

How Do **Disruptive Innovators**

Prepare Today's Students
to be Tomorrow's Workforce?

**HOLBERTON'S
SCALABLE EDUCATION
FOR THE DIGITAL
ECONOMY**

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About Holberton

Holberton is not your regular university or coding Bootcamp. Its project and peer-based methodology are inspired by progressive education, a pedagogical movement that the world-famous Montessori is part of. The Holberton School was founded in 2015 by experienced software engineers Julien Barbier and Sylvain Kalache, working at the time in Silicon Valley's best companies. Sylvain and Julien decided to build a new type of school, one that is accessible to anyone, that has no cost to apply and attend, until professionally successful, and that helped students develop the necessary hard and soft skills to compete successfully for the best software engineering jobs. As of 2020, Holberton is operating 16 campuses worldwide, spanning five continents and seven countries, including Colombia (Bogotá, Cali, Medellín, Barranquilla), Puerto Rico (San Juan), Mexico (Mexico City), and Uruguay (Montevideo). They also provide their tools and curriculum to other schools and universities. By doing so they can offer the same high-quality education that made Holberton School students secure full-time jobs at top companies like Apple, Google, Mercado Libre, NASA, Tesla, and more. The school is supported by professional advisors and investors who are leaders in technology, sports, and entertainment.

Abstract

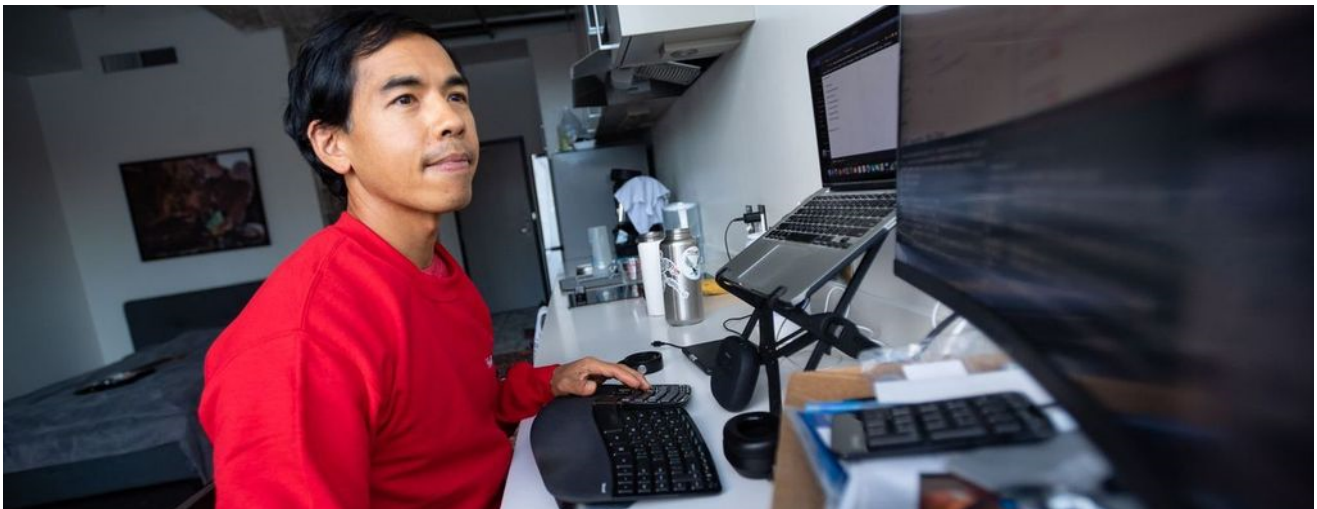
Latin America is entering the Fourth Industrial Revolution, where its digital world is increasingly controlling the physical one. The digitalization of the economy is well underway. The COVID-19 pandemic is acting as an accelerator, forcing most businesses to transition online or die (slowly, or in fast-changing markets, quickly). While Latin America's higher education system has not evolved for centuries, it has no choice now. The Internet, growing exponentially, holds more information that we need, making knowledge widely accessible, allowing the rate of innovation and change to accelerate. In this context, professionals need, more than ever, the right set of skills, at the right time, to find a job and remain employed. Lecture-based and rote-learning education is not equipping students for today's world, and even less for tomorrow's one. While quality education exists, it is only accessible to an elite. This paper will explore how a Silicon Valley software-driven education, using a project and peer-based approach with no formal teachers or lecture, can solve the quality, accessibility, and scalability issues that Latin America higher education system is facing.

1. Defining a 21st - Century Economy

Our world is entering the dawn of the Fourth Industrial Revolution. Previous industrial revolutions were dominated by inventions, such as the steam engine, mass production, and the beginning of digitization. Conversely, today's merging technologies, such as AI, robotics, the Internet of Things (IoT), nanotechnology, quantum computing, and biotechnology, are fundamentally changing how we work, live, and play, upending the current social order. As the lines between the physical, digital, and biological worlds blur, our world is transforming at an accelerating pace, scale, and scope that we have never experienced before.

Despite fears associated with transformative change, past industrial revolutions ultimately created more opportunities for workers than they destroyed. Will this revolution follow the same course? Whatever the answer is, one thing is certain. The society needs to adapt quickly. How we plan for the future can make a difference. Therefore, it is our responsibility to determine this industrial revolution's course and spur positive innovation.

Businesses are driving much of today's innovation. As they transform, so must their workforces. The 21st-century job market demands that professionals acquire up-to-date skills in their areas of expertise. Moreover, those skills are far from static. Business needs are constantly changing, so they need workers with the intellectual and social agility to continually learn and grow even as the ground shifts below them. Finally, now more than ever, the modern workplace requires workers with the soft skills necessary for cross-functional ideation and collaboration. Fortunately, technology is not only changing what the business needs. It is also enabling new realms of possibilities. Remote work is on the rise, just as remote learning is becoming more pervasive as well. Fewer workers need to commute to work, and fewer students must sit in classroom lecture halls to access knowledge. The Internet has made knowledge accessible to anyone with a mobile phone and the Internet connection. The challenge now is to equip people to navigate this ocean of information, understanding how to search it, parse it, and differentiate what is right, wrong, or incomplete.



Andreas Schleicher (2019), Director for Education and Skills at the OECD, said: “The Industrial Age taught us how to educate 2nd-class robots, people who are good at repeating what we tell them. In the time of artificial intelligence, we need to think much harder about how we can educate 1st-class humans.” (IDB & Virtual Educa, 2019). A small number of elite institutions have been able to provide a high-quality education to their students. Unfortunately, however, they are inaccessible to most due to their inability to scale.

Today’s citizens are perpetually seeking the skills to secure a meaningful and financially sustainable job, while businesses are perpetually scouting out the best talent, wherever it is. Yet, many people cannot find jobs, and many companies cannot find highly-trained talent. There is a missing piece: a scalable, accessible, high-quality education able to meet the demands of this latest industrial revolution. Our educational model is based on centuries-old paradigms that have long faded into the ether. However, the Fourth Industrial Revolution demands a reimagined educational model capable of equipping the future workforce to meet business and society’s new needs and exceed them.

This paper covers three main challenges that higher-education education in Latin America is facing: accessibility, quality, and scalability. Specifically, in each section, we will explore each challenge by examining their three sub-dimensions. Then, we will discuss how Holberton has successfully overcome each challenge.

*This introduction was written by Mr. Stephane Kasriel, a former Upwork CEO.
The author thanks Mr. Kasriel for the introduction*



2. The Accessibility Challenge

The first challenge in the region is accessibility to education. According to OECD, only 44.5% of Latin Americans between the ages of 24 and 34 have completed some form of post-secondary (tertiary) education (OECD, 2020). The populations of many Latin American countries fall even lower than this average:



29%
for Colombia



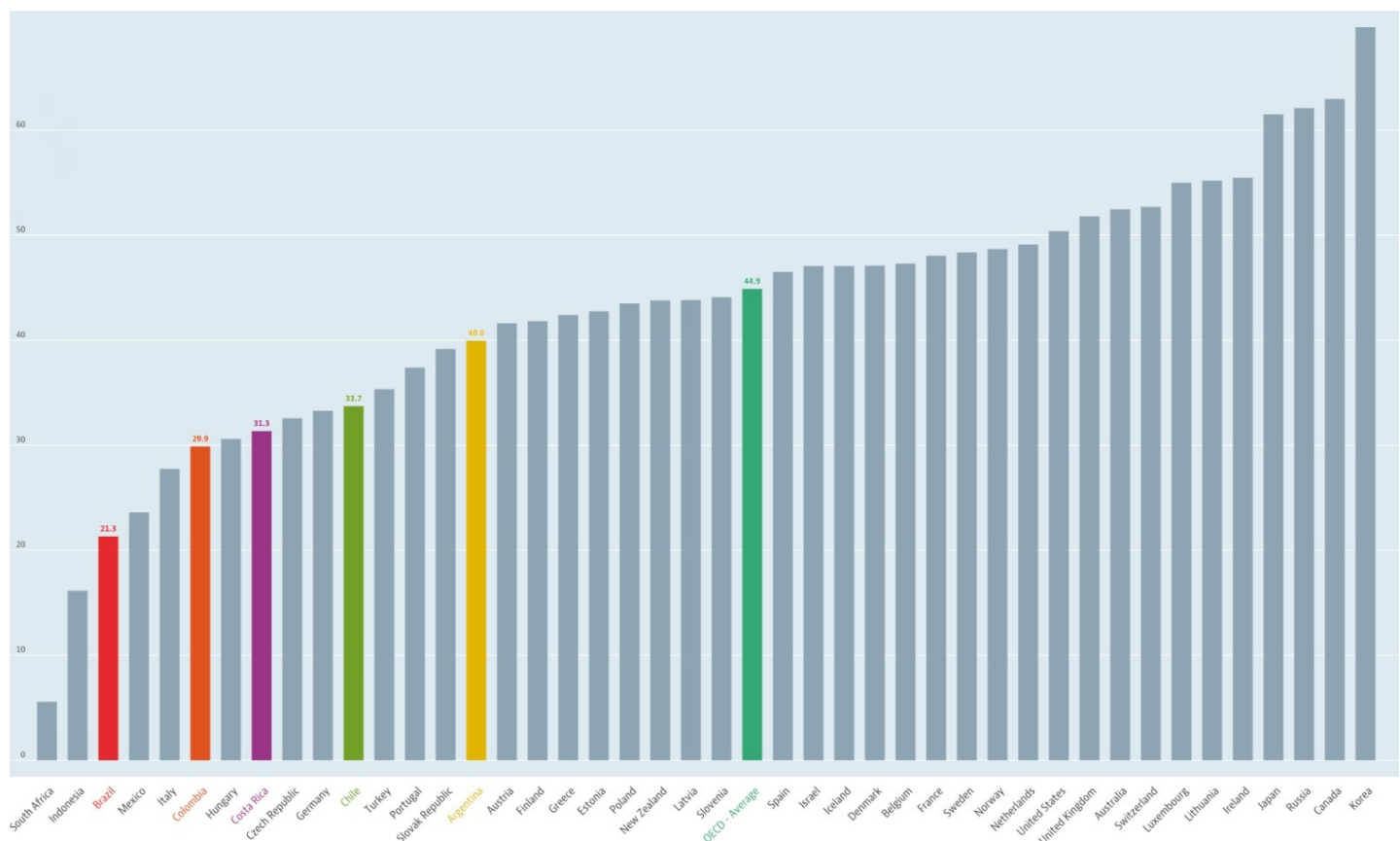
23%
for Mexico



20%
for Brazil

As a comparison, the **US stands at 49%**, while **Japan is at 60%**.

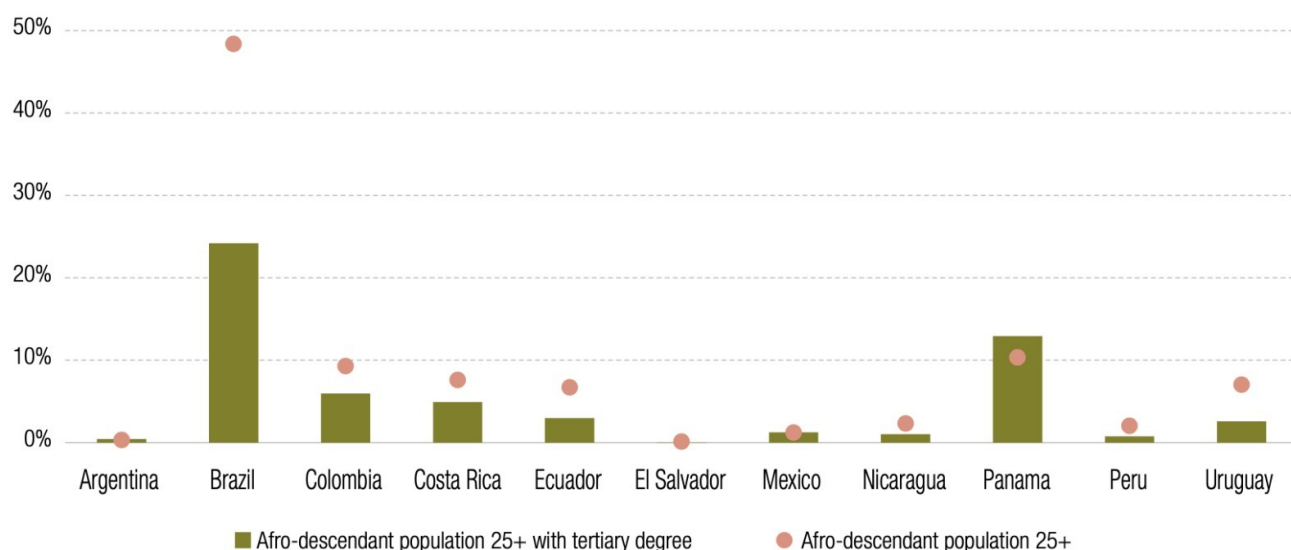
Figure 1. Percentage of the Population 24-34 who Completed Tertiary Education



Source: Organization for Economic Cooperation and Development, 2020a.

Even worse, accessibility is far direr among diverse populations. In several countries in Latin America and the Caribbean, Afro-descendants are underrepresented among the population holding a post-secondary degree. For example, we can find the starkest differences in Brazil and Uruguay. See Chart 2: note differences between the gray dots, indicating the proportion of the population, and the green bars. Gender is also an essential factor. For the same age range (25-34 years old), only 16% of Brazilian men achieved tertiary education while women are at 22% (OECD, 2020).

Figure 2. Afro-Descendant Share of the Population with a Tertiary Degree vs. Share of the Overall Population



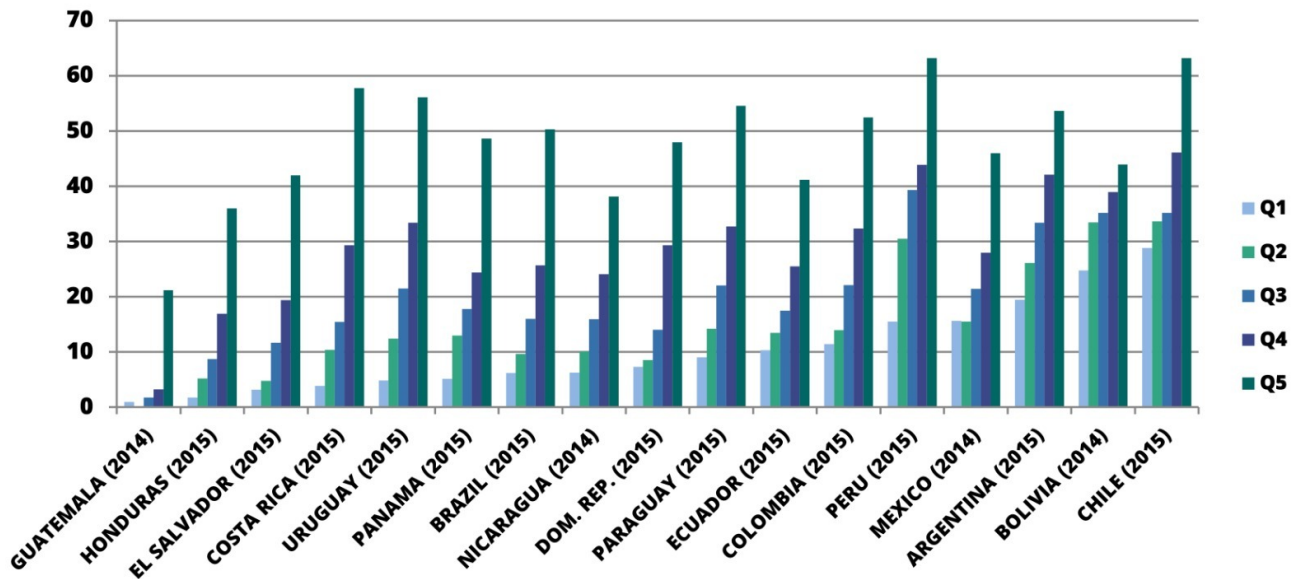
Source: Freire et al., 2018.

Specifically, in this section about accessibility challenges, we will further discuss challenges that determine education accessibility: cost, admission criteria and curriculum length, and the lack of exposure.

Accessibility Challenge 1: High Costs and Crushing Student Loan Programs Have Led to Low Levels of College Education

The first challenge is the cost. Because so few Latin Americans have attained college degrees, the region faces a “nini” crisis (ni estudia ni trabaja): many young people are neither working nor studying (OECD, 2020). Tuition costs are among the primary barriers preventing Latin American youth from obtaining post-secondary degrees. For instance, in Brazil, 85% of surveyed potential college-aged students reported being unable to attend college due to the high cost of tuition (Quero Educação, 2017). 57% of dropouts state doing so due to tuition costs. In Honduras and Guatemala, students in the top income quintile are twenty times more likely to enroll in tertiary education than students from the lowest income quintile.

Figure 3. Tertiary Net Enrollment by Income Quintile



Source: Fiszbein & Stanton, 2018

Unlike students in other parts of the world (for example, in the United States, people rely heavily on loans), loans are not available in all countries. For example, only 8% of Mexicans use loans to finance their education (OCC Mundial, 2012). There are multiple reasons why people avoid loans. Sometimes, they simply do not know that loans exist. Other times, people know about them but cannot get them. Oftentimes education loan interest rates are usurious.

Among people who turn to loans, many additional problems can arise. For starters, they're often predatory. The U.S. has many predatory lenders with abusing student loan practices. There the national student loan debt stands at a whopping USD 1.6 trillion (Friedman, 2020). Possibly, 40% of borrowers could default on their loans by 2023 (Scott Clayton, 2018). Tragically, more than a quarter of this debt is owned by Americans aged 50 years or older, demonstrating that, once in debt, many Americans find it nearly impossible ever to escape. Latin America has also faced some related issues. Chileans experienced high default rates during this decade, which led to student protests and demands to overhaul its system (Ramírez, 2014). Colombians had interest rates hovering as high as 24% (Ramírez, 2014).



Holberton's Solution to Accessibility Challenge 1: Diverse Ways to Pay for Tuition Including Results-Based Payment

Holberton responds to the cost challenge by ensuring that any student can pick a tuition payment format that fits them, no matter their financial situation. For Holberton school Mexico, we offer four different tuition payment formats: upfront, student loans, monthly payments, and Income Share Agreements (ISAs).

ISAs are agreements in which an individual, in exchange for something of value such as a service or fixed amount of money, agrees to pay back a percentage of their income for a set amount of time. In the case of Holberton School, students enroll in the program at no cost. Only if and when they find a job that pays over a certain amount – COP36,000,000 per year in Colombia – they then share 17% of their salary over 42 months. The school covers the cost of education and invests in its students. ISAs align school and student incentives. The only way that schools using ISAs can receive a return on their investment is to provide an education that leads students to a good, job. Lumni, a social mission company that offers novel financing for education, has been using ISAs since 2001, with 9,000 students in Chile, Colombia, Mexico, and Peru.

Box 1.

Income Share Agreements (ISAs) are different from loans because there is no interest. Furthermore, the amount paid is variable since payments are based on a percentage of income, not a fixed amount. Thus, schools are not just incentivized to record students as “employed” so they can inflate their success rates on their recruitment literature, but rather, they are rewarded for training their students for great jobs. If a student decides to take time off or change a job and is therefore not earning an income, the payments stop. Finally, they provide a financial cushion to students unable to secure high-paying jobs or in-between positions; the ISA does not need to be fully repaid if they do not reach the necessary income threshold. ISAs eliminate the predatory nature of paying for college.



Accessibility Challenge 2: Biased Admission Processes and Long Programs Reinforce Structural Inequality

The second accessibility challenge is that admission processes can reinforce existing inequalities. Sometimes, taking on loans or otherwise securing funds is still not enough to guarantee a ticket to post-secondary education. First, the students must get accepted, which can be a significant hurdle itself, given that many admissions tests reinforce structural inequalities. It is true that recent admissions scandals, involving wealthy parents who essentially bribed school officials to cheat their way into the system (The New York Times, n.d.), is an uncommon and extreme example of how wealth can impact access. But there are far subtler yet pervasive ways in which bias enters the system. Wealthy parents are more likely to help their children with the school work, either directly or through tutors. They are more likely to pay to have their children participate in expensive extracurricular activities and to be able to hire expensive private college counselors and coaches to improve their scores on standardized tests (Murrell, 2019). Less wealthy families cannot afford to hire tutors for these tests; it's hard for them even to afford the tests at all, given their steep costs (Saxena, 2019). Furthermore, admissions tests have long been argued to have embedded within them biases tied to geographic location, income, and gender (Murrell, 2019).

In Brazil, students from private universities had writing scores on the National High School Exam (Examen Nacional do Ensino Medio, or ENEM) that averaged 20% greater than those coming from public schools (Vasconcellos, 2013). Most post-secondary institutions use the ENEM as a criterion for admissions, as well as for scholarships. As a result, students from racial majorities with high incomes who have attended private K-12 schools have a better chance of access to the best schools. In the US, a candidate's SAT score, a major part of the application to many post-secondary institutions, correlates directly to parents' income (Godfarb, 2014). In an education system that is often monolithic when it comes to teaching methodologies, a learner who does not fit the traditional approach is unlikely to succeed, given that every step assesses the student based on factors relating to their background, not their potential.

Higher education in Latin America is often also too long for many. In over a dozen countries in Latin America and the Caribbean (LAC), more than 40% of students who enroll in higher education do not complete a degree (Fiszbein & Stanton, 2018). Almost 65% of students who drop out do so after spending two years in the system, and nearly 20% do so after spending six or more years pursuing a degree. Compounding this inefficiency is the fact that completing a bachelor's degree takes longer (5-6 years) for most universities in LAC than in other areas of the world (4 years), and students who do enroll and successfully complete a degree often take longer than the stipulated time.



Holberton's Solution 2: Automated, Blind Admissions Processes and Shorter Program

Holberton's admissions test is entirely free and automated with no human intervention, removing any human bias or possibility of bribery. The process does not consider candidates' previous education, work experience, gender, religion, sexual orientation, ethnicity, or age, but is based solely on their motivation and talent.

Talent is tested by getting students to start learning to code through a unique Holberton "learn by doing" based project. No prior coding experience is required. It's also a good opportunity for candidates to understand if they enjoy coding, and if the Holberton project-based methodology fits their learning style. This innovative admission process has enabled Holberton to attract a diverse student body. At the San Francisco campus, 37% of the students are in the first generation in their families to attain post-secondary education (Bathel, 2019b). This percentage rises to 45% for Holberton Colombia. The students range in age from 18 to 58 (Kalache, 2018), a third of them identify as women (GlobeNewswire, 2018), and they come from all walks of life. Some just finished high-school, some graduated from or dropped out from college, and some are former breakdancers (Giraldo, 2020), grocery store clerks (Bort, 2019), veterans, artists (Cognet, 2018), and even homeless (Benner, 2017).

The Holberton curriculum is designed to concentrate on both soft and hard skills that professionals need to be successful, not covering topics such as history, geography, art, or philosophy. The pace is intense and efficient compared to traditional institutions, reducing completion time. Holberton's 2-year in-person curriculum results are positive, with 99% of Holberton School (San Francisco campus) (Bathel, 2019c) students finding an internship or full-time job within three months of graduation. Actually, 78% have found an opportunity before even graduating. Based on these results, Holberton decided to provide a shorter, 1-year program that will be first offered in Holberton Mexico, opening in September 2020. In the US, Holberton's dropout rate is 25%, substantially lower than the 56% dropout rate among US four-year institutions. In Colombia, Holberton's dropout rate is 20%, again considerably lower than the region's dropout rate of 40% among students attending four-year colleges (Fiszbein & Stanton, 2019).



Accessibility Challenge 3: A Lack of Exposure Leads to a Lack of Opportunities

The third accessibility challenge is the lack of exposure, which leads to a lack of opportunities for students: making an education financially and demographically inclusive is not enough if the student is not exposed to it. A student who could be a perfect candidate may not consider an opportunity without inspiring role models (Carter, 2013). When friends, family, and the broader community are excluded from post-secondary education, these role models may be scarce. Industry training is often exclusive. People can remove themselves from the opportunities that higher education could bring, just because they feel they do not belong. A great example is the low number of women and people of color in the high-technology industry. For many, it's hard to envision becoming something they've not seen. As NE-YO, the Grammy Award-winning artist who sits on the Holberton Board of Trustees said, "Kids that grew up where I grew up do not grow up saying things like I want to learn how to code [...] because it's not realistic to them. It becomes real when they see it."



Holberton's Solution 3: Celebrity Collaborators, Role Models, and Inclusive Environments Reach Under-Represented Demographics at Scale

Holberton strives to make their approach to a tuition-deferred high-quality education known by all. NE-YO, the award-winning actor and activist Priyanka Chopra, and legendary songwriter Savan Kotecha are part of the Holberton Board of Trustees. They have used their massive platforms to inspire a diverse student body to join the tech industry. Their efforts have a direct, positive impact. Since NE-YO has joined Holberton, TechCrunch reported that "the number of African-American applicants has doubled from roughly 5% to 11.5%" (Clark, 2018). Holberton highlights diversity by showcasing success stories on their website, blogs, and at their events. This way, potential or current students can find someone who looks like them who have succeeded.



3. The Quality Challenge

The second challenge in the region is the quality of education. In this section, we will further discuss education quality, which is a massive challenge. The first topic we will address is an outdated curriculum, not providing students the skill they need to get a job. The second topic is the lack of soft-skill training. The third and last topic is how knowledge-centered education is no longer relevant.

Quality Challenge 1: Outdated, Impractical Curricula Lead to Mismatch with the Employer Needs

The first challenge is that post-secondary education is outdated and impractical leading to a mismatch with employer requirements. In Latin America most educational programs are not meeting the industry's needs (Fiszbein & Stanton, 2019). In a 2017 survey by ManpowerGroup, more than 35% of employers in Brazil, Costa Rica, Guatemala, Mexico, and Panama reported difficulty in filling positions. In Argentina, Colombia, and Peru, more than 45% of employers experienced a shortage of qualified workers. Lecture-led college curricula – often built around rote memorization – focus too heavily on theory and too lightly on practicality. Curricula are aligned with dynamic employer needs. Instead Colleges follow tradition and chase accreditation requirements that are seldom updated.

Interested and talented people cannot get the training they need for the jobs they want and that industry needs to fill. For instance, in Brazil, only 38% of engineering graduates (Fiszbein & Stanton, 2019) go on to work as engineers because students are not trained to fit businesses' needs. The five countries, including Argentina, Brazil, Guyana, Paraguay, and Suriname, comprise half of the top ten countries where an inadequately trained workforce is a major issue.

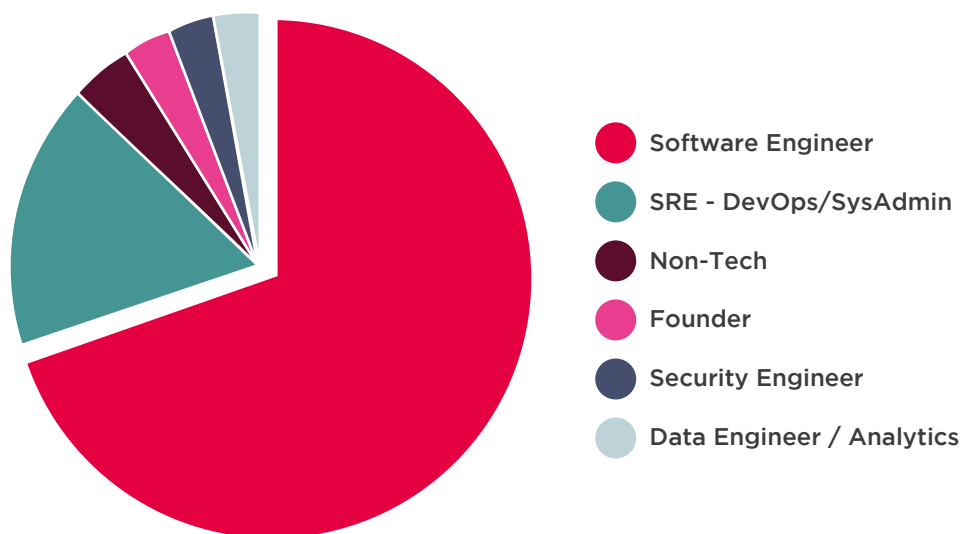


Holberton's Solution: A Curriculum Built in Collaboration with Industry Expert Leads to High-Caliber Jobs

While the vast majority of people – 91% of students (Fishman, 2015) – go to college to improve their employment opportunities, most colleges fail this basic test. More post-secondary institutions must provide educational outputs that train students to succeed in the job market. Holberton's strategy is to provide an education that will not only get students their first job but will prepare them for a long-term successful career. The curriculum is designed and continuously updated in collaboration with industry professionals, such as software engineers, hiring managers, and CTOs to make sure that students learn the hard and soft skills that companies need.

The curriculum is project-based, enabling students to learn by collaboratively completing projects just like in the real working world of technology. The projects start easy and become increasingly more difficult, eventually reaching industry-level complexity. By doing so, they mimic the work that they will do while employed, fitting companies' needs and training students to think creatively. Holberton students are getting hired by the best tech companies, such as Tesla, Apple, LinkedIn, Mercado Libre Rappi, and Google. Only 4% (Figure 4) of Holberton graduates end up working outside the tech industry.

Figure 4. Professional Occupation of Holberton School Graduates



Source: Holberton School, 2019.

Quality Challenge 2: Hard Skills are Meaningless When not Combined with Soft Skills

The second quality challenge is that hard skills are meaningless if they are not combined with soft skills. Soft skills are necessary for today's professionals, yet these critical skills are often overlooked in traditional education models. At best, they may be covered in a lecture but rarely practiced. In the traditional setting, helping a classmate is cheating. In the corporate world, helping a co-worker is collaborating and an essential soft-skill much needed by companies (Charlton, 2019). Top employers like Google have found out that soft skills are among the key characteristic of their top performers (Strauss, 2017). Successful companies nurture teamwork, which is a skill that cannot be taught through lectures.

Soft skills are also critical to get a job. Job interviews are like an exam where the candidate has to convince the employer that they should hire them. Being able to speak clearly about oneself, ask follow-up questions, and maintain eye contact are just a few of the many soft skills that will increase a job applicant's odds of success.

In the era of distributed and remote working, where the workplace will be a mix of in-person and online interaction, the range of soft skills that people need to master is increasing. Work interactions are happening online, via video or text chat, with co-workers living in different time zones. And work colleagues come from different backgrounds, cultures, and countries. It's imperative that 21st century workers are open-minded, flexible, adaptable, and have empathy (Indeed, 2020). The COVID19 pandemic has been dramatically accelerating the trend (Remoters, 2020).



Holberton's Solution: Soft Skills Are the Key Pillar of the Curriculum

Holberton places soft skills at the center of its methodology. At Holberton, students learn by working in groups, developing their ability to collaborate, communicate, and express empathy. In other words, they learn to be team players. Holberton students work on projects in groups of two, five, and 15, effectively mimicking, once more, the real working world. Holberton orchestrates collaboration sessions to guide students on collaborating and working in groups. Collaboration is not always instinctive.

Students also practice public speaking, technical writing, post-task reviews, and other types of enterprise-oriented communications. Holberton's students become not only great software engineers, they support their colleagues in doing a better job. This way, an individual contributor can multiply their value by inspiring and leading others to do their jobs better.

Holberton's hybrid education model, online and offline, also offers students the ability to practice the soft skills that remote working requires. Students are meeting and collaborating via video calls and also communicating via a chat tool (Slack) across a student community involving 16 campuses located on five continents and nine countries.

Holberton not only focuses on the required soft skills to be well at the job, but also on those soft skills demanded to be hired in the first place. During the whole program, students participate in mock interviews that mimic the industry process, which is often not necessarily focused on the hard skills such as coding but rather on the candidate's ability to manage pressure (NSCU, 2020). Students are asked to whiteboard, code, and problem solve in front of someone. They are also questioned why they want to work for the specific company they are applying to (each mock interview is inspired by an actual tech company recruiting process); what are their salary expectations and other usual questions that an interviewer may ask. Students come better prepared for real job interviews after practicing them numerous times with us.



Quality Challenge 3: Knowledge-Focused Education is no Longer Suitable for Most Professionals

The third quality challenge is that the higher-education system in Latin America and the Caribbean faces is that lecture and rote-learning-based education do not prepare students to be good professionals. Centuries ago, the lack of access to knowledge was the main barrier to learning. Scholars in the middle-ages were a tiny part of society, and their work was confined to the literate minority. Up through the 20th century, students had to look up what they needed to know, typically using a card catalog in a library. Today, access to information is no longer an issue. The Internet gives everyone access to more knowledge than we could ever access in the past. As of 2018, Latin America is one of the largest regional online markets with 438 million internet users (Chevalier, 2020). However, the user must navigate this ocean of knowledge: search it, parse it, interpret it, and distinguish truth, lies, and opinions. The phoney fake news phenomenon illustrates the gravity and complexity of the situation (Fitch, 2019).

It is also estimated that 65% of students who enter primary school today will end up in a job that does not yet exist (WEF, 2016). No one knows what the skills of tomorrow will be. While our grandparents and parents may have enjoyed lifelong careers based on one skill set or craft, today that is rare. As we enter the Fourth Industrial Revolution, the pace at which our world is changing is drastically accelerating. Professionals now have to change careers frequently – not just jobs, careers! As former LinkedIn CEO Jeff Weiner said, “historically, the rate of change was much slower, people had plenty of time to retrain and retool to take on these new opportunities, today it’s not the case” (Weiner, 2016). Professionals need to learn continually, not only to grow in their careers but to remain employed. Unfortunately, our current education model is not developing skills that will allow students to become flexible, life-long learners.



Holberton's Solution: A Curriculum that Emphasizes Analysis and Synthesis Turns Students into Lifelong Learners

As Jack Ma stated during a WEF interview, traditional education needs to evolve from teaching knowledge-based topics that are no longer relevant (Barnes, 2018). If you can just look something up on the internet, why would we need to spend such a disproportionate amount of our education to memorize it? It is essential to rethink our education so that students and workers can leverage the power of technology and the internet.

While a traditional education typically provides the answers in a lecture and then tests for retention in an exam, Holberton mimics the professional world and flips the model by providing a problem set, and guidance (but never enough of it) to students in how to solve it. Still, ultimately the students are the ones who need to find the solution: they learn how to become their own teacher. Holberton has no formal teachers and no lectures.

This methodology takes its cue from Progressive Education – putting a strong emphasis on learning by doing, lifelong learning, and the development of critical thinking, problem-solving, and social skills. Following this ideology, Holberton students acquire knowledge and learn to use the tools needed to reach the goal by working on projects in groups. By doing so, they develop learning mechanisms that they can re-use throughout their career. As the saying goes, “Give a man a fish, and you feed him for a day. Teach a man to fish, and you feed him for a lifetime.” The same lesson can be applied to education. Holberton equips students so that they become lifelong learners who can thrive in the Fourth Industrial Revolution.



4. The Scalability Challenge

The last main challenge in the region is the scalability of current education models. The demand for software engineers is growing at a much higher pace than the supply of qualified people entering the workforce, leaving massive skills gaps all over the world. There are roughly 500,000 open computing jobs in the US alone (Code.org, 2020), 756,000 unfilled ICT jobs in Europe (European Commission, 2016), and 450,000 unfilled tech jobs in Latin America (IDC, 2017). While the digitization of our economy was well underway, the COVID19 pandemic has accelerated the trend. The demand is only expected to grow but with a catch: it's not only about hard-skills (Frankiewicz & Chamorro-Premuzic, 2020).

In this section, we will discuss three scalability challenges. First, we will examine why MOOCs did not have the impact that we expected. Then, we will discuss how the traditional education model is not able to scale because of the lack of teachers. Lastly, we will discuss why free education is not feasible for many countries.

Scalability Challenge 1: Massive Open Online Courses (MOOCs) Disproportionately Benefit the Students who Need it Least

The first challenge is that MOOCs (which were predicted to disrupt the education system completely) benefit the students who need it the least. And while they have had a massive positive impact, it falls far short of the early expectations. Where MOOCs have found success is among already highly educated people who are looking to upscale their existing knowledge base and experience.

One of MOOC's main issues is that there are so many unstructured options that students can get confused about which path to take to get the right skills to open the doors for their career of choice. MOOCs work well for disciplined students who are structured and can follow through in front of the computer. Some MOOCs start with 500,000 students, but only 20,000 finish. The MOOC dropout rate can be as high as 96% (Murray, 2019). This is likely due to the ease of enrollment, and it is also an indicator of a lack of support. This lack of support can be an impassable obstacle for students from underserved communities, where more structure is often needed. MOOCs do not offer the same level of guidance as in-person education. Also, MOOCs students do not develop a professional network, which is key to professional success.

Besides content, many MOOCs also fail on student engagement or instructor quality (World Bank, 2018). As humans, we are inherently social animals, so staying alone in front of a computer, as we're required to do with most MOOCs, is not a natural fit for many of us. As universities try to fill their budget shortfalls, leading to tuition increases and college bankruptcies, we face the possibility of further divisions in society. On the one side are the wealthy few privileged to attend an Ivy League college; on the other, the working poor and middle class piecing together MOOCs because they cannot afford an elite education. And this is a best-case scenario. Currently, MOOCs mostly serve a single purpose: they enhance the skills of the skilled.

In the US, data shows that a majority of MOOC users – as high as 80% – already have college degrees (Zhenghao et al, 2015). For BRICS countries (Brazil, Russia, India, China, and South Africa), 5.1% of the population holds tertiary degrees, while 79.4% of MOOC students from the same countries have tertiary degrees.

Holberton's Solution: A Structured Curriculum and a Peer-based, In-person Education Meets the Needs of the Students Who Need It Most

The school admission process and curriculum are designed to accommodate candidates and students who may not have prior knowledge in software engineering and computer science. The curriculum is made of projects, with specific tasks, requirements, and deadlines. That, coupled with the in-person and peer-based education, means that there is always someone to collaborate with and to get help from. This interaction comes at multiple levels: among their peer group, and with senior students from former cohorts who are on-site too (the school has three starting dates per year so that there are always two overlapping cohorts). But they can also work with their classmates in other cities or countries who are all working simultaneously on the same projects. If the student body is not enough, they can get in touch with Holberton Resident Software Engineers, who are available to provide any needed guidance. A significant share of Holberton students lack a tertiary degree. In Colombia, 58% of Holberton students have a college degree, while nearly 48% of them are the first in their family to access post-secondary education. The figures are similar in the US, with 61% and 36%, respectively.



Scalability Challenge 2: There Are Not Enough Qualified Teachers to Reach Every Student Who Wants to Learn

The second scalability challenge is that there are not enough qualified teachers to meet demand relying on traditional education. This gap has a significant impact on economies (Ovanessoff et al., 2018; Business Software Alliance, 2016). Conveniently, the answer sits right on our desktop or even directly in our pocket – a computer or smartphone. However, as we have seen, MOOCs are not the whole answer.

Universities' education relies mostly on academics. There are several problems with this. An academic's main priority is to get grants and write papers. They can get by with mediocre teaching skills because teaching is not incentivized. Besides, professors are often narrowly focused on training more academics. Brilliant tech talent can often make more money in business than academia, and it can be rare to find either great software engineers or great teachers. Recruiting talent is extremely difficult for universities. At many prestigious universities, the PhDs and researchers who had historically served as teachers are now frequently poached by tech companies (Sample, 2017).

Given the scarcity of both software engineers and teachers, imagine how hard it is to find an instructor willing to forego lucrative private-sector salaries to teach software engineering. It is also quite challenging to keep teachers up-to-date on current industry skill requirements. The tech world changes extremely fast, often leaving a massive skills gap between what the academic institution offers and what the enterprise world needs. Even when professors are current on the latest technologies, they still need to choose between spending their time updating their courses and advancing their careers (since excellent teaching takes a back seat to grants and papers).



Holberton's Solution: Innovative Software and a Peer-driven, In-person Curriculum Scale Educational Access without Needing to Scale the Number of Teachers

Holberton education leverages both community and software to overcome the scarcity of qualified teachers at scale.

Holberton's software automatically handles admissions, project delivery, and feedback, and it has assessed about 20,000 candidates with no human subjectivity. The school expanded rapidly in 2019 with five new campuses and is planning to accelerate this expansion. Holberton offers the same curriculum in all locations. Since the correction system assesses each student's project using many data points, Holberton can ensure that every country, school, cohort, and student performance follows international trends so that no countries are treated like second or third tier economies. Today, this correction system analyzes more than 10 million lines of code per week, completing the equivalent work of 600 full-time teachers (Bathel, 2019a). Students get immediate feedback. But automation does not mean that there is no staff; the model requires one software engineer to train 300 students per year. The staff is not here to bestow knowledge, but rather, they help students when they are stuck. They help teach students how to learn.

Another pillar of Holberton's scalability involves students helping students according to a specifically optimized framework to teach life-long learning skills. There is a format for helping peers: starting with providing all the answers is not part of it; providing guidance is. The more students in Holberton's network, the stronger it becomes. The large cohort of peers and overlapping expertise offers advice to all students during training, during their job search, and more broadly, later during their professional careers. The network can be defined in terms of cohorts, cities, and countries. As our professional and social worlds become increasingly global, it becomes increasingly valuable to enjoy a global professional network of peers.



Scalability Challenge 3: “Free” (i.e., government-subsidized) Education is Too Expensive for Many Countries

The third and perhaps most difficult scalability challenge is that free education, often paid by taxpayers, is not feasible for many countries. Education is central for upward mobility in modern society, and therefore should be made available to all citizens with the drive and initiative to advance. In a money-driven world, society must find financing mechanisms to achieve this goal. Free education is ideal, but there is no such thing as free education (Kalache, 2019). Rent, administrative and professional salaries, and operational costs all need to be paid. Governments and institutions offering free educational opportunities fund them through taxes or philanthropic grants. Countries with struggling economies and workforces with low levels of qualified workers can’t afford to subsidize world-class education. We see a continued widening of the gap between “haves” and “have-nots.”



Holberton’s Solution: Align What’s Best for the Students, the School and the Local Economy, and Everyone Wins

The Holberton model operates on a self-sustainable financial model as long as it fulfills its mission to provide quality education to students. With the ISA model, while the education is not free, it is as accessible to students as if it were. With ISAs, students are not affected by tuition prices, regardless of their financial background. This model could be extended to other means of financing. Companies could fund education in exchange for prescribed work commitments. A government could subsidize tuition and see returns on investment based on economic development and taxes paid by the working graduates. The common point to all these models is that when education provides real opportunity for students, a self-reinforcing economic cascade returns and exceeds the initial investment.



Conclusion

The Fourth Industrial Revolution is accelerating change at an unprecedented scale that influences the structures of time-honored institutions. Computers and networks can transport and store incredible amounts of information and unfiltered knowledge. Our education has traditionally attempted to make humans compete and independent stores of information, but as Jack Ma said, “We cannot teach our students to behave like robots, because we are less good than them.” The future of education is about empowering our students and workers to leverage the technology around them. Students need to develop self-learning mechanisms to search and sort the information accessible to them efficiently. Rather than memorizing facts, they need to develop their creativity and critical thinking skills.

We need to place the “learn-by-doing” methodology back at the center of our education. One cannot learn to play tennis by listening to Serena Williams’ class or by reading her book; only practice will suffice. A surgeon is generally not assessed by completing coursework but through hands-on experience and outcomes. In any craft, whether it’s playing tennis, surgery, baking, or software engineering, practice makes perfect.

Progressive education, which came about at the end of the 19th century, is today looking more relevant than ever. It focuses on learning by doing, lifelong learning, and the development of critical thinking, problem-solving, and social skills. Learning something for the sake of it has its place in society, but it is hard to live a life of scholarship and growth if you are poor and unemployed. Getting a job is important for all but the independently wealthy.

Holberton started its journey by using the progressive educational model to train adult software engineers. In the United States, 99% of students were placed in a company within three months of graduation (Bathel, 2019c). Students in Colombia have not finished the program, yet many find jobs before even graduating. For example, a former nurse, who was too stressed at work, became a Huge software engineer. A former breakdancer who could not make the end of month meet got hired in the Mercado Libre machine learning department. A former graphic designer joined the software team of the first Colombia unicorn Rappi (Corrales, n.d.), and Holberton School Colombia co-founder reported version promising salary data for students, above the country’s leading institution (Barreto, 2019).

This education model could be used to learn most any craft, at any age. The Montessori methodology, which employs several progressive educational elements, is a great example. Learning how to learn, at the center of the progressive education model. It is not only useful to a job, it is a state-of-mind that allows citizens to evolve in a fast-changing environment. Holberton summer camp for 15-to-18-year-olds also showed that the model could work for a younger demographic (Kirschner, 2018).

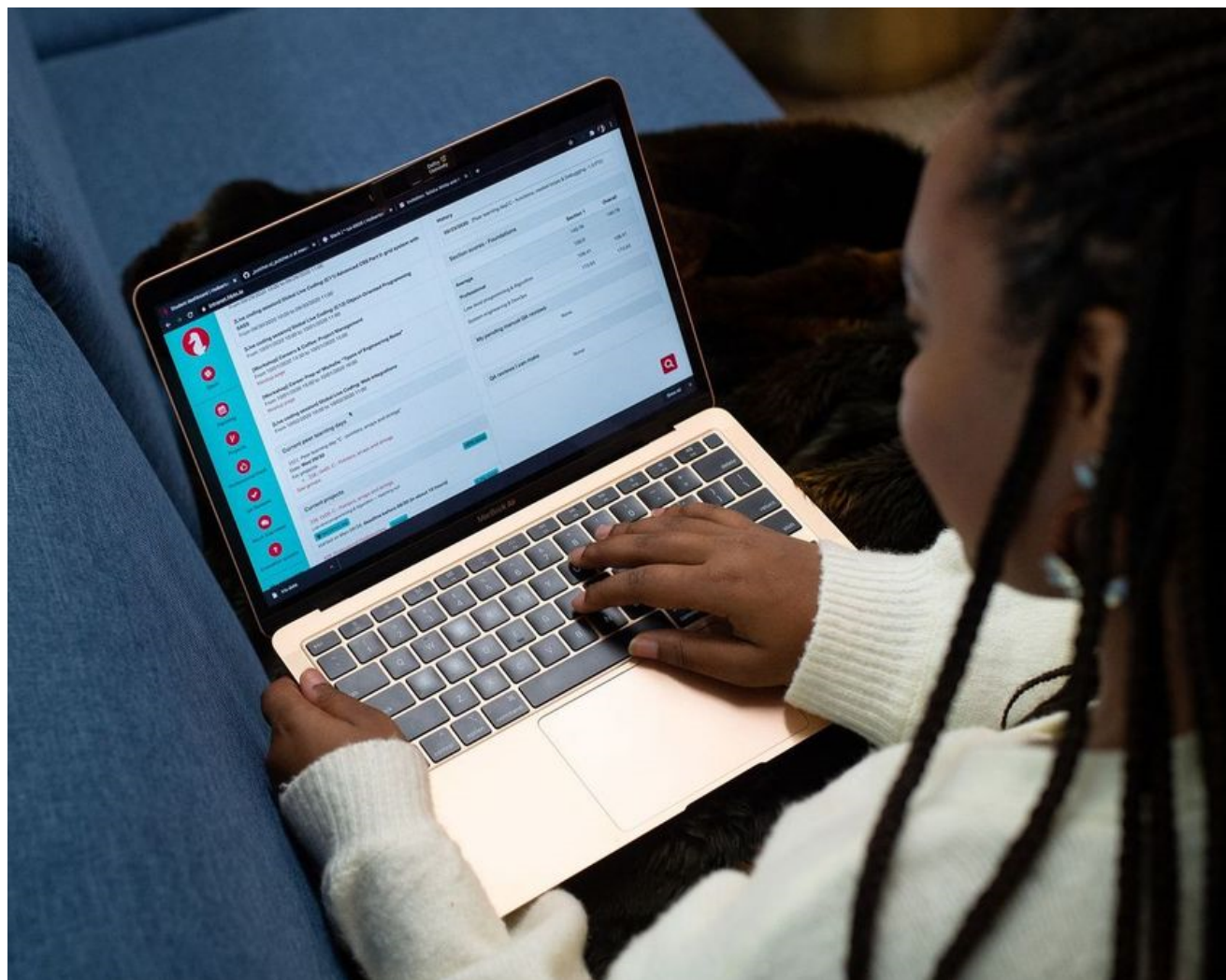
Holberton has started to license its tools, curriculum, and methodology so that other schools and universities can provide students with the same accessible, quality, and scalable education. Our expansion model is based on partnerships with local players to tap into local expertise and ecosystems. For example, our Colombian campuses were founded by education entrepreneurs Andrés and Hernando Barreto, who were already operating software education ventures and knew

that Colombia could benefit from a methodology that could provide quality education at scale. The Bogotá campus was co-financed by Rappi even as they started to build an internal coding Bootcamp to train the tech talent they needed and decided to redirect the funding to Holberton and then hire our graduates.

The Medellín and Cali campuses were, respectively, co-financed by Comfama and Comfandi, two local Family Welfare Funds who wanted Holberton in their community to provide upward social mobility opportunities.

Holberton School Montevideo campus was brought to Uruguay by Zonamerica, a business and technology park with world-class infrastructure and a community of more than 350 companies and 10,000 people, producing 1.8% of Uruguay's GDP. The school will provide the digital talent the companies need.

Education is one of the most critical industries in our society, and it takes a village to make it right. In responding to the Fourth Industrial Revolution, governments, foundations, companies, and existing educational institutions must continue to collaborate to ensure that their citizens have access to education relevant to today's world and economy.



Appendix

Holberton & UN development goals

Holberton impacts are contributing to several UNESCO Sustainable Development Goals (SDGs):

- Quality Education
- Gender Equality
- Decent work and economic growth
- Reduced inequalities



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