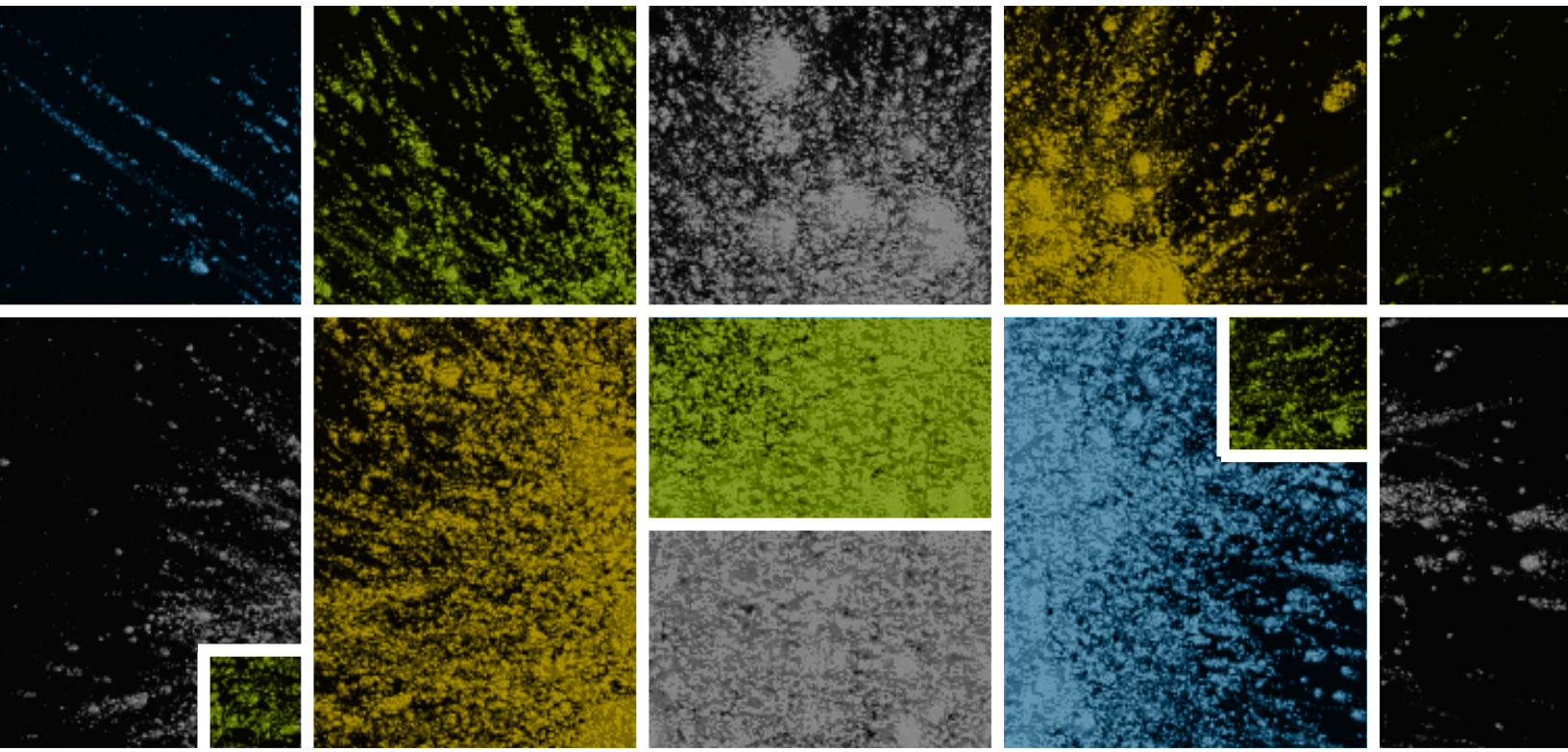
How Do **Disruptive Innovators**

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



LABORATORIA'S AGILE LEARNING MODEL

IDB
Inter-American Development Bank

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About Laboratoria

At Laboratoria, our mission is to empower women who dream of a better future to begin and develop transformative careers in technology. In order to succeed in our mission, we provide a 6-month immersive bootcamp in technical skills (web development,UX-design and Data Analysis) and life skills for women, place our graduates in quality tech jobs, and foster a strong community of alumnae who support each other's growth as future leaders of the tech sector. Our graduates go on to build transformational careers for themselves, while also filling in the wide talent and gender gap in tech that the region is currently facing; contributing to build a more diverse and inclusive industry.

Since our launch in Lima, Peru in 2014, Laboratoria has grown in scale by opening training operations in more countries: Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, México, Panamá, Paraguay and Uruguay. We have trained over 3,300 women, placing 82% of them in tech jobs in Latin America and abroad. We are talent providers for over 1,100 leading businesses, helping them find the technical talent they need while also bringing the diversity that will help their companies build better products. This work contributes to our vision of shaping a more diverse, inclusive and competitive digital economy that opens opportunities for every woman to harness her potential and in this way, transform Latin America's future.

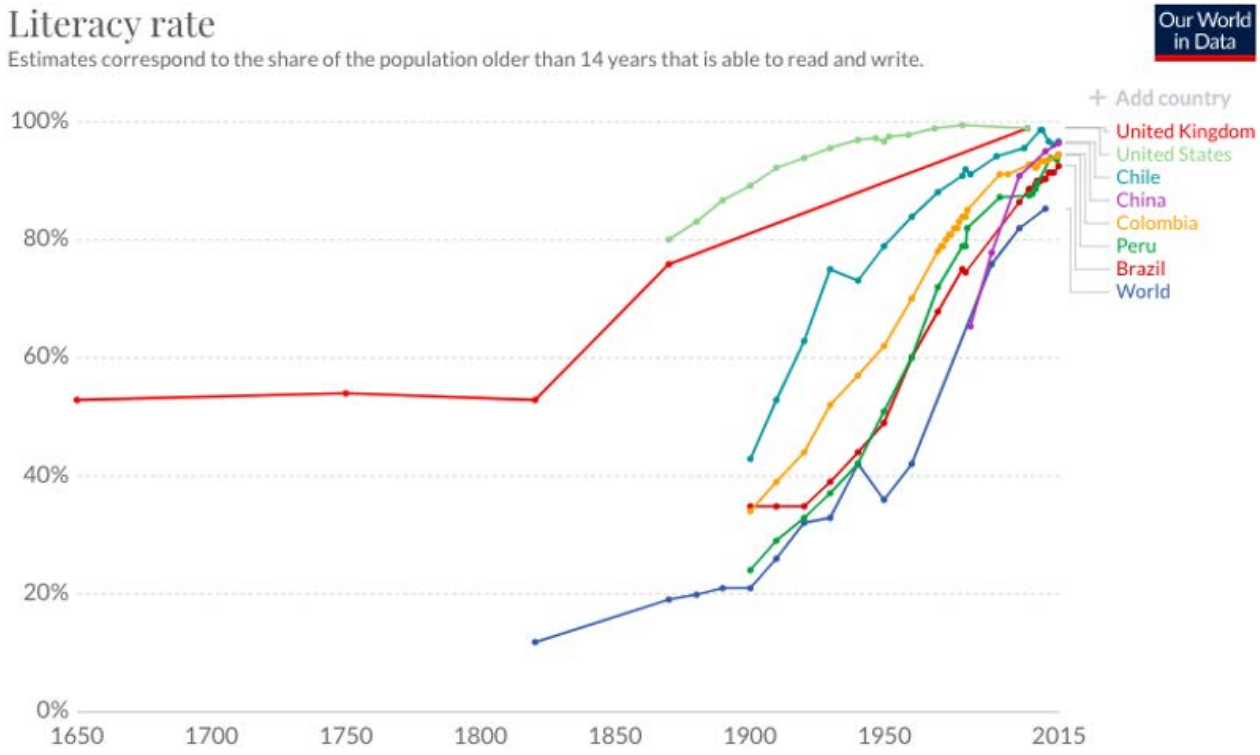
Abstract

In the dynamic landscape of modern education, addressing the diverse needs of students while preparing them for the challenges of the 21st century is a paramount task. Laboratoria, a pioneering social impact organization, has crafted an innovative learning model grounded in agile principles to empower women in Latin America with the skills required for success in the tech industry. This paper offers an insightful exploration of “Laboratoria’s Agile Learning Framework,” unveiling its key components and the transformative impact it has on students.

1. Introduction

Up to the start of the twentieth century, education was a privilege only available to a limited few elites.In the 1900s, only a fifth of the world's population could read and write. Since then, as primary education became a global priority, literacy and schooling rates have steadily increased. Today, more than 85% of the world's population can read and write, and 80% have completed primary education.

Figure 1. Literacy Rate 1800 - 2015



This effort to universalize education began in the context of a crucial phenomenon: the (second) industrial revolution. As the world transitioned from an agrarian economy to an industrial one, factories started to have an insatiable need for semi-skilled workers. States began the audacious goal of providing education to the masses and preparing vast numbers of students for factory work.

To organize and teach children to become factory workers, educators set out to remake the architecture of the entire educational system to conform to the industrial paradigm. Schools replicated factories and **learning was heavily standardized and regulated.** In an unnatural and impersonal manner, students were placed into "grades" based on their age (rather than prior knowledge) and allowed to advance as they master the curriculum at the same rate. The hierarchy was imposed, with the teacher at the helm. Students were disciplined to follow rules and to respect authority. The school system was governed by a bureaucracy that valued standardization and efficiency over students' individual needs. The system offered the same class, the same exam, and the same schedule of activities for all students. It was the ultimate "one-size-fits-all", a model aimed to prepare students for factory work, emphasizing their ability to read manuals and follow instructions.

Indeed, it is evident that schools have undergone relatively minimal transformations. The aforementioned characteristics continue to be prevalent in numerous classrooms worldwide to this day. As professor at the Harvard University Todd Rose writes in his book, The End of Average:

> *Contemporary pundits, politicians, and activists continually suggest that our educational system is broken, when in reality the opposite is true. Over the past century, we have perfected our educational system so that it runs like a well-oiled Taylorist machine, squeezing out every possible drop of efficiency in the service of the goal its architecture was originally designed to fulfill: efficiently ranking students in order to assign them to their proper place in society.*

Yet, while classrooms and education systems have remained somewhat frozen in time, the rest of the world has been uniquely transformed. The industrial economy has been replaced by a knowledge-based economy: a system where knowledge and ideas are more important than land, labor, or even money. More than 60 years ago, Peter F. Drucker coined the term "knowledge worker". In 1969 he wrote:

> *The most valuable assets of a 20th-century company were its production equipment. The most valuable asset of a twenty-first-century institution, whether business or non-business, will be its knowledge workers and their productivity.*

Hence, even though the industrial model was largely responsible for democratizing access to education and for incorporating millions of people into the labor force, it did so with almost complete disregard to people's aspiration for "non-material" fulfillment and their individuality, and has become obsolete to the demands of the age of knowledge-era citizens.

The knowledge-based economy of today has three main features that render the industrial model of education ill-equipped to successfully prepare students for life in the twenty-first century.

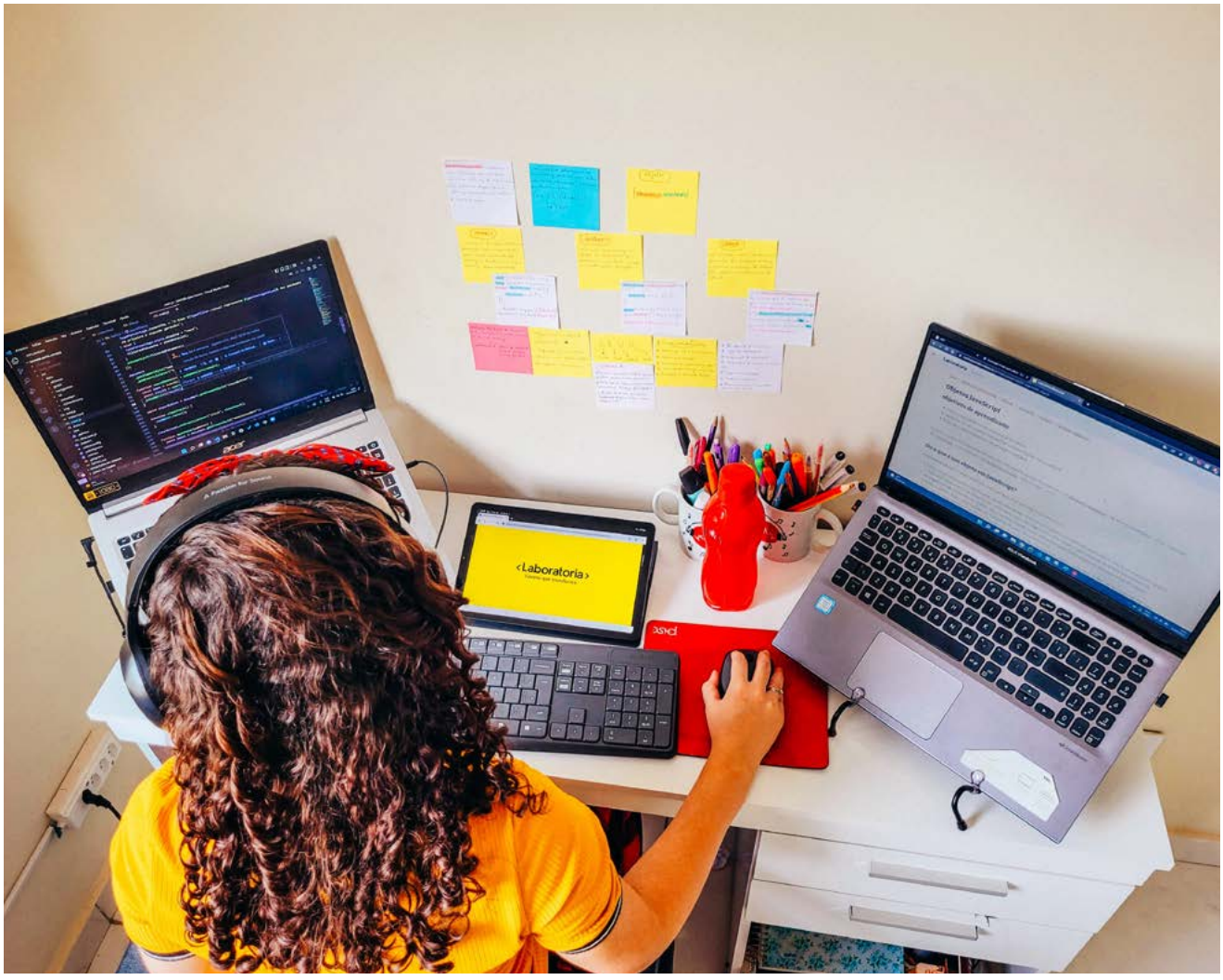
First, the labor market demands a different set of skills. Most of today's work is less about following instructions, and more about finding *new* solutions to *new* problems and being able to successfully navigate uncertainty and ambiguity. Instead of endlessly repeating the same task over and over again, as factory workers did, today's jobs are about testing new ideas constantly, validating hypotheses, and iterating. According to The Future of Jobs Report of The World Economic Forum, published in the 2023 World Economic Forum, analytical thinking and creative thinking remain the most important skills for workers in 2023.

Schools haven't been able to keep up with these changes in the labor market, generating a phenomenon often referred to as the "Skills Gap": while millions of aspiring workers remain unemployed or underemployed, companies across industries and regions find it hard to fill open positions. According to ManPowerGroup's 2020 skills gap report, nearly twice as many companies as there were ten years ago are now unable to find the skills they require. Data from the same Future of Jobs Report by the World Economic Forum cited above shows that six in 10 workers will require training before 2027, but only half of workers are seen to have access to adequate training opportunities today.

Second, with the advent of the Internet—the greatest web of interconnected knowledge ever created—information and content have become commodities. People today have abundant and almost infinite means and tools for learning at their fingertips, 24/7. As a result, the very meaning of knowledge has changed. Knowledge is no longer thought of as 'stuff' created and preserved in books or in the minds of experts. Instead, It is now considered to be more akin to an energy source, something that causes or affects events. As described by the New Zealand Council for Educational Research (2010):

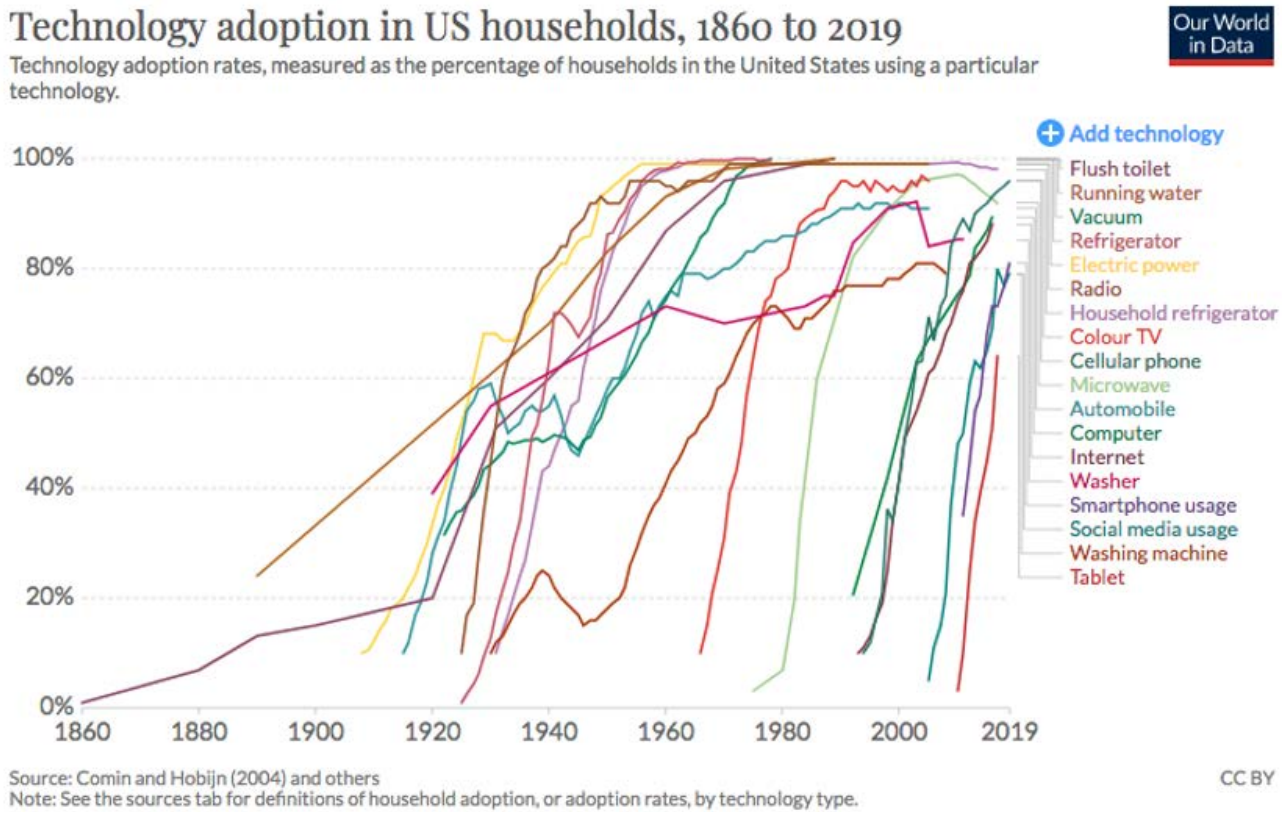
> *Knowledge is defined—and valued—not for what it is, but for what it can do. It is produced, not by individual experts, but by 'collectivising intelligence' – that is, groups of people with complementary expertise who collaborate for specific purposes.*

Third, the pace of change and adoption of new technologies has accelerated. It took almost 60 years for 80% of households in the United States to have a landline. The Internet reached the same milestone in 10 years. This has been driven by several factors, including the increasing availability of powerful computing resources, the rise of cloud computing and AI-powered systems, and the explosion of data-driven insights and analytics. As a result, new technologies are emerging at an unprecedented rate, transforming virtually every industry and aspect of our lives.



One such innovation that has garnered significant attention recently is ChatGPT, a large language model developed by OpenAI. Since its launch in 2020, ChatGPT has been used by millions worldwide, generating over a billion messages per day. In addition, its natural language processing capabilities have made it an invaluable tool for various applications, from customer service to chatbots and virtual assistants. The widespread adoption of ChatGPT and other AI-powered technologies is a testament to the growing role that technology plays in our lives and the potential for these innovations to revolutionize how we live, work, and communicate.

Figure 2. "Technology adoption in US households, 1860 to 2019"



Given this increase in the pace of change, being able to adapt has become more important than ever. Having the emotional flexibility that allows for periodic reinvention is one of the most critical skills for today's workers. In the words of historian and best selling author, Yuval Noah Harari in his book 21 Lessons for the 21st Century:

> *I think the most important thing is to invest in emotional intelligence and mental balance, because the hardest challenges will be psychological... The most important investment that people can make is not to learn a particular skill— "I'll learn how to code computers," or "I will learn Chinese," or something like that. No, the most important investment is really in building this more flexible mind or personality.*

2. Laboratoria's Learning Model

Laboratoria's learning model aims to: i) develop the **cross-sectional skills that twenty-first century jobs demand,** with a special emphasis on continuous learning; and ii) materialize our **guiding principles** around self-directed, non-linear, collaborative learning and individualization. Additionally, given that Labortatoria exists to empower women who dream of a better future to begin and develop a career in technology, our learning model must also allow for students with no previous knowledge or experience in technology to develop the minimally necessary technical and soft skills to start working as Web developers, UX designers or Data Analysts in 6 months or less.

Our experience has taught us that we can reach all of these goalposts by **designing a learning experience that simulates a work environment with an agile culture.** More specifically, we have discovered that the best way to achieve this (as will be demonstrated later in this paper) is to integrate the agile mindset and development practices (ceremonies, events, etc.) into a Project Based Learning (PBL) approach.

3. Laboratoria's "Agile" Learning Framework

a. Simulating an agile work environment

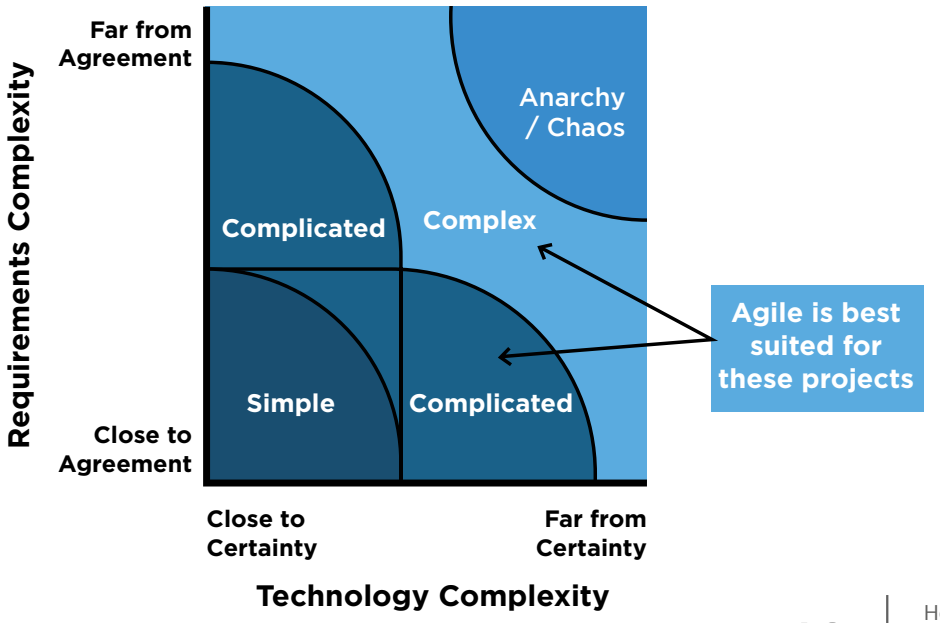
Simulating a work environment does not mean simply acting out role-playing scenarios; that would be erroneous. In order to build a product or service, it is important to collaborate with peers, which requires the development of a variety of skills. Successfully navigating a twenty-first century work environment means following "*a process in which individuals take the initiative, with or without the help of others, in diagnosing their needs, formulating goals, identifying resources for success, choosing and implementing appropriate strategies, and evaluating outcomes*". In other words, the aim is to develop self-directed workers (self-directed learners).

The agile mindset constitutes an ideal paradigm to design a natural and self-directed learning experience.

b. Why agile?

The industrial era also gave rise to the traditional way of working, which is heavily reliant on standardization, planning, and prediction. Making plans and predictions are useful when operating under conditions of certainty. That is, when we know *what* we have to do, and *how* to do it (which, for the most part, is the case of factory work). However, when we need to discover, innovate or build something new, we usually don't know well enough what to do, or how to do it. Often, it's unclear where to even begin. Under these conditions of uncertainty, we are better off following an adaptive approach, and "Agile" is one of them.

Figure 3. Strategic Management and Organizational Dynamic by Ralph D. Stacey. Taken from the book "Agile Software Development with Scrum" by Ken Schwaber.



Agile frameworks recommend working in *short cycles*, called **Sprints,** in which a integral part of the project is advanced, during which all stages of the process occur (multidisciplinary), as opposed to the linear process of independent and successive stages (waterfall) of research, design, implementation, testing, and delivery for the entire project. In this case, we would only deliver something "valuable" at the end of the entire process. The goal is to produce a "Potentially Shippable Product Increment" that can be delivered to the end user at the end of each Sprint. These Sprints allow you to deal much better with uncertainty and changes because they constitute a continuous Plan-Do-Check-Act cycle that allows you to plan, test, fail, learn, and reflect before working on the next cycle.

Agile, however, is more than just efficiency and ongoing improvement in contexts of uncertainty. . This agile mindset also promotes an open culture of respect, collaboration and trust among peers. It allows self-organized teams to work at a sustainable and healthy pace, promoting, therefore, a type of work that is challenging, interesting and worthy.

Learning is an inherently uncertain and non-linear process that requires constant adaptation and iteration, especially when students must take ownership of their learning. Agility promotes our capacity to navigate unknown territories and constantly adapt through an empirical approach to experimentation. Hence, **the agile mindset is, for our students, an instrument for learning and a mindset shift that prepares them for future work.** Furthermore, given that each student adopts different strategies, progresses differently, faces unique challeges, and so on, we (educators) are obliged as a team to adapt and respond to needs of each student individually. For this reason, Agile is, for us—the education team - an instrument for personalized accompaniment and "just-in-time" coaching. Therein lies the importance of Agile for us.

We have named our learning model Laboratoria's "Agile" Learning Framework in homage to Agile, as a response to industrial management practices, and due to its enormous utility in our context. In the following section, we will go into more detail about the model.

C. Key Ceremonies and Events

i) The Sprint

Sprints are fixed-length events that act as a container for all other events, for instance a learning unit, as in Agile software development. Sprints are where all the work is done to help students meet their learning objectives. Immediately following the conclusion of the previous Sprint, a new Sprint begins.

A few guidelines about Sprints at Laboratoria:

- Typically, we plan and execute 1-week Sprints.
- We "shield" the Sprint as much as possible, avoiding interruptions (e.g., chats, guests)
- Sprints are the cycles that determine the work for students and our team, i.e. we all work in synchronized sprints

ii) Sprint Planning

During Sprint Planning, students lay out the work to be performed during the Sprint, and define how the chosen work will get done, by decomposing it into small, prioritized, tasks of one day or less.This event is carried out by the student, with the guidance of the coaching team.

A few considerations:

- Although students bring an inherent bias towards execution, it is critical that they spend the necessary amount of time to plan the Sprint in advance. We should never skip a planning session to “save time”.

- Typically, for the first Sprint of a project, we recommend that students invest time building a paper prototype of the project. This can be in the form of a wireframe or simply a flow chart.

iii) Project Kick-off

The students are required to conduct the Kick-Off ceremony prior to the start of a project. The efficient and strategic development of the project will depend on the success of this ceremony. The project’s goals and scope are defined here, allowing for clearer communication between the parties and the alignment of any shared ideas or goals.

Important considerations:

- Students must comprehend the significance of a kick off because it can be very important in determining the outcome of the project. Transparency and honesty are required, leading to the development of more practical and manageable rules.

- We advise students to pose the following inquiries, among others, to themselves in order to fully understand a situation: What need is being met by this project? What is the answer we are searching for? How can we accomplish these objectives? What part is each person taking in the creation of this project?

- With the answers to the previous questions on hand, the students can elaborate operations and strategies more clearly.

- It is important to keep in mind that unexpected events can take place: what is established in the kick off isn’t necessarily unchangeable. The students must work under this constant flexibility.

A project kick off can prove to be a helpful and valuable starting point for the project’s development as well as for students who must deal with the uncertainty of meeting mostly undefined technical requirements. We can move on to sprint planning to specify the steps they will take on their sprints once we have a clear context and set of goals.

iv) Daily

The students are required to hold daily meetings throughout the sprint in order to define the context for the remainder of the day while always taking the work from the previous day into consideration. We recommend that they share and discuss the problems they have faced so far and ask for help explicitly, providing help where needed, while also visualizing the challenges ahead. This facilitates cooperation within the team and, therefore, their productivity.

Important considerations:

- For the daily, we recommend the following guiding questions:
  - What did I do yesterday?
  - What will I do today?
  - What impediments am I facing in achieving the established goals?

- Carrying this daily ceremony out increases productivity and reinforces the students' commitment to the project.

- This ceremony encourages students on the same team to work continuously, from the technical aspects to the individual strategies they each employ to solve these problems.

- The students should plan and make decisions throughout the ceremony with the sprint objective in mind rather than trying to figure out the problems they are stuck on.

These ongoing daily meetings help students prepare for and take into account the uncertainty of their work without it becoming a barrier, which is beneficial for the project's development both technically and in terms of helping them plan for it. Planning is an important component of the agile framework, but it differs from the traditional model because of the agile methodology's ability to allow for organization-wide adaptation, pivoting, and recalculation.

v) Sprint demo and peer review

The students are required to perform a demo after each sprint, both with their own team and with other teams. Here, they are free to discuss openly how their recently completed sprint is going and get honest feedback. The greatest benefit of the peer review ceremony is that it promotes peer-to-peer learning through both the act of observing one another's work and the act of receiving and providing useful feedback to address the issue the project requires of them.

Important considerations:

- They should ideally display the goals they've met, the ones they haven't, and the challenges they encountered in order to get a complete picture of how this sprint is going.

- Creating a space for questions, feedback, suggestions, and so on, is very important, as this will allow them to obtain valuable information that will improve the final product.

- Constant peer reviewing ensures a collective learning experience, and that the whole team has a real understanding of the project design.

Having a demo at the end of each sprint is very important, because that is the moment where students can harbor a dynamic of collaboration, receiving feedback that will allow them to update their plans and, if necessary, adjust them accordingly. Additionally, both the demo and peer review can provide relevant information for the newly finished sprint retrospective and aid in the planning of the next sprint.

vi) Retrospective

At the end of a sprint, students take a moment to reflect on their work, focusing on "how" we are working and "how" we are progressing, in order to solidify improvements for the next sprint. Furthermore, the students can take advantage of this moment to understand what skill set each team member is working with, therefore allowing them to reorganize their team and continue to improve.

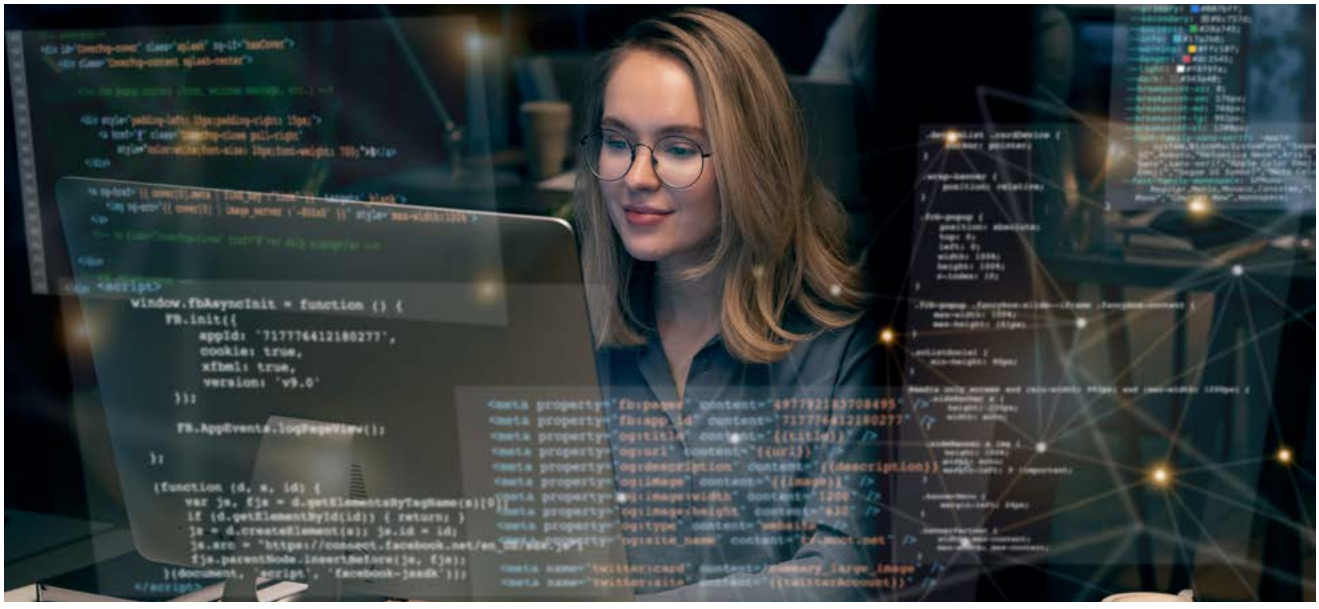
Important considerations:

- Generating a safe space of trust is essential so that every student may feel free to express their opinions.

- For the retrospective, we recommend the following guiding questions:
  - What worked well in the sprint we just finished?
  - What can be improved in the following sprint?
  - What new things can we try out in the following sprint?

- All the reflections generated in the retrospective help the students face the sprint planning in a clearer way, with the objective of implementing those improvements.

Undoubtedly, this ceremony is fundamental for the student's development. With all the information on the table, the students are ready to begin the next sprint's planning and start the whole process all over again.



4.Guiding Principles

Experience has taught us that before focusing on rules, rituals, and ceremonies, we need to articulate a set of guiding principles and values that will ensure consistency and coherence in everything we do.

a. Students take ownership of their learning

> *"At the beginning, I asked myself how I was going to be able to learn something completely new without a teacher. Now I believe that I am capable of learning on my own, as long as I always include feedback and self-evaluation of the progress in my learning goals."*
> ***- Laboratoria student from 2019***

At Laboratoria, each student must be responsible for, and in control of, her own learning process. Our system should aim to be more *pull* and less *push*. This means entrusting and empowering students with decision-making authority. Every decision that *can* be made by the student, *should* be made by the student.

The main obstacle of upholding this principle of ownership is that, for the majority of us, education has been an extremely passive experience. We have been taught and trained *not* to make decisions or plan and evaluate our own learning and growth, relying on teachers and experts who "know the most". We are accustomed to following a standard one-size-fits-all curriculum laid out module by module that needs to be completed in sequence. We must challenge this normative way of thinking.

i) The Role of Educators in the 21st Century 

Given the rising and unmet demand for workers with 21st century skills, the fact that people have unrestricted access to information and knowledge, and the fact that technological change is only accelerating, what should the role of educational institutions be in the 21st century?

Answering this question is not easy because it requires a significant framework shift. As an education organization, we must get out of the center of what we do, moving from an "*I teach*" mindset (with teachers as protagonists) towards an "*I learn*" mindset (with students as protagonists.) Laboratoria's role is *not* to teach. Our role is to design and facilitate a natural learning environment for students to **learn how to learn and become continuous and expert learners.**

This inevitably means breaking free of the "factory school" mindset. John Dewey's book, for example, emphasizes the importance of experiential and hands-on learning, as well as the role of the environment in shaping learning experiences. His book "Experience and Education" explores the idea of learning through experience and advocates for a learner-centered approach to education. It entails letting go of one-size-fits-all standardization and putting each and every student at the center, with all their particularities and individualities. It means understanding that facilitating the growth of skills and competencies that enable students to adapt and learn independently has much more value than merely "transferring knowledge." In other words, rather than learning for the sake of getting an accreditation, students must have the self-directed drive to keep learning.

ii) Metacognition 

In a learning context, metacognition is what enables learners to monitor and regulate their cognitive processes. A useful metaphor is thinking of it as a skill that allows students to "drive" their brain and make learning more effective. When students engage in metacognitive activities, they take ownership and become self-directed learners. In the words of the authors of How Learning Works, Ambrose et al:

> *To become self-directed learners, students must learn to assess the demands of the task, evaluate their own knowledge and skills, plan their approach, monitor their progress, and adjust their strategies as needed.*

A learning environment that fosters metacognition is one that allows and encourages students to assess the task at hand as well as plan, monitor and evaluate their learning process. Assessing the task at hand involves having a clear picture of what needs to be accomplished and evaluating one's strengths and weaknesses. Planning involves the selection of appropriate strategies and the allocation of resources based on the initial assessment. This includes specific activities like goal setting, time management and activating relevant prior knowledge. Monitoring includes self-assessments, gathering feedback and collecting diverse measures of progress. Evaluation refers to the processes by which students reflect on the degree to which their approach and strategies are working, in order to identify ways to improve.

iii) Growth Mindset 

Just a few decades ago, scientists thought that a mature brain was "static" and thus incapable of changing. Today we know that our brains and nervous systems constantly change in form and function until we die (neuroplasticity). When we learn something new, our brains change, we make new connections and build new neural pathways that enhance our capabilities. This means that shaping our intellectual abilities lies, to a large extent, within our control.

Understanding and believing that we can grow our intellectual ability is crucial for students to **take ownership and become lifelong learners**. The study "Brainology: Transforming Students' Motivation to Learn" from psychologist Carol Dweck has shown how large an impact this conviction can have on learning and performance. According to Dweck's research, those who have a "fixed mindset," or who think that, like the color of their eyes, their intellectual ability is also hard-wired into their genes and immutable, tend to shy away from challenges and see failure as something that defines them. On the contrary, people with a "growth mindset", who believe that they can change their brain through effort, strategy and the help of others, are more likely to stretch themselves out of their comfort zone and view failure as a sign of effort, and as an essential element for learning and growing. In short, attitude counts for a lot. As the authors of the book "Make it Stick" (Brown, add year) have stated, the work of Carol Dweck goes a long way toward validating the maxim: "*Whether you think you can, or you think you can't, you are probably right.*"

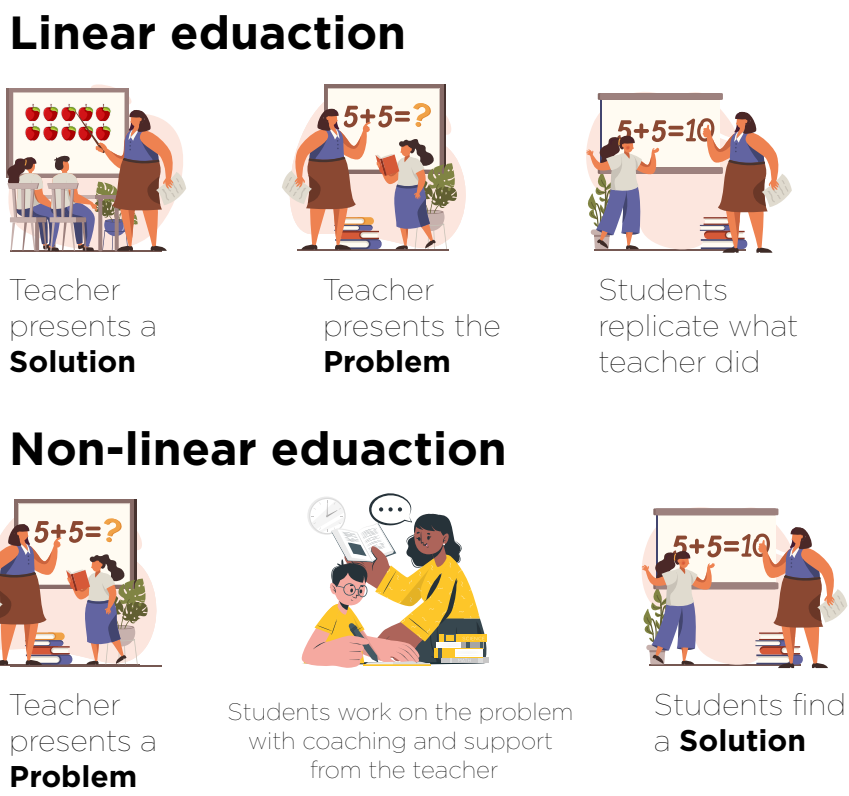
Students are poor judges of when they are learning well and when they are not, and they frequently misinterpret the ups and downs of effortful learning as a sign of poor performance. This presents a challenge for embracing effortful learning (the cognitive struggle of a non-linear learning process) as a design principle.

A recent study called “Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom” from researchers at the Harvard University shows how this takes place. An introductory physics class taught using two distinct methods, compared students’ self-reported perception of learning with their actual learning under controlled conditions. i) traditional lectures (easy learning), and ii) active learning (more effortful and in-depth learning), where lectures were enhanced with frequent physics demonstrations, along with occasional interactive quizzes, conceptual questions, and group work.

According to the findings, although students in an active, hard-working classroom learn more, they believe they are learning less. Additionally, the cognitive fluency (and easier way) of traditional lectures can mislead students to think that they are learning more than they actually are.

b. Learning is not linear

Figure 4. Non-linear education



There are many misunderstandings surrounding what constitutes effective learning. The least effective learning techniques include rereading texts and studying in a hurry before exams. While reading, underlining doesn’t really help either. Furthermore, there is no empirical evidence to back up the idea that learning occurs more effectively when instruction is delivered in a way that suits the student’s preferred learning style. But one of the most pervasive misconceptions is that we assist students by making learning easier. Recent advances in learning sciences have turned this notion on its head: when learning is more difficult, it is stronger and more durable, as highlighted in the aforementioned Harvard University study, as the authors of “Make It Stick” write: “Learning is deeper and more durable when it’s effortful.” Learning that’s easy is like writing in sand, here today and

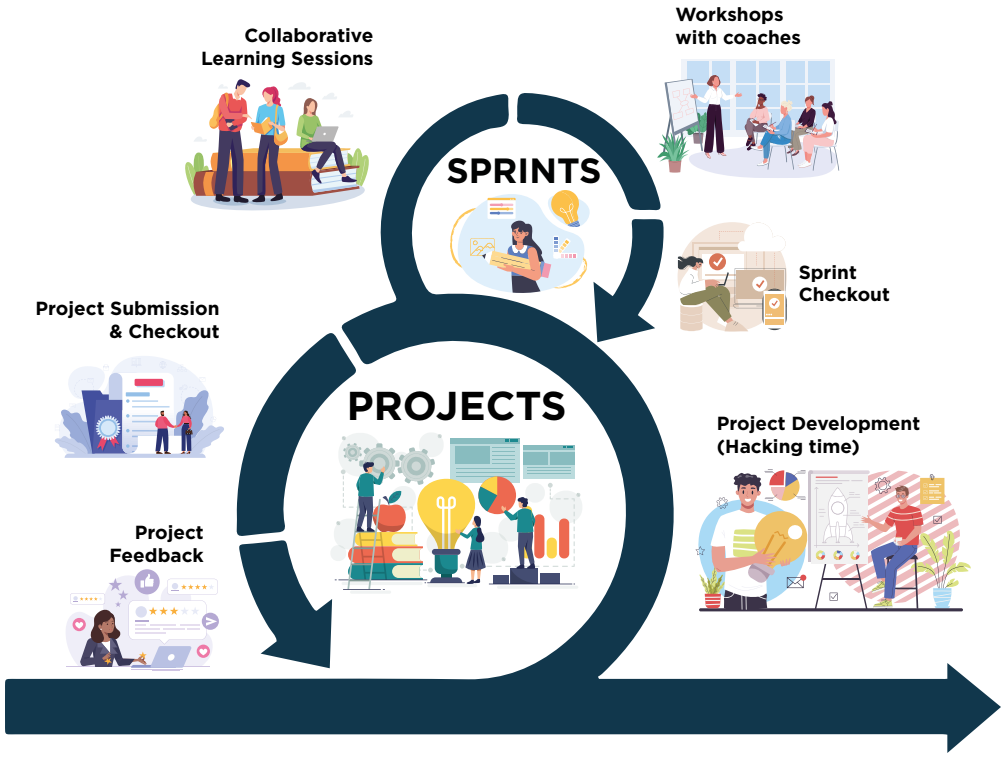
gone tomorrow". In 1994, psychology professor at UCLA, Robert A. Bjork, coined the term desirable difficulty precisely to explain that although a difficult (yet achievable) task may initially slow down learning, it actually improves long-term performance.

By teaching students the solution before presenting the problem, traditional education is infamous for trying to make learning easier. Students are taught to mechanically apply a prepackaged set of information to solve a predefined problem in a traditional and linear educational setting. After presenting a solution to a problem, teachers ask students to copy it. Everyone is aware that this is not how life actually functions. The problem always comes first outside of the classroom, forcing us to find a solution with limited prior knowledge. It is a considerably more difficult and inherently nonlinear process.

i) Project-based learning

At a macro level, the learning experience at Laboratoria **simulates a work environment with an agile culture**. We do this by incorporating agile practices and ceremonies into a Project Based Learning (PBL) approach. This means students learn by completing projects and working through each project in a series of Sprints (a time-boxed period of usually one week), with specific reflection ceremonies and rituals as part of each Sprint.

Figure 5. Project Based Learning



We have found that project-based learning in particular posits a great way to materialize our guiding principles.

Complex, real-world problems that enable students to think and act like subject-matter experts are the best vehicles for learning because they guide instruction and promote understanding. The content (subject, theory, knowledge) is learned through activities that help to solve problems and not by "packages" of information organized and presented by instructors. The instructor's role changes from providing and structuring information and knowledge through lectures and presentations, to modeling, coaching, and providing the necessary support for learners to use the information and create knowledge to solve problems in context and in real life

These "complex and realistic problems" are the projects of our curricula. Students learn as a result of working on, and eventually successfully completing, these projects; not the other way around. It is through these projects that students develop their socio-emotional and technical skills. Through this experience, students learn to work collaboratively and to deal with the insecurity, frustration and fear of missing deadlines. They ultimately learn to understand and trust their own abilities and talents.

Studies of how memory and learning work have proven that trying to solve a problem before being given the solution leads to better learning, even when (or perhaps especially when) errors are made. The generation effect is what's known as this. In contrast to passively receiving or reviewing information, actively creating or retrieving information from memory improves long-term retention, according to Dr. Henry L. Roediger III. In other words, students are more likely to retain information when they actively participate in the process of recalling or creating it. In essence, we learn better when we take charge of our education and work things out on our own.

ii) Project Feedback

After several rounds of sprints, the student must decide when to "let go" of a project. This does not necessarily mean that the project is complete or fully functional, but it must meet the objectives that were established both initially and after each sprint. In order to have a clear picture of the objectives that have been achieved, it's important to have a project feedback session, where students will engage in a full revision of what they have learned and the progress that has taken place, alongside a more experienced person (coach). This event is crucial because it provides the best opportunity for students to visualize the progression of their learning curve, allowing them to determine where they should concentrate their efforts on future projects.

Important considerations:

- In order to have a clearer perspective on the objectives that have been achieved, we recommend answering three questions regarding the solutions that have been proposed:

  - Do I understand what it is, what it does, what its context is, and how it is supposed to work?
  - Is what I did in this project clear to me, and can I explain it in my own words?
  - Could I do it again, on my own, from the ground up, in a different context or project?

- Before the project feedback session takes place, we recommend that each student self-evaluates their performance based on their learning objectives, as well as conducting an evaluation with a partner. This will give them a better perspective and will increase their autonomy when making use of this practice as a constant element of their work.

- The focus must always lie in learning over completion: the point is to know what is working well and what they must focus on for future projects.

The feedback session for each project is an excelent way to complete the cycle it represents. Everything that occurred isn't left behind with the previous sprint, but rather it is revised, and it aids the students in defining new objectives or simply reorganizing the ones that had already been established.

iii) Personal development 1:1

Throughout their projects, our students also continue to work on the development of their professional skills, which play a fundamental role in becoming a well-rounded professional in the tech industry.

These projects not only encompass technical requirements, but they also include learning objectives related to communication, teamwork, professionalism and other life skills.

In order to carry out the entire personal development process, two fundamental pillars must take the limelight: **self-knowledge** and a **growth mindset,** which function as the base for all other soft skills.

Important considerations:

- Life skills are usually the hardest and they take the longest to develop, but everyone has the capacity to develop them.
- Time management, navigating uncertainty, making unwarranted comparisons, and effective communication are some of the abilities that need improvement.
- All of this personal development is focused on generating the necessary tools that the student will need to make use of in a real workplace environment.
- This development always takes place alongside and guided by their team, in a long and in-depth process.
- We must never forget that every student has different skills and different skill levels. Getting to know them and supporting them within that individuality is a key element in the proper development of their soft skills.

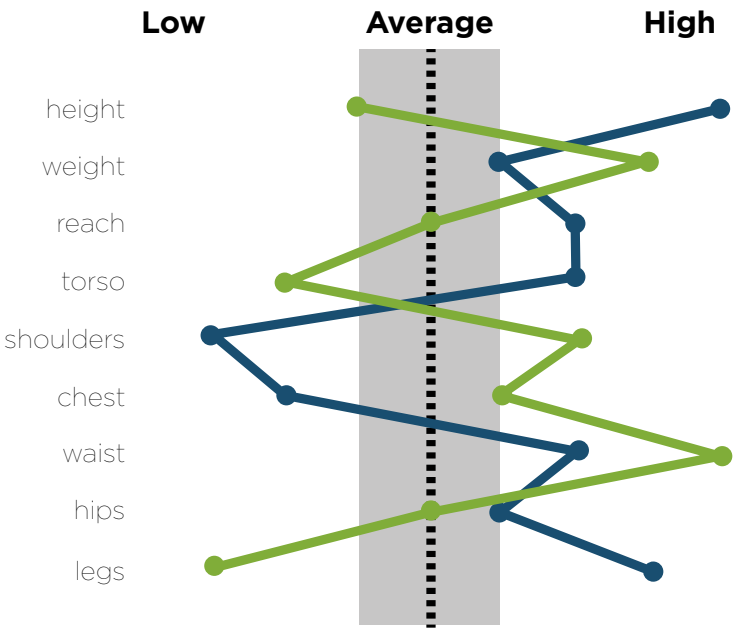
c. We value and respect individuality

> *"I learned many things about programming, but I also became very aware of my learning processes, my cycles of handling uncertainty, and my internal reactions when I was projecting myself to my team."*
> ***- Laboratoria student (from which year?)***

One of the main spokespersons for individuality is researcher and professor Todd Rose at the Harvard University. In his book, "The End of the Average" (2016), he explains that "*any system designed around the average person is doomed to fail*" and encourages the environments (work, school, etc.) to be the ones who adapt to individuals, not the other way around.

In both his book and his TED talk, Rose tells the story of Lieutenant Gilbert S. Daniels, who worked on the redesign of the American Air Force's airplane cockpit in the 1950s. Until that time, the cockpit had been designed around the average size of the pilots, under the assumption that a cockpit designed for the dimensions of the 'average pilot' would make the best fit for most people. Daniels' contribution was to demonstrate how wrong such thinking is. By taking measurements in different body dimensions of over 4,000 pilots, he realized that absolutely none of them fit the 'average pilot'. That is, no pilot was average in all the different dimensions. "If you've designed a cabin to fit the average pilot," Daniels concludes, "you've actually designed it to fit... nobody." Daniels' work changed the design paradigm in the Air Force and led to the development of a flexible cockpit, which can be altered to fit the dimensions of each person with the use of, for example, adjustable chairs.

Figure 5. Actual pilots' measurements compared to the average. | L. Todd Rose, TEDTalk: "The Myth of Average".



The great lesson of it all: the average person does not exist. Therefore, we must not offer a standard and inflexible learning process for all our students. The industrial education model, based on standardization, defined according to the characteristics of the average student, is precisely the antithesis of what we are looking for.

Our learning experience needs to be adapted to the individuality of each student. It is the system that must adjust, not the student. This individuality manifests itself in different ways. First, ability and talent (in the same way as body dimensions) are multi-dimensional qualities. Therefore, there is no one student who is more talented or capable, on a general level, than another. Each student has talents, skills, and abilities in several different dimensions, which we cannot group, summarize or standardize into a single indicator. Secondly, each student has a particular context and history. A student's behaviors always occur within the frame of her unique context. As a result, each student has a unique learning path and pace.

Our aim is to offer a learning model equivalent to the 'adjustable chair', in which each student can 'adjust' the 'levers' and find the configuration that best suits her, based on her talents, context and her particular way and pace of learning. We pursue a learning experience design which facilitates this self-adjust process by removing barriers at all levels.

i) How do we apply it in our bootcamp?

Considering our "adjustable chair" analogy, Laboratoria is looking to create programs with a certain degree of customization, so our students can define the depth they wish to take on for each project.

We have established three levels of completion:

1. Minimum Viable Project (MVP): This deliverable encompasses only the essential learning objectives for a project. It's easier and shorter, but seeks to ensure that the students have the basic knowledge they need to move on to the next project. This level is only recommended for students in special situations that are unable to dedicate as much time to the program as they ideally would, because it isn't considered an optimal learning experience.

2. Base Project (BP): This is the base project which includes all the necessary learning objectives to develop the technical skills at the expected Laboratoria level. The majority of students complete their projects under this level of depth. The entire learning experience, from the ceremonies to team support, is designed so that most students can complete every base project in the program.

3. Hacker Edition (HE): Advanced students have the option to explore more advanced learning objectives in an extension of the project if they have completed their base projects earlier than usual.

This project structure allows students to move at their own pace and complete projects according to their skill level and time availability *(self-paced)*. However, this doesn't mean that each student can deliver their project or finish their program whenever they deem convenient. On the contrary, each project and program has a clear set of deadlines *(time-bound)*.

d. Community

> *"Those who have a strong sense of love and belonging have the courage to be imperfect."*
> ***Brené Brown***

In traditional education, most courses are designed in such a way that students are meant to compete individually against one another. Exams, tasks and projects are created to measure individual performance and do not foster cooperation. This is very different from a standard workplace setting, where employees often work together to achieve a common goal. In fact, according to a study developed by Gallup (2020), which collects data on well-being and various social and economic indicators across countries, a market research corporation, 87% of workers on a global scale claim they work in a team on a regular basis.

Collaboration is important not only because employers are demanding it as a basic skill, but also because it makes the employee's work easier as well. A study conducted by McKinsey consulting (2019) found that workers spend around 20% of their time looking for internal information or contacts to help them fulfill their tasks. In this respect, the ability to collaborate and share information with others has become a fundamental part of workplace success. This is placed in contrast to the predominant practice of treating knowledge as something personal that must not be shared or copied, as seen in traditional education.

Even more relevant than professional positioning, is the fact that learning is more effective when it's communal. We learn more and better when social accountability is present. Just being with other people in a synchronized environment where we can see how others advance within their own projects is enough to move us to advance accordingly, and not get left behind. In a study published by the Journal of the Learnings Sciences (2006), they found that social accountability can improve students' learning capacity and performance.

People want to feel like they belong to something bigger than themselves. This sense of belonging and community is particularly crucial for empowering women in their educational journey. Laboratoria, recognizing the significance of fostering a supportive environment, has taken a focused approach by targeting women. By creating an all-female space, Laboratoria not only acknowledges the unique challenges women may face but also underscores the immense value of learning within such a community.

In our programs, we have witnessed a powerful correlation between this feeling of community and dropout rates. The stronger the bond that develops among classmates, the lower the likelihood of participants deserting the program. The impact of community-based learning is further emphasized by research conducted by the University of California, revealing that students engaged in learning communities boast an impressive retention rate of 91%, in stark contrast to the 71% retention rate among those not involved in such supportive activities.

In light of these insights, it becomes evident that learning within a community can serve as a highly effective approach to skill and knowledge acquisition in today's complex landscape. Collaboration, the seamless exchange of information across diverse teams, social accountability, and the profound sense of belonging that an all-female space provides can collectively emerge as pivotal factors in driving success both in the learning environment and the professional realm.

i) Learning Squads

At Laboratoria, we organize students into squads of 6-8 women who work together to develop the required skills in a learning cycle. In order to achieve this goal, the students must work with their teams in practical exercises for the course. Whether the projects are carried out individually, in pairs, or in groups of three, the students share a virtual space and work alongside one another. In this way, we promote learning between peers. Students know the workflow they must follow when they have a question:

1. Look up the answer by themselves on the internet or in course contents
2. Ask your project partner
3. Ask your team partners
4. Ask the guide or coach

This incentivizes self-learning and independence for the student who has a question, but also reinforces the knowledge of their supporting partner. This also clears some space for the coach to answer only those questions that the entire team cannot solve.

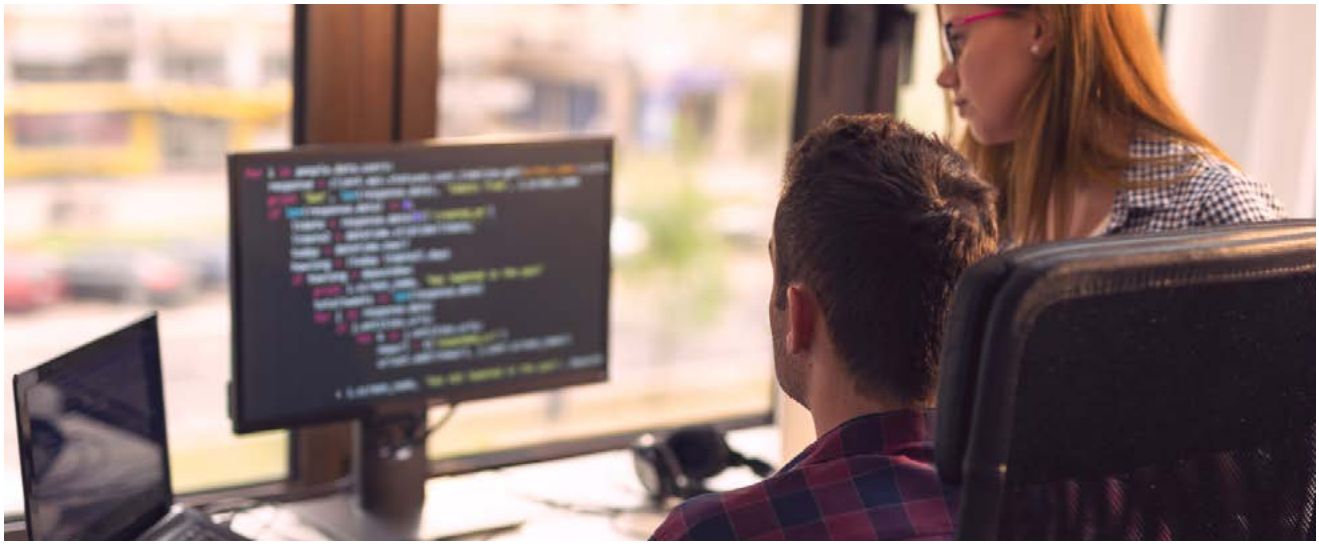
5. Challenges and opportunities

After a couple of years of solid results, with more than 3,300 women trained at Laboratoria's bootcamps, we feel confident that our learning model, even if it is improving continuously, is transforming the lives of thousands of women and changing the face of the tech sector. This success is a testament to the efficacy of Laboratoria's agile learning framework, which provides a flexible and self-paced approach to learning.

As of today, over 1,100 companies across the continent have hired graduates from Laboratoria, offering salaries that average $980 since 2020. Overall, female graduates from Laboratoria achieve a salary increase of 3.8 times, considering those who had a salary before the bootcamp. Laboratoria's impact goes beyond the employability and financial empowerment that graduates experience. There are several different mechanisms through which Laboratoria ignites change. We could think of Laboratoria's bootcamp impact on three different layers or dimensions: the individual level, the labor market level and the societal level.

This is achieved, in part, thanks to Laboratoria's payment model, which is designed to make education in the technology field accessible and affordable. Students at Laboratoria begin paying for their education only after they have secured a job in the technology sector. They are provided with up to two years to complete their payments, and the amount they owe is calculated as a percentage of the total program cost. This innovative approach ensures that students can pursue their dreams of a career in technology without the immediate burden of tuition fees. It aligns their financial commitment with their career success, making quality tech education more inclusive and equitable.

We firmly believe that our self-paced model strengthens our impact and the potential to create even more opportunities for women given the diversity of our student body, their backgrounds, and levels of experience. However, implementing such a model comes with its own set of challenges and opportunities.

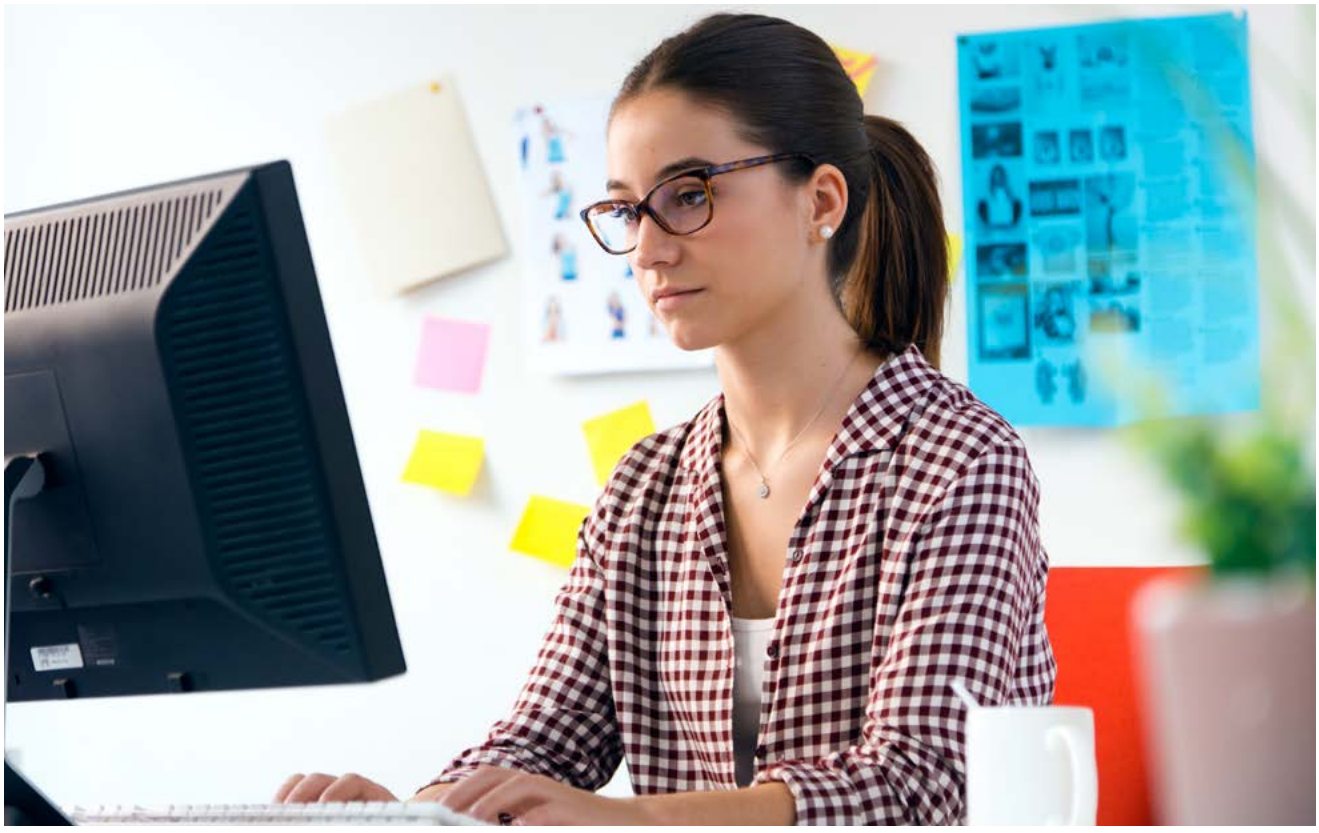


One challenge lies in ensuring effective guidance and mentorship for our students while still promoting their autonomy. To address this, Laboratoria must invest in tools and technology that empower our team to provide the necessary guidance tailored to each student's needs. Artificial intelligence (AI) can play a crucial role in assisting mentors and providing personalized support to students throughout their learning journey. AI-powered systems can analyze student progress, identify areas where additional guidance may be required, and offer targeted resources and feedback.

Another challenge we face is scaling our operations without compromising the quality and essence of what makes Laboratoria unique. Our safe space, characterized by a culture of sorority, teamwork, and caring feedback, is fundamental to our bootcamp's transformative nature. As we expand, we must ensure that this culture is maintained and nurtured, creating an environment where women feel empowered to learn, grow, and support one another.

Flexibility is key to staying relevant in a rapidly evolving tech industry. Our learning model and curriculum must be adaptable to changes in technology and industry demands, ensuring that our students are equipped with the most updated and relevant skills. By integrating AI and leveraging data analytics, Laboratoria can stay agile and responsive to industry's trends, continuously refining the curriculum to provide the most valuable learning experiences for our students.

In conclusion, Laboratoria's agile learning framework presents both challenges and opportunities. Through strategic investment in technology, maintaining our unique culture, and staying flexible in our approach, we can overcome these challenges and continue to empower women, transform lives, and shape the future of the tech sector. AI can be a valuable ally in supporting our efforts and enhancing the learning experience for our students.



6. Concluding remarks

In conclusion, Laboratoria's Agile Learning Model offers a comprehensive approach to address the skill gap and promote diversity in the tech industry. Through a combination of hands-on training, coaching, and job placement support, Laboratoria has successfully trained and placed thousands of women in high-demand tech jobs.

Laboratoria's guiding principles of empathy, collaboration and continuous learning provide a strong foundation for the Agile Learning Model. This approach has allowed Laboratoria to remain flexible and adaptable to the needs of its students and the ever-changing tech landscape.

Overall, through its Agile Learning Model, Laboratoria provides a scalable and personalized approach to tech education that has shown great success in training women who have no previous experience or knowledge in this area.

However, in order for the experience to be both scalable and personalized, it is necessary to constantly invest in technology and data analysis. This is the only way to ensure that students will continue to learn according to Laboratoria's principles, while also feeling guided in their work. The team must also be aware of progress and blockages in order to intervene in the best possible way. These developments should also be communicated in a transparent and assertive way, considering that part of the learning-model success is based on the students' autonomy and empowerment of their progress.

By continuing to innovate and invest in technology, Laboratoria can further scale its impact and continue to promote diversity and inclusion in the tech industry.

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