Leadership", n.d.). Of the nine people listed online as part of Udacity's leadership team, one mentioned an education-related degree and five mentioned previous work experience in education ("About us", n.d.). Khan Academy actually lists the names and brief descriptions of all of its employees online. Out of the 141 people listed on the website, seven mentioned a degree in education and 55 mentioned some previous experience in education. It's worth noting that the Khan Academy statistics are slightly underreported, as a lot of the employee descriptions were casually written, and many of them discussed personal interests rather than a formal background of work experience and education ("Meet the Team", n.d.). Prior experiences in the field of education that were mentioned in the online descriptions of employees of all three companies include teaching (either as a university professor or K-12 teacher), administrative roles in schools or universities, volunteer teaching or mentoring work, and working at other education startups ("About Us", n.d.; "Leadership", n.d.; "Meet the Team", n.d.). Although none of the brief descriptions available online are comprehensive summaries of the backgrounds of these employees, and two of the websites only listed the leadership team online, it does offer a sense of the degree to which employees can draw

from their own experiences working in education in order to try to better understand their users on these online platforms.

7. Research on Education

When asked about the ways in which their company and individuals at their company stayed up to date on research in the field of education (specifically research outside of online education but about education), most of the interview participants were able to mention both formal efforts organized by their company and their own personal efforts. None of the interview participants were able to talk in depth about the organized efforts within their company that were focused on staying up to date with research in the field of education. However, participants at Khan Academy, Coursera and Udacity all pointed to a "teaching and learning" team (the name varied depending on the company), whose job it was to stay up to date on this kind of information.

Most of the ways in which all four interviewers engaged with research in the field of education were through individual interest or through communities and resources that formed "organically" within the company. One of the participants from Khan Academy, who was hoping to be a teacher in the future, had been taking graduate classes in education. The interview participant from Coursera said that she personally found it hard to stay up to date on issues in education, and that conversations with friends who were teachers were the primary way that she learned about issues directly related to education but not related to technology. The other Khan Academy participant also mentioned heavily relying on friends for this kind of information, talking about how she often spoke to parents in her community about the education decisions they'd made for their children. The Udacity participant did not mention anything that she did in particular, but said that many employees at Udacity have a "longstanding interest in education".

Interestingly, much of what the interview participants brought up in response to this question were informal communities that had been created by employees on their own, rather than formal company processes. At Khan Academy, employees have a group called "learnception", that chats online and meets for lunch periodically to discuss topics in learning and pedagogy. They have also had a book club at times. At Coursera there is an email list that people in the company use to send out readings they think others might be interested in. Udacity has a similar place where employees can post papers and articles they read that they want to

share with the rest of the company. The Udacity participant also said that because so many people in the company are interested in education and are coming from education backgrounds, keeping up with the literature in education becomes a "shared responsibility".

The websites of some of these companies also illustrate some examples of how these companies stay up to date on research in the field of education. For example, Khan Academy's use of the phrase "You can learn anything" at the top of the website home page and in a variety of marketing materials is rooted in educational research on the impact of a "growth mindset" ("Khan Academy", n.d.; "The Growth Mindset", 2014; "You Can Learn Anything", 2014). Coursera's Press Insights page also shows three different education studies Coursera has done, although no new studies have been added in the past two years ("Press", n.d.). Coursera's blog also has occasional posts focused on pedagogy (Saraf, 2017). Udacity's website did not have any obvious, explicit references to educational research. In fact, most of its blog posts and writing, even in the "lifelong learning" section of the blog, focused primarily on talking about education in the context of career development ("Lifelong Learning", n.d.). However, this does not necessarily mean that Udacity does not stay up to date on literature in education. Another possible explanation is that because Udacity's product is so focused on helping students change careers, it makes more sense for its marketing team to focus website content on that benefit.

The Accuracy and Quality of These Seven Methods as well as Directions for Improvement

Having identified these seven methods, the question now is this: how likely are these different sources of information and user research processes to enable an *accurate* understanding of student, teacher and school needs, and how might online education companies be able to improve these research processes in the future?

The seven methods identified can be divided into two categories: company-organized methods and employee-organized methods. User interviews, user observations, quantitative studies and customer support channels are all efforts that are actively run and organized by the company itself. However, there are a variety of sources of information that are not formally guided by company processes, but that employees are still able to use, such as their previous personal experiences as a student or previous work experience in education. For seventh method identified, the ways in which online education companies stayed up to date with research in the larger field of education, it was a joint effort, with some of it part of established company

research processes, and some of it naturally forming out of employees' interest in education. The discussion below will first analyze the accuracy of the methods that are already formal, company-organized research efforts, and suggest potential areas for improvement or questions that still need to be answered. It will then analyze the accuracy of the more informal methods, and suggest ways in which companies can support and encourage the stronger informal research methods that have formed within these companies. While the results from the interviews point to several types of research methods that seem to have been successful, the interviews also highlight some debates and unanswered questions around the types of biases that might also be introduced by some of these different methods, which will also be discussed below.

User Interviews & Observations

Everybody that was interviewed felt that user interviews and user observations were extremely helpful and insightful for them. Yet there was a huge amount of variety in the degree to which they were able to engage with this source of information. The interview responses suggest that within the product development team, product managers and designers have extensive opportunities to interview and observe users. The exposure that engineers have to these sources is much more varied. One future direction that might be worth exploring is whether increasing the degree to which engineers participate in user research helps teams more easily meet their students' needs.

However, a variety of factors can make it difficult for engineers to participate more. One interviewee cited scheduling constraints as the reason she had not participated more, while another explained that she likely had not gone on any student observation trips because of her low level of seniority on the team. Both Khan Academy and Coursera's practice of recording these interactions with students and making them accessible to the entire company is one potential way to combat this challenge. The ease of accessibility of these resources in each company was unclear, but more frequent, public dissemination of this type of information could help people working across all parts of the product better understand their students.

Although the onsite visits that the engineers at Khan Academy and Coursera discussed helped those engineers understand their users more deeply, they also highlighted a potential source of bias in these two user research methods. While observing and interacting with students in person can be much more insightful than the limited amount one is able to see over video chat

and screen sharing software, it's not necessarily feasible for companies to send large portions of their product development teams to schools all over the world. There is a tradeoff between the diversity of schools visited and the size of the team can do that visiting: as the increased difficulty and cost of visiting faraway schools likely means that fewer employees are sent on those trips. Consequently, increasing the amount of exposure that employees have to student observations, even if they are less directly involved with the user research, means that many of them will primarily observe students and classrooms in California. For example, the two engineers interviewed in this project who had gone on school visits, had both visited only schools in California. Only observing classrooms in California has the potential to significantly bias employees' understanding of their users. The interview participants seemed very aware of this challenge, with the participant from Coursera saying that it was something "really interesting to just keep in mind as I'm designing a product, that the people that I may see around in my day-to-day, even the learners that I saw in this panel, are not representative of the full coverage of learners that we're serving". Given that product managers are involved with most of the user research, while engineers only participate in or watch a small subset of interactions with users, this potential for bias seems higher for engineers. Companies that want to increase the amount that engineers engage with user research should keep this in mind, encouraging engineers to make sure they are engaging with resources that cover the diversity of their users.

Overall, the interviews in this project did not deeply address how these online education companies select users to observe and interview. Given that all three of these companies have users all over the world, at a variety of ages, taking classes in a wide range of subjects, it seems likely that getting a representative sample of users to interview and observe might be difficult, particularly because of language barriers and logistical challenges such as time zone differences. Investigating whether or not these user interview selection processes introduce bias into the user research could be a promising area of future research. The limited results from this project on this subject were quite mixed. The interview participant from Udacity was quite confident that she was able to get a representative sample of users, while the participant from Coursera mentioned that the user panel she watched was quite "homogenous".

Programs such as Khan Academy's Ambassador program, Coursera's Advisory Council and Udacity's alumni community also highlighted a tradeoff between frequent, rapid access to user feedback and getting a diverse and representative sample of users for research. These

communities are extremely valuable and enable the product teams to conduct user research more frequently. However, talking primarily with heavily active users, users that have already completed a course, or a small subset of users repeatedly, also have a large potential to bias employees' perceptions of user needs. While these resources make it easier to do user research more frequently, over the long term it might be better for companies to try relying on specific communities less often.

Lastly, the interviews with Khan Academy employees pointed out several key stakeholders that were not getting much attention. Neither Khan Academy interviewee mentioned user interviews with parents or school administrators. While these groups of people are not relevant to Coursera and Udacity's products, parents and school administrators could both offer valuable information on what students need, that could supplement and offer new perspectives on what Khan Academy learns directly from students and teachers.

Quantitative Studies and Customer Support Channels

Although none of the interview participants spoke in depth about the use of quantitative studies and customer support channels, the participants who did mention them spoke very positively about them. The strength seems to be in the narrow but very precise nature of the information. Bug reports and customer support tickets tell product teams about specific technical problems with the product, common features that are confusing users, and features that users want to see in the product in the future. Although the content of support tickets is biased towards more vocal people and people who feel strongly enough about the problem or feature request that they spend the time and energy needed to report it, the information is useful. The engineers that were interviewed also seemed quite aware of the fact that it is a channel of information that is biased towards the most pressing pain points and needs. Additionally, one interviewee mentioned that a benefit of this source of information was that it was quite representative of their user base, because it was equally easy for users all over the world to submit support tickets. Based on the benefits that the interviewees conveyed about customer support tickets, one promising direction of future research could be an analysis of the ways in which users can currently submit written user feedback, and an exploration of whether these channels should be increased and made easier for students to participate in.

Personal Learning Experience

The interviewee responses to the question of how their own personal educational experiences play a role in their work highlighted an interesting debate as to whether it was better for employees to use their personal experiences as a source of information, or to ignore that information in order to reduce potential sources of bias. As mentioned earlier, it can be difficult to find opportunities for every team member to watch or engage with user research. However, every employee has their own educational experiences, which could act as a valuable source of information. As a result, Coursera's program "Coursera for Courserians" makes a lot of sense. Rather than getting all team members to watch other people use the product, Coursera encourages employees to use the product themselves and reflect on that experience. However, the issue of bias raised by one of the Khan Academy participants is an important critique of these types of approaches. As the Coursera participant discussed, the community in Silicon Valley can be quite homogenous and contains many highly educated people with advanced degrees. Consequently, their own personal educational experiences (either experiences from earlier in their lives or their experiences using their products today) will not be representative of the wide variety of students actually using their product. As a result, it is unclear whether employees should be using their own personal experience as one small data point in their decision making, with the awareness that their users are coming from extremely diverse situations, or whether employees should be actively trying to ignore their own experiences and only listen to what their users tell them. It could be helpful to further explore the number of online education employees who are aware of this kind of bias and to discuss with a wider collection of employees whether they feel this source of information is valuable enough that it is worth keeping.

Previous Work Experience in Education

One surprising finding was the fact that three out of the four people interviewed had some type of previous teaching experience, even though none of them were on the content development teams at their companies.[3] Whether or not this experience helped them understand student and teacher needs during product development was unclear, as they only cited their teaching experience as a large reason they were interested in the online education industry. The

[3] It is worth noting that the fact that all of the interview participants were female might have biased this outcome slightly, given the higher rates of women in teaching-related roles.

usefulness of previous work experience in education likely depends on the duration and depth of the experience. The people interviewed in this project all had brief teaching assistant experiences in college, which likely offer only a limited amount of helpful information about the needs of the people that use their products. However, some employees listed on the websites of these companies did have much more extensive work histories in education.

One potential problem with using previous work experience in education to inform product development is the same problem that was discussed with using personal educational experiences. Given that these websites have users all over the world, focusing on the previous work experiences that employees had, likely in America, could bias people's understanding of student and teacher needs. However, the diversity of schools or other education-related institutions that employees worked in and the diversity of the students they served is likely to be larger than the diversity of their personal educational experiences. Based on the initial website analysis results, people's work experiences were quite diverse, while their own personal educational experiences were primarily at elite universities in America ("About Us", n.d.; "Leadership", n.d.; "Meet the team", n.d.).

Given that there are no industry-wide statistics on the number of people in the online education industry with previous work experience in education, this might be a question worth exploring further. This project was able to investigate this question briefly through an analysis of three company websites. However, those resources are not able to address industry-level trends or questions such as the following: how does the degree of work experience in education vary between engineering teams, design teams, content development teams and management teams? Or, out of the people who have work experience in education, what is the average duration of that experience? Asking employees more about their previous work experience, and asking companies whether they try to hire people with previous work experience in education and whether or not they find it to be valuable, could be a useful area of future investigation. One particularly interesting question to explore is whether companies have found it valuable to have employees with education-related work experience on teams outside of content and curriculum development, such as engineering, design and management.

Research on Education

While all of the people interviewed knew of a team within their company responsible for staying up to date on research in the field of education and information on areas such as pedagogy, the interviewees' lack of knowledge about what those teams did highlights a need for more communication between the teaching and learning teams and the product development teams in these companies. Product development teams, by virtue of working on the product, are still making decisions that affect the educational experience of the product, and when testing the product are trying to evaluate whether or not it is teaching students well. As a result, deeper knowledge of pedagogy and research in education could be useful to them.

Additionally, the interviews revealed many informal ways in which employees in product development tried to stay up to date on research in education. Consequently, another way in which companies might be able to increase employee knowledge about research in education could be by formally supporting these efforts that spontaneously crop up. For example, the learning and teaching teams could habitually post some of their findings every week on the chat and email chains that interviewees mentioned using. Companies could support things like the book club and learnception meetings mentioned by offering funding for books or for employees to order lunch on the day of their discussions. Formally requiring employees to do research that is slightly out of scope of their job can be difficult. For example, engineers already need to stay up to date the literature and current events in computer science in order to make sure that they can do their engineering work well. However, encouraging and supporting these spontaneous efforts that are initiated by the employees themselves might be a promising way to grow and expand the knowledge that people across the company have about education.

Conclusion

Online education's ability to reach students around the world is one of the main reasons that so many people are excited about its potential to have a huge positive impact on the world. However, with the potential to positively impact so many students' educational outcomes also comes the potential to give millions of students a bad education. Deeply understanding the needs of students, schools and teachers around the world can help companies build the most effective online education products possible, which helps to both maximize online education's potential for positive impact and minimize the risk of promising students an education and failing to deliver. As a result, it is worth evaluating the research and product development practices

currently used in the industry and trying to see how we can improve them. Hopefully the results of this project can serve as a broad survey of methods in the industry that need to be explored further.

However, it is worth noting that many of the challenges and tradeoffs in user research and product development that were discussed in the results section are not entirely unique to education. Innovation always requires a balance between time and accuracy. Innovating and trying new things that have never been done before comes with an inherent risk that the innovation might not work. Using research to inform these innovations can help reduce risk. Deeper, more accurate, unbiased and in-depth research takes more time, but potentially reduces risk further, while faster types of research allow innovations to make an impact sooner, but do not reduce risk as much. However, no amount of research can completely remove uncertainty. Eventually the innovation has to be tested in real life with real people, and then it can be improved or modified based on the initial outcome. As a result, any team trying to build something new and innovative is forced to identify the point at which releasing the innovation out into the real world and letting it impact people is more beneficial than further research.

So why analyze the innovative processes used in online education specifically? Silicon Valley has created many products that make a positive impact on society, but that have low consequences if they perform badly or unexpectedly. For example, the shopping cart that IDEO designed had the potential to improve grocery store shopping experiences, but if it broke within a few days or did not work as anticipated, there was limited potential for it to hurt others. It would only make grocery store shopping difficult until the store could go back to the old carts.

Only extremely recent current events, such as controversies around the use of Facebook data, and concerns around how Facebook is impacting how humanity interacts and socializes, are prompting Silicon Valley to consider the ethical implications and risks of the products they create (Rosenberg & Frenkel, 2018; Wang, 2017). For example, Chamath Palihapitiya, who was a Facebook executive early in its development but no longer works there, admitted in 2017 that he feels “tremendous guilt” over Facebook, and that “the short-term, dopamine-driven feedback loops that we have created are destroying how society works: no civil discourse, no cooperation, misinformation, mistruth” (Wang, 2017).

Online education is one place in Silicon Valley where the risks inherent in trying new educational approaches are clearly an ethical issue. The products that these online education

companies experiment with influence the lives, perspectives and educations of their students. For example, making U.S.-centric curricula available to students all over the world could have cultural implications for students in other countries that are difficult to anticipate in advance.

While this ethical issue is not present in all products made in Silicon Valley, it is not entirely unique. The pharmaceutical industry and the larger field of medical innovation have spent decades dealing with tradeoffs between releasing innovations sooner so they can help more people and releasing innovations in a way that minimizes potential harm. A variety of laws and institutions have formed to help deal with this tradeoff. Education is not a matter of life and death the way that medicine can be, and therefore does not need the same level of regulation around innovation. However, the already established processes and guidelines on innovation within the medical community could still offer valuable insights and ideas for ways in which the field of online education might better balance innovating quickly with innovating in a way that minimizes the risk of hurting students. For example, Doctors Without Borders published the ethical framework it uses to guide its innovations, and the tradeoffs it discusses when trying to innovate in humanitarian aid have many parallels to the challenges and tradeoffs of innovating in education (Sheather et. al., 2016).

The results of this study have identified several research methods that offer valuable information and insight to employees in online education, and that help them better understand the users they are serving. However, the results also show that there are still numerous places for improvement and further research. In particular, reducing bias in favor of the American student population seems like an important but difficult challenge in user research in online education. Lastly, in addition to some of the future directions of development suggested in this paper, the field of online education could likely learn a lot by looking to organizations and industries in similar situations, such as the medical innovation space.

Appendix

Interview Questions

Intro/Demographic Info:

1. To start, can you tell me a little bit about yourself and what you do at company X?

2. Can you tell me about how you came to work in the online education industry?
    - Why online education?
    - User of online education product?
    - Why online education as opposed to different education initiatives or technology initiatives?
    - Previous work experience?

User Research:

3. I'm interested in the user research processes used in the online education industry. Can you tell me about how the people in your team do user research?

   Follow up Questions (if you're not familiar with the process/don't know the answer to any of these, no worries!):
    - Who do you talk to? (users, students, teachers, school administrators, parents?)
        - Users, students, teachers, school administrators, parents?
        - Geographic diversity? Are the people you talk to local? Far away? A mix?
        - How do you choose who to talk to?
    - How frequently do you talk to them?
    - Who conducts the user research?
    - How are the results shared within the company?
    - At what point(s) in the product development process is user research done?
    - How do you and other employees at company X stay up to date on the research going on within the field of education?
        - Specific people/roles? Everybody? Is it part of the general culture?
        - Talking about edu current events at work?

4. Has there been a time when you got to see your company's product in action, being used by students? Can you describe the experience? What were your thoughts/reactions when you got to watch students using it?
    - Were students using it in the way you expected when making it?
        - If you have had opportunities to see your company's product used by students, how frequently have you had these opportunities?
    - Do you think you have enough of these opportunities?

Education:

5. Can you tell me about your own education experience?
    - How do you think that has affected the work you do at company X? Did it play a role at all?

6. What do you think of U.S. education today? What do you think are the most pressing problems/challenges in education today?
    - What aspects of US edu are you most familiar with?
    - Early childhood, K-12, higher ed? Private? Public? Charter?
    - Most pressing problems in US education today?
    - If kids, where did you send them and why?

7. How would you describe your ideal classroom? What should learning look like?

8. Hopes for the Future: What are your biggest hopes for online education? Among the ideas you see getting pursued today, what do you think are the most promising/most likely to solve pressing problems in education? How do you think all of these ideas/ongoing projects in online education today will affect education in the next 20 years or so?
    - What do you think tech can't help with?
    - Thoughts on the future? The company you're at? Most promising areas/efforts?
    - Where does it have potential for impact?
    - Specific problems it can help with?/Pressing problems in edu?
    - Strengths and weaknesses of using tech?
    - How do you imagine tech in an ideal classroom?

9. Anything you want to add? Any comments?

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