

# Study of Social Entrepreneurship and Innovation Ecosystems in the Latin American Pacific Alliance Countries

Case Study: Lab4U, Chile

Fundación Ecología y Desarrollo

Office of the Multilateral  
Investment Fund

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Isidro Lagos, Product Owner & Co-founder Lab4U  
Alvaro Peralta, Lead Engineer & Co-founder Lab4U  
Victoria Corti, COO Lab4U  
Felipe Merino, Enseña Chile  
Matías Rojas, Socialab  
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## 1. Introduction

<b>Name: Lab4U</b>	
Description	Lab4U delivers low cost learning solutions transforming smartphones into laboratory instruments, which enable students to undertake practical science experiments with their phones and help increase their scientific literacy.
Founded	2013 in Santiago, Chile and in 2015 a parent company was founded in Delaware, USA.
Legal format	Limited company in Chile and private company in the US, (C-corporation).
Num. employees/volunteers	12 in Chile, 2 in USA, 2 interns & 1 volunteer in USA.
Geographical reach	Chile and USA.
Certifications/ awards	Latin American Intel Innovation Award and Global Intel Innovation Award (2014), Gartner Cool Vendor in Education (2015).
<b>Social innovation variables</b>	
1. Innovation type	Lab4U's products are radical innovations that differ from the existing science education mobile learning solutions, which require expensive hardware or software.
2. Social impact	Although still in its early stage, in 2 years since registering the company, Lab4U has achieved significant financial and technical support from a diverse set of players in Chile and the US. 3,000 students have experienced Lab4Physics so far.
3. Financial sustainability	Lab4U operates a Freemium model. The apps are free to download for a 45-day trial, after which the school purchases a monthly subscription at 9.99 USD per student.
4. Key Partners and Support ecosystem players	Government of Chile, private investors and incubators in Chile and the US have been key supporters in the early stages and now schools networks and distributors will play a key role.
5. Scalability and Replicability	The global m-learning market provides huge opportunity for scale. Lab4U predicts that 70% of its market will be from the US, 20% from MENA countries and 10% from Chile.
References	<a href="http://www.lab4u.co">www.lab4u.co</a>

## 2. Local Social Issue and the Challenge

The key challenge that LAB4U addresses is the low scientific literacy<sup>1</sup> rate in Chile and subsequently in Latin America as a region and the US. In the US there are 4,019 scientists for every million inhabitants, in China 1,036, in Latin America there are on average 546 and in Chile only 391.<sup>2</sup> This is due in great part to the lack of decent science laboratories, given the expense of purchasing laboratory equipment. In Latin American countries 88% of schools do not have a science lab (IDB, 2012).

### **Poor quality science education**

An additional challenge is the fact that when the schools do have a science lab, they are generally poorly equipped and teachers often don't have the adequate training to use the resources available effectively. In Chile students receive 1,700 hours of science lessons per year, compared to an average of 700 in other OECD countries. The long class times result in less time for teachers to plan classes, design experiments, or prepare teaching material adequately. The Physics curriculum in particular is lengthy, heavily focused on theory and therefore challenging both for teachers and students. As a consequence of the lack of or inadequate infrastructure, in addition teachers don't have the tools to teach science effectively and are restricted to teaching science through theory alone. There are limited opportunities for carrying out an experiment in class so the students become disengaged and unmotivated with very little curiosity for discovery.

*"Science education is boring because there's no practical experience. It's like learning how to ride a bike with a book. To learn science you need to live the experience, but this requires equipment that unfortunately is expensive," Komal Dadlani, founder of Lab4U. The situation in Chilean Universities is not much better as Komal recalls from her experience as a biochemistry student in one of Chile's best public Universities; "We had one spectrometer for a large group of students, and in the end one student would end up using it, so where was the learning for the rest of us?"*

### **Lack of access to STEM education**

A related challenge is the lack of access to the interdisciplinary and applied approach to teaching science, technology, engineering and mathematics (STEM education) worldwide, with only 1 in 10 teachers in the US having a science degree. This results again in low motivation levels and few students go on to study science at University level. According to UNESCO for a country to meet the basic needs of its people, the teaching of science is a strategic imperative.

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<sup>1</sup> The OECD PISA Framework (2015) defines scientific literacy as "*the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen.*"

<sup>2</sup> Researchers in R&D per million inhabitants: classified as professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned.

<http://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6>

## 2. The solution and social impact

Lab4U's mission is to develop holistic science education solutions that can be easily adopted and create effective, long-term scientific learning. The company aims to democratize the lab experience at schools through the delivery of low cost solutions transforming smartphones and tablets into laboratory instruments. Lab4U has created a series of mobile Apps to enable students to undertake practical science experiments with their phones and help teachers facilitate more effective learning.

### A lab in your pocket

Lab4U's applications use built-in smartphone sensors (e.g. accelerometers, magnetometers, GPS) as science instruments, giving students the opportunity to carry out experiments with their phones as "*a lab in your pocket.*" Lab4U's philosophy is that science education is a gateway for children to be able to develop their own knowledge about the world, a sense of curiosity and critical thinking. The team is passionate about science as an adventure worth exploring. All experiments are aligned to the national science curriculum in Chile and cover 40% of the Next Generation Science Standards of the United States.



Students can compare and analyze data collected, enabling them to develop more sophisticated competences than before. Teachers are supported with an online portal where they can download lesson plans and share experiences.

Lab4U has three applications; Lab4Physics, Lab4Chemistry and Lab4Biology. Lab4Physics is the most advanced with six tools that support a total of 22 experiments.<sup>3</sup> Lab4Chemistry will be launched in 2016 and Lab4Biology in 2017. An online support system for teachers has been developed with complete lesson plans, a forum and other services.<sup>4</sup>

### Social impact

Since the first pilot in September 2015 Lab4U has reached 3,000 students aged between 14 and 20 and currently has 41% of users in the US and 49% in Chile with evaluations showing that student performance overall has increased by 40%. The application is available for Android and IOS systems and can be purchased in Google Play for Education and the iTunes store. In 2013 the company opened in Santiago and in 2015 in San Francisco. In 2016 a first pilot project was carried out in the Middle East. Lab4U has an ongoing collaboration with networks of schools in Chile who continue to help test and improve the product and in May 2016 a new version 2.5 of Lab4Physics was launched. Product sales began in late 2015 with 18 schools and 2 Universities as clients so far.

<sup>3</sup> See Annex 1 for a details of each experiment and the educational level to which it is targeted.

<sup>4</sup> [www.teachers.lab4u.co](http://www.teachers.lab4u.co)

### 3. The Social Entrepreneur



Komal Dadlini is the daughter of Indian immigrants who came to Chile seeking opportunity. She studied at a private school in Santiago where she was bullied for her skin color and for being a vegetarian. Komal recalls that her family was critical in helping her move forward despite these early challenges as they taught her about karma and Gandhi's teachings: if others gave her harassment she shouldn't give it back in return. This only served to strengthen her and she set up Lab4U as a female entrepreneur in a sector dominated by men.

Komal is a Biochemist with an MSc from the University of Chile, she was awarded the CONICYT Scholarship of academic excellence, has research experience in nano biotechnology, biomedicine and molecular diagnostics (University of Chile, Andes Biotechnologies and Science and Life Foundation). In 2013 she started Female Entrepreneurs of the World (FEW), she is member of the American Society for Quality, lead auditor for ISO 9001, recipient of the Cartier Women Initiative Awards 2015 and internationally recognized by Forbes and the BBC for her work at Lab4U as a top female entrepreneur.

The company began when Komal and Isidro Lagos, biochemist and former secretary of the Student Council at the Science Faculty at the same university went to the Start-Up weekend in Santiago in 2013. The weekend was organized for students to invent software, apps and other technologies. There they met Alvaro Peralta, a software engineer finishing his Masters thesis in Computer Science at the University of Chile and the three scientists formed a team to design a science laboratory in a mobile phone.

Komal's dream is that more Latin Americans become scientists and more people in general have a deep understanding of science, regardless of their profession. As a young girl she wanted to make a difference. She was the first person in her family to study science, *"I wanted to be different, the black sheep, or should I say white!"* She was well aware that to achieve this she needed a robust business model. She is a committed social entrepreneur however hopes that all entrepreneurs could by definition solve social problems, *"I wish they'd take the word social out of social entrepreneur and that all companies are "B" companies. All companies should be responsible, ethical and have a social aim so why should a certification be necessary?"*

Komal is now based in a technology incubator in San Francisco from where she leads the business with regular travel to Santiago, Chile where the majority of her team is based. Since starting Lab4U Komal has received support from leading scientists, mentors and investors.

## 4. Business Model

Lab4U's business model is based on the fact that access to technology through smartphones is growing at a vertiginous speed. Most smartphones already have highly sophisticated built-in sensors around which scientific experiments can be created at no additional cost. Additionally the alternative science education solutions tend to be either expensive software or hardware, which means that even the schools with access to science labs are interested in the technology as it is a means of motivating science education for students, by delivering learning through their own mobile phones.

### 4.1 Characteristics

Lab4U offers a cheaper solution for the lack of equipment in the labs, solving three main problems with the product; 1) Lab preparation, 2) Hands-on science lab (experimental activity with a mobile device) being able to do the same experiments as LabDisc, and 3) Analysis of lab results through the educational platform. *"We discovered it was possible to make use of these sensors to improve the laboratory experience,"* Komal Dadlani. The Apps are free to download and after a 45-day free trial period users are charged an annual subscription fee.

The Apps are designed to stimulate curiosity, to enable students to undertake an experiment quickly, fail and ask themselves why the experiment didn't work and then immediately reproduce it. For example, students can calculate the concentration of a chemical solution, learn about pendulum movement or free fall. In addition they can understand and analyze graphs and compare their results with fellow students, facilitating a truly interactive experience and making science fun. The experiments are designed around everyday scenarios to make the learning more accessible, and bring abstract concepts to life. For example a school bus scenario teaches the relationship between weight and force to help understand Newton's second law of physics. Students have to work out how many people should get out of the bus that has come to standstill to make it move, versus how many should push. Lab4U offers three main platforms, each offering a series of experiments which are described below.

Figure 1. Lab4U – a lab in your pocket



## Lab4Physics

Lab4Physics is a mobile App designed to improve the experience of a physics class doing practical exercises with a smartphone to learn about pendulum motion, uniform motion, magnetism and freefall among other key concepts. The experiments follow the needs of the Chilean and US national curriculums and turn a physics lesson into a fun experience for students. The interface combines photos, diagrams and explanations and the App is accompanied by a web based portal where teachers can download pre-designed experiments, instructions for students as well as a lab report for each experiment and video tutorials. The table below provides a brief description and the objectives of a sample of **Lab4Physics** educational activities based on **Next Generation Science Standards**.<sup>5</sup> For a description of all 22 experiments see Annex 1.

**Table 1. Examples of Lab4Physics Experiments**

<b>Name of Experiment</b>	<b>Objective</b>	<b>Description</b>
Move it!	Associate movement in one dimension to a position-time graph, using the concepts of Reference System, Position and Time	A student moves through a coordinate axis along two different routes. Students analyze the position-time graph generated by the Lab4Physics Velocity tool.
x-t Graph	Hypothesize the position-time chart of one-dimensional motion.	Students move a toy car along two routes and hypothesize about the shape of the position vs. time graph. They compare it with the graph obtained in the Lab4U Average Velocity Tool.
Are d, $\Delta x$ , the same?	Use the definitions of distance and displacement to solve problems.	Students use the definitions of distance and displacement in position-time graphs to solve problems in the Lab4Physics Average Velocity Tool.
What are average speed and velocity?	Know and understand the meaning of average speed and average velocity.	Students discuss the meaning of average speed and average velocity on the position-time graph obtained using the Lab4Physics Average Velocity Tool.
Slope and Velocity	Determine the meaning of the slope of the position-time graph.	The students discuss the meaning of the slope of the position-time graph representing the motion of the toy car, the graph being generated by the Lab4Physics Average Velocity Tool.
Uniform Rectilinear Motion	Associate the uniform rectilinear motion of a toy car with the position- time graph.	The students plot the position-time graph of a toy car with uniform rectilinear motion (URM) using the Lab4Physics Average Velocity Tool for three starting positions and direction of motion. Finally, they must identify the trajectory of the toy car and replicate it from various position-time graphs.

<sup>5</sup> <http://www.nextgenscience.org/hsp5-fi-forces-interactions>

What is acceleration	Propose and implement a strategy for finding the time of collision between two moving bodies.	The students propose and implement a strategy to calculate the time of collision between two trains, using graph paper and the Lab4Physics Average Velocity Tool.
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The technical requirements for Lab4Physics are as follows:

- Android version: Ice Cream Sandwich 4.0, API level 14 or more
- Processor: 1.2 Ghz or more, RAM Memory: Minimum 1GB de RAM
- Minimum sensors required: accelerometer, magnetometer, compass, camera.

### **Lab4Chemistry**

This second App uses the camera as a sensor cell, transforming the mobile device into a colorimeter and spectrophotometer capable of determining the concentration of aqueous solutions, generating calibration curves to be analyzed by the students to learn spectrophotometry techniques in an easy, interactive and entertaining way. This App allows students to take pictures of droplets of different concentration and different optical density creating a calibration plot in which one can interpolate a desirable unknown sample. This instrument is not only useful in chemistry classes, but can also be used for field experiments. This technology is Patent-Pending and has not yet been launched to market.

### **Lab4Biology**

The third App is currently in its prototype phase. It uses the camera of the device and an external 1 USD lens attached to the smartphone, transforming the mobile device into a microscope where students can see the world around them from a new lens. By leveraging built-in sensors from mobile devices, the App will enable students to develop an "all-in-one" scientific-educational instrument capable of collecting data and delivering results in real time.

## **4.2 Fee structure or pricing model**

Lab4U Apps are free to download and after a 45-day free trial schools and institutions are charged an annual subscription fee of 9.99 USD per student or 299 USD per class. In the US a platinum and gold program are also being developed with additional services. It is predicted that 90% of purchases will be institutional (schools buying directly from Lab4U) and 10% through the App Store (which takes a 30% commission) and Google Play Store. This price has been set after research into current expenditure in science education as well as an analysis of competitors.

Research was carried out in the US showing the annual budget for science equipment could vary from 6,500 USD to 14,475 USD. Although the funds to plan, design, and build new laboratory facilities come from the school or district's capital budgets, the supplies and equipment needed to make the lab operational usually come out of the school's operating budget. Research in 2004 showed that the average spend on science equipment in the US was 4 USD per pupil per year among schools in the lowest poverty quartile, compared with 2 USD per pupil per year among schools in the highest poverty quartile (Banilower et al., 2004).

More recent research shows that even if there are the resources available for the school build a laboratory often no funds are set aside for an operating budget to provide the equipment and supplies to use the laboratory over subsequent years. *“It is not uncommon in jurisdictions throughout the country to find people who invest a tremendous amount of money in high tech systems, great science labs, and then underfund them historically once they are built,”* (Gohl, cited in Lab4U Business Plan, 2014).

### Analysis of Competitors

Lab4U has analyzed several competitors in the international science education market which provide educational software, student-teacher interactive platforms, mobile applications, lab equipment and analysis technology devices. This research is summarized in Table 2. All of these companies originate from the US however most now have a global market.

Table 2. Lab4U competitors

Name & country of origin	Description	Differentiating characteristics
Fourier <a href="http://einsteinworld.com/">http://einsteinworld.com/</a> 	Fourier products are customizable for students from elementary school to high school and it is designed to automate and simplify the way data is collected, analyze and shared.  <ul style="list-style-type: none"> <li>How are they similar to Lab4U? Einstein Tablet + is a device “all in one” for educational use,</li> </ul>	<ul style="list-style-type: none"> <li>Price High price per unit: 299 USD This price doesn’t consider the external sensors and the educational experience.</li> </ul>
Vernier <a href="http://www.vernier.com/">http://www.vernier.com/</a> 	Vernier products are affordable and easy to use for data acquisition (probeware) in science classes and labs. Their products are used for students from high school to university.  <ul style="list-style-type: none"> <li>How are they similar to Lab4U? Vernier LabQuest 2 is an independent interface used to collect data from sensors with integrated graphics and analysis application.</li> </ul>	<ul style="list-style-type: none"> <li>Price Students must buy LabQuest 2 analyzer plus external sensors separately to experiment. LabQuest 2: 455 USD Sensors Accelerometer: 135 USD Magnetometer: 79 USD Microphone: 50 USD Light sensor: 75 USD Colorimeter: 147 USD</li> </ul>

<p>PASCO <a href="http://www.pasco.com/">http://www.pasco.com/</a></p> 	<p>PASCO is a global company specialized in science education. They have designed, developed and supported innovative solutions in technology education for primary, secondary, and university level science.</p> <ul style="list-style-type: none"> <li>• How are they similar to Lab4U? SPARK Science Learning System is a mobile “all-in-one” that seamlessly integrates the power of the sensors with content and research-based assessment. It has the ability to collect and analyze data from large, full-color, touch navigation, all completely intuitive.</li> </ul>	<ul style="list-style-type: none"> <li>• Price Students must buy Spark Science Learning System and external sensors separately. Spark Science Learning System: 350 USD Sensors Accelerometer: 199 USD Magnetometer: 60 USD GPS: 159 USD Sound Sensor: 125 USD Light sensor: 110 USD Colorimeter: 199 USD</li> </ul>
<p>Globisen <a href="http://www.globisens.net/">http://www.globisens.net/</a></p> 	<p>Globisens is a technology education company focused in delivering solutions for K-12 science classes. Globisens Labdisc has launched an all-in-One, which is a multidisciplinary laboratory for each field of science including physics, biology, chemistry, environmental studies and geography.</p> <ul style="list-style-type: none"> <li>• How are they similar to Lab4U? LabDisc laboratory is a complete “all-in-one” that fits in the palm of your hand.</li> </ul>	<ul style="list-style-type: none"> <li>• Price High Price per unit: 1.200 USD</li> </ul>
<p>Late Nite Labs <a href="http://www.latenitelabs.com">www.latenitelabs.com</a></p>	<p>Late Nite Labs was acquired by Macmillan in 2013. LNBS It is a web platform that simulates lab experiments that any student can perform anytime.</p> <ul style="list-style-type: none"> <li>• How are they similar to Lab4U? They are not, these are virtual experiments with no real data or hands-on experience</li> </ul>	<p>Currently offered by Macmillan (Publisher), sold in different packaged to Schools and Districts.</p>
<p>Pocket Lab <a href="http://www.thepocketlab.com">www.thepocketlab.com</a></p> 	<p>Myriad Sensors is a startup developing a hardware (PocketLab) with built-in sensors where the data can be exported to smartphones via Bluetooth. (Only Physics)</p> <ul style="list-style-type: none"> <li>• How are they similar to Lab4U? They are not, they provide hardware solutions, we are a software-based company using pre-existing sensors on mobile devices.</li> </ul>	<p>Price: 99 USD</p>

Source: Business Plan Lab4U 2015.

Lab4U concluded after this research into competitors that Lab4U offers a solution at significantly lower cost than the rest of the market. For most offers on the market schools have to invest in software or hardware (up to 1,200 USD) and in addition students have to purchase external sensors, which can cost between 50 USD and 150 USD. With Lab4U, the

students just need their mobile devices, which already have built-in sensors making access wider and easy for reaching difficult areas where schools don't have sufficient lab infrastructures or a budget for more equipment.

### **4.3 Target beneficiaries**

Lab4U's target customers are secondary schools and universities that need an inexpensive, better and faster solution to improve their infrastructure in science education. The users are students and teachers that need an educational lab experience. In order to reach a wide range of students and teachers in the subscription model for the web and mobile platform, the different science applications are available for students, teachers and scientists through a Freemium model with a limited number of experiments.

Lab4U began piloting the product with a network of private schools focused on innovation in Santiago, Chile. After the pilot, across the seven schools in the network, three schools have started purchasing the product. The team is currently expanding marketing actions for private and public secondary schools in Chile and other countries in Latin America is also targeting high schools in the US, with the support of an educational platform incubator.

#### **Marketing**

Lab4U has analyzed the sales cycle in education first in Chile to develop its marketing strategy and is constantly measuring metrics and focusing on feedback. Learning from Chile is now being incorporated into the marketing strategy for the US. The next milestones are to enter the 2016 education sales cycle in the US and increase the market share in Chile.

After the first contact is made an offer of 45 days free trial or the implementation of a pilot program is made. The annual subscription is offered to teachers who are already engaged in the free trial and once there is a group of client schools from a District, Lab4U approaches the district education authorities to offer products on a larger scale. In 2016 a new Educational Program Director was hired in the US to put in place the above strategy and to date there are four schools in the Bay Area piloting the product.

## 5. Social and Financial Performance

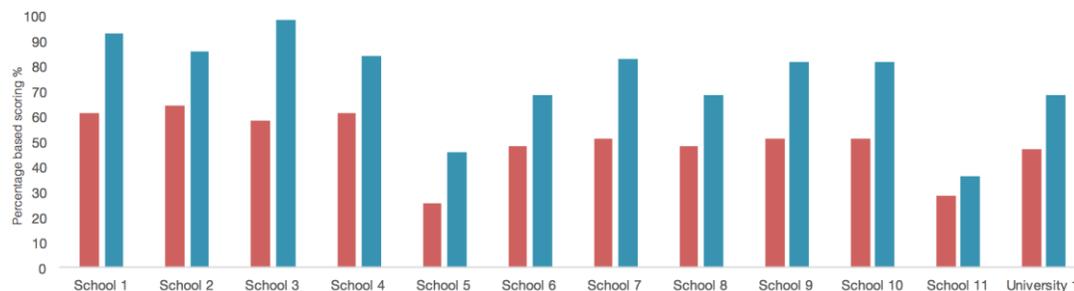
### 5.1 Social Impact Performance

#### 5.1.1 Social impact achieved

Lab4U has to date influenced the education of 3,000 students aged between 14 and 20 in Latin America and the US with the average time spent on the application is 9 minutes, which is considered a relatively long time to spend on an App. However, when the students are carrying out experiments with Lab4Physics they usually spend 20 minutes on the App. The first evaluation of Lab4U's social impact was carried out in 2014 with a total of 2,037 students (14-18 years old) from 35 schools (26 in Chile and 9 in the US) to understand the effectiveness of using Lab4U versus traditional science education methods with a "before and after" test. This evaluation showed that academic performance increased by an average of 34%. The initial phase of this evaluation is illustrated in Figure 2 below. Since this initial evaluation, an educational expert has been contracted to develop more robust measuring methodologies.

Currently Lab4Physics Premium has been bought by 2 private Universities, 15 public schools, 3 private schools and through the Samsung project several regional schools have experienced Lab4Physics with the project "Solutions for the Future." 10 pilots programs were carried out in 2015 and in 2016 pilots are planned in 2 Universities and 40 schools in Chile.

**Figure 2. Academic performance of students before (red) and after (blue) using Lab4Physics**



Early feedback from students shows that Lab4U is fun and useful; *"The best part was the telephone with the vibrating magnet, that's the most incredible thing I've ever seen,"* said a student from *Santa Joaquina de Verdruna* school in Chile. Teachers have also given positive feedback claiming that the mobile is no longer a distraction in class, but rather a learning instrument.

#### 5.1.2 Social impact measurement

Lab4U's impact measurement systems are currently being developed with the following actions; technical development of software to enable more sophisticated measurement; feedback mechanisms from teachers and users via an online portal, and the inclusion of Lab4U in the existing evaluation mechanisms run by partner organizations.

In 2015, with support from CORFO Lab4U invested time and resources in developing a sophisticated “back-end” system to be able to monitor the use of different applications, the time spent on each App and which experiments have been used. Currently customers are migrating to this system, which will enable Lab4U to measure the usage of applications with more precision and feedback this information to teachers. In addition, as part of the collaboration with Teach Chile (in Spanish *Enseña Chile*), a public organization that supports the insertion of professionals into the teaching sector,<sup>6</sup> further evaluations will be made around the quality of the education perceived through the use of Lab4U in 2016. *Enseña Chile* conducts an annual survey with all the teachers they place across Chile and Lab4U will be able to compare the results between those schools who have used Lab4U and those who have not. The intention will be to identify signs of differentiation in the perceived quality of learning to have an objective understanding of where the real value of the product lies.

Felipe Merino from *Enseña Chile* considers that LAB4U is “*disruptive, new and works really well in class, however the downside is that teachers need training to be able to use it. Many teachers in Chile are quite senior and not familiar with m-learning so this is a handicap to the system.*” The following indicators are currently being developed to help measure the effectiveness and social impact of Lab4U.

Quantitative indicators	Qualitative indicators
<ul style="list-style-type: none"> <li>• Number of students who have downloaded the application</li> <li>• Average time using the application per student</li> <li>• Usage of different experiments per cohort of students</li> <li>• Number of schools subscribed</li> </ul>	<ul style="list-style-type: none"> <li>• Degree of curiosity and level of interest in science from students. Perceived quality of education from students (via <i>Enseña Chile</i> survey)</li> <li>• User feedback from teachers (via online portal teacher’s forum)</li> </ul>

## 5.2 Financial Performance

### 5.2.1 Revenue and Expenses

Lab4U has generated high levels of confidence in a select group of investors and has raised a total of 420,000 USD in investment since 2013 and is currently raising a Seed Round with an undisclosed amount already secured from seed angels. First sales began in late 2015 and 10,000 USD has been achieved in sales revenue to date with four paying customers, (18 schools and 2 Universities), with a 3.1% conversion rate from Lead to Paying Customer. Operational expenditure in 2014 was 49,800 USD and 44,200 USD in 2015 and for 2016 revenues of 150,000 USD are expected, with a target of 3,000 students subscribed.

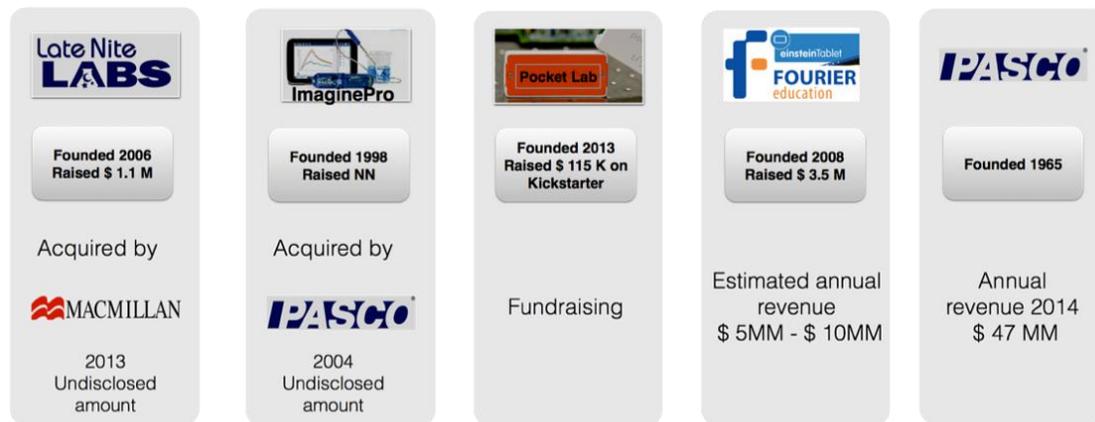
Lab4U understands that product-market fit is key for their business and that if there is high engagement in the platform, probabilities of receiving an Annual Recurring Revenue is higher,

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<sup>6</sup> *Enseña Chile’s* objective is to enable each child in Chile to have at least one day of quality teaching per year by encouraging more professionals from different disciplines in Chile to join the teaching profession. Professionals from all sectors can work as teachers for 2 years without formal training. After this piont

therefore the company has a strategy to invest highly in the first years in order to scale. A Seed Round is currently being raised and once the conversion rate to client has increased and a set of schools and universities are clients Lab4U intends to offer stock to external investors by the beginning of 2017. Figure 3 below shows the exit strategies and investment raised by Lab4U's major competitors.

**Figure 3. Investment raised by competitors**



### Lab4U Investor profiles

Currently Lab4U has three major investors, two individuals and a US based accelerator program. **Fundación Ciencia y Vida** was one of the first organizations to invest in the company in 2014. The famous Chilean scientist Pablo Valenzuela is the Director of this foundation, he is the National Awardee of Science in Chile and co-founder of the biotech company Chiron Corporation that in 1997 was the second-largest biotechnology company in the world and was acquired by Novartis in 2006. In the same year after seeing a speech given by Komal, **Alan Farcas**<sup>7</sup> also invested in the company. He is Director of Innovation and Entrepreneurship at Universidad Adolfo Ibáñez and one of the co-founders of the venture capital fund Nazca Ventures and board member at Endeavor, EcoSea, Centrovvet, ASECH and Socialab. Finally in 2015 Lab4U received investment from **Zynga.org**<sup>8</sup> through its program Co.Lab, an accelerator that works with startups leveraging the power of digital games to build transformative educational technologies for PK-12 students and teachers. The founding partners are Zynga.org and New Schools Venture Funds. Lab4U is one of 5 companies currently participating in the acceleration program.

### 5.2.2 Proportion of Income from Sales

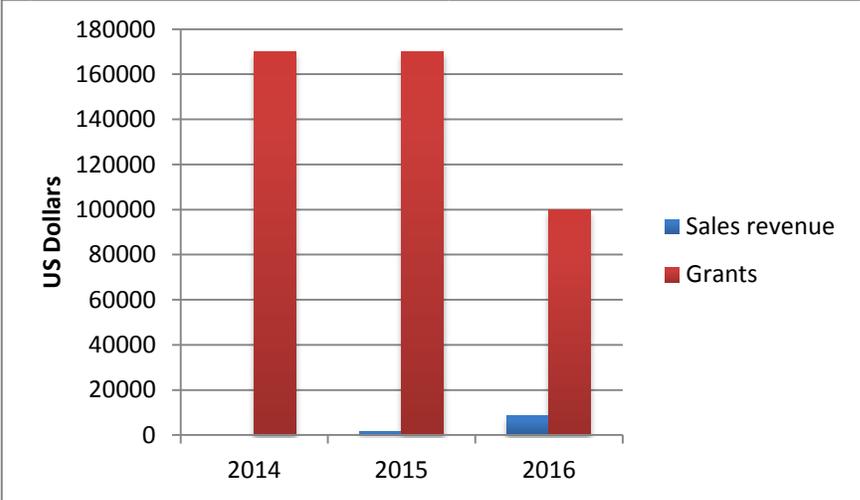
Lab4U is in its first year of sales, with total revenue of 10,000 USD in the first year, which represents less than 1% of total income. While it is too early to measure the company's potential in terms of actual sales revenue, the investment that Lab4U has secured as well as the grants show that the company has successfully created confidence amongst several key

<sup>7</sup> [www.linkedin.com/pub/alan-farcas/4/2b1/241](http://www.linkedin.com/pub/alan-farcas/4/2b1/241)

<sup>8</sup> <http://playcolab.com/>

stakeholders. At the time of writing a total of 440,000 USD has been received in grants since 2014 and 420,000 USD in investment. Lab4U has achieved the financial support necessary for the early stage development of a technology company and expects sales to grow by over 100% in 2017, which would mean a break even in the third year of operations.

**Figure 4. Lab4U income in sales and grants**



## 6. Business Development and Ecosystem Evolution

Since registering as a company in Chile in 2014, Lab4U has achieved significant financial and technical support from a diverse set of players both in Chile and the US. However it is still at an early stage of business development and the process can be categorized into two stages: Start-up Stage and Early Stage.<sup>9</sup>

**Table 3. A summary of Lab4U's business development milestones from 2013 to present**

Stage	Month/Year	Description
Start-up	March 2013	Won 3rd prize in Start Up Weekend to develop the concept
	Aug 2013-Jan 2014	Lab4U entered StartUP Chile's co-working space to develop prototypes and received 40,000 USD in seed capital
	Feb 2014	Lab4U moved to Socialab co-working and received a loan (7,000 USD)
	Jan 2014	Lab4U registered as a private company
	July 2014	Received first private investment from <i>Fundación Ciencia y Vida</i>
	July 2014	Won Intel's Latin American Innovation Prize
	Sept. 2014	Received private investment from Alan Farcas and SSAF grant from Corfo (80,000 USD)
	Nov. 2014	Won of Global Intel Innovation Prize (50,000 USD)
Early	Nov 2015	Moved offices to CasaCo
	Oct 2015	Received 20K from Cartier for the Cartier Women Initiative Awards and Gartner Education prize "Cool Vendors in Education"
	September 2015	Pilots in Red Alcantara Schools, Samsung Support
	June 2015	Sign agreement with Zynga and receive capital (50,000 USD)
	July 2015	Received technology grant from Corfo (120,000 USD)
	July 2015	International experts (Apple, Microsoft & McMillan) joined as advisors
	June 2015	Opened office in San Francisco in Co-Lab incubator
	Nov 2015	First sales began in Chile
	Nov 2015	Received grant from New School Ventures (50,000 USD)
	March 2016	Piloted program in schools in Abu Dhabi
	March 2016	Hired US based Education Director

<sup>9</sup> **Start-up stage:** a preparation period for setting up a business or an enterprise. An entrepreneur's team develops a business idea and a business model. In some cases, they have product/service prototypes which are not fully developed or tested. **Early stage:** A period from business initiation until business scale-up. An entrepreneur's team may first deliver its products/ services in a test market to examine its business model. Also, the team may file patents or obtain licenses, if necessary. Once the business model is consolidated, it starts its business. However, the business remains quite small due to lack of capacity and resources. It may reach a breakeven point at the end of this period. **Growth stage:** A period after scaling up the business. The business exceeds the breakeven point and increases its sales, number of beneficiaries, the market share etc. The team revises the business model in order to sustain and/or expand the business, if necessary. In some cases, the team starts to investigate new products/services.

## 6.1 Startup Stage

### 6.1.1 Milestones

#### **From Start Up weekend to Start Up Chile**

The Lab4U story began in March 2013 when Komal Dadlini, at the time studying biochemistry at the *Universidad de Chile* and Isidro Lagos, biochemist and former secretary of the Student Council at the Science Faculty at the same university went along to the Start Up weekend organized by Start Up Chile for students to invent software, apps and other technologies. At the event Komal and Isidro met Alvaro Peralta, a software engineer finishing his Masters thesis in Computer Science. The three students decided to form a team and set themselves the challenge of designing a science laboratory in a mobile phone. After 48 hours of intense creativity the team won 3<sup>rd</sup> place at the weekend, which gave them their first motivation to apply for funding from the incubator Start Up Chile. By August of the same year the team was given 40,000 USD in seed capital from Start Up Chile as well as 6 months of co-working space, mentoring and support. During this time the team worked hard to develop a prototype, yet at the same time studying, and working part time. The early prototypes they developed didn't meet users expectations and the team struggled to continue and almost abandoned the project.

*"Startups usually die due to lack of capital or because the team doesn't work. If you have a good team, you'll re-invent the technology, if the market is not ready, you'll adapt and shift towards it,"* commented Komal Dadlini.

#### **Socialab support system**

At the critical moment of Start Up Chile's support coming to an end in January of 2014 Socialab contacted Lab4U and invited them to join their support program for social entrepreneurs, and gave them a loan of 7,000 USD. Socialab supported the team with business plan development, clarifying their vision as well as a co-working space. During this time the team also received support from the incubator 3iE from the Technical University of Federico Santa Marta. With this support Lab4U was able to carry out market research and start testing their product in the classroom as well as registering the business as a limited company in Chile.

*"I started studying science because I saw Pablo Valenzuela talking about biochemistry and biotechnology and the vaccine he created, and I thought to myself, I can be like him,"* said Komal Dadlini.

#### **The first investor**

A critical moment for the company in 2014 was when the renowned Chilean scientist Pablo Valenzuela, biochemist, entrepreneur and winner of the National science prize along with the Science and Life Foundation (in Spanish *Fundación Ciencia y Vida*) noticed Lab4U and decided to support them. The Science and Life Foundation was the first organization to invest in Lab4U, which, according to Komal, *"changed everything."*

### **From prototypes to prizes**

Later in 2014 Samsung provided 10 mobile and tablet devices to carry out a first pilot program, using Lab4U devices to maximize the control of the situation to test prototypes. Lab4U created a minimum viable product of three prototypes and began working with *Enseña Chile* to carry out the testing including pre and post evaluations to assess the effectiveness of the learning with the application. In the same year discussions began with a network of the most innovative private schools spread across the Metropolitan area of Santiago, the Alcantara Network (in Spanish *Red Alcantara*).

As well as testing prototypes the team applied for several competitions and grants, and in July 2014 won the Latin American Intel Innovation prize, which would take them on to winning the Global Intel Innovation prize in November of the same year, in which 20,000 Startups from across the world participated. The visibility Intel gave the team was key in helping secure support from US based Angel Investors, as well as engagement with renowned international advisors.

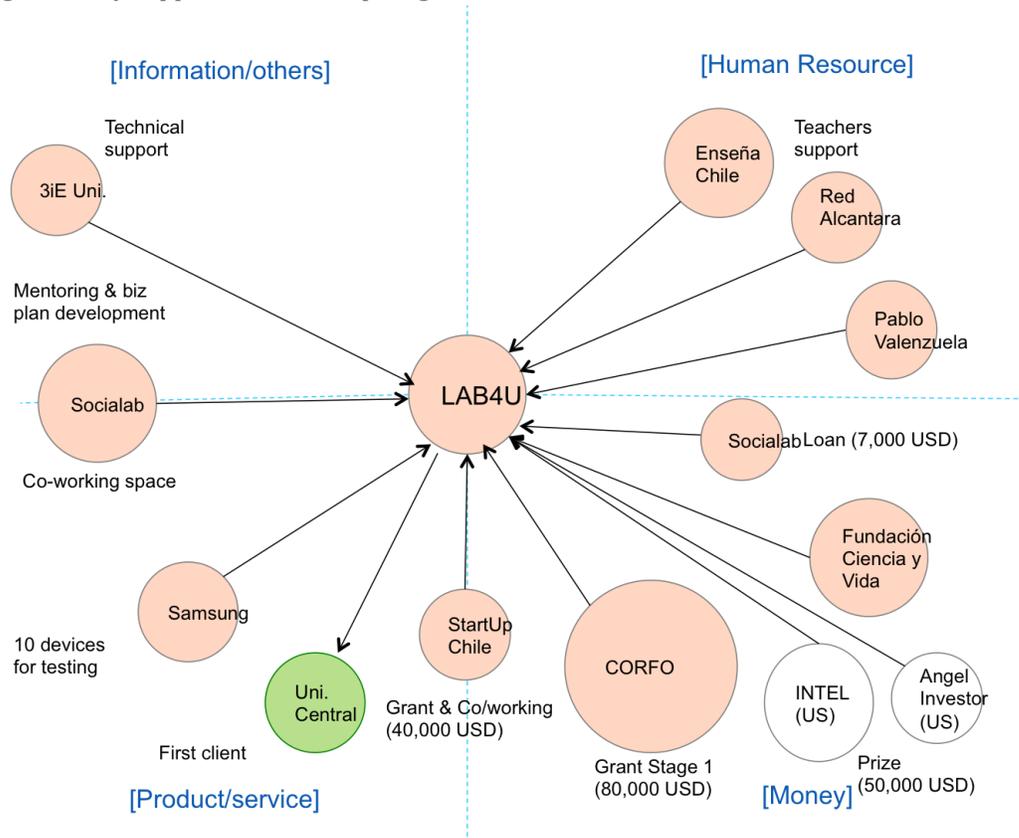
### **CORFO and Samsung support technology development**

Since the start Lab4U has been active both internationally and in Chile, and in 2014 received a grant of 120,000 USD from their technological fund to develop the back-end of the application. For the first product, Lab4Physics 90% of the programming was done in-house by the Lab4U team and at the same time Lab4Chemistry development was outsourced to enable the two products to be developed simultaneously. By 2015 Lab4Physics was well underway and ready for testing. A new partnership was agreed with the *Red Alcantara* to test the product. Three teachers from this network approach Lab4U and helped with product development and Samsung provided the second phase of support for testing with 20 devices.

In the same year Samsung launched a competition amongst schools in Chile and the winners received a free subscription to Lab4U. Testing continued and early feedback showed that the product still had some technical glitches and was not sufficiently easy to use. As well as product testing Lab4U also ran focus groups around pricing, identifying school budgets for science education as well as the competitors in the market. The company discovered that the culture of “bring your own device” was completely absent from the market, this was their niche. The first pricing strategy was to have a tiered system of 5-15 USD per student depending on how many students per school. This was later replaced with the simpler model of 9.99 USD per student across the board. By the end of 2015 Lab4U had secured its first clients.

## 6.1.2 Key supporters

Figure 5. Key supporters at Startup Stage



## 6.2 Early stage

### 6.2.1 Milestones

#### From StartUp to SME: CasaCo

A significant step for Lab4U was to move out of the Start Up arena of Sociallab to a relatively new ecosystem for early stage businesses, CasaCo. The company now needed a different kind of service, such as their own office space, meeting rooms to meet investors and networks to share with other businesses also in their 2nd or 3rd year of business. CasaCo houses 10 early stage businesses that mostly with a social purpose, however this is not the case for all of the businesses. Here Lab4U received mentoring support from the founders of CasaCo, three individuals with a depth of experience in the entrepreneurial ecosystem in Chile; Nicolas Shea, Catalina Boesch and Cristobal Unduraga. The local partnerships in Chile continued to mature, and a formal agreement was signed with *Enseña Chile* to share all their evaluation material with Lab4U to identify any differentiation between schools who have access to Lab4U and schools who don't.

### Launch in San Francisco: Co-lab

A key milestone for the company was in 2015 when Lab4U entered into the San Francisco based incubator program, Co-lab, an initiative of the leading online gaming company Zynga. The program included a co-working space, advisors specialized in mobile learning, student engagement and online education market as well as 50,000 USD in investment. By October 2015 Komal was installed in San Francisco, the product market feed began and a pilot in 4 schools in the Bay Area was carried out resulting in positive feedback for the products. At this point the company also shifted from a 2.0 to 3.0 company offering integrated solutions for the education sector with a focus on better design, usability, and complete education solution with online support for teachers.

### Team consolidation and world class advisors

By late 2015 the team of scientist founders was complemented with professionals from complementary disciplines, such as innovation and international development. Victoria Corti was hired as COO,<sup>10</sup> with a degree in corporate communications and international experience in NGOs and B-Lab companies. Fernando Mejía<sup>11</sup> a specialist in internet architecture and innovation and former founder of two Start Ups also joined the team. In March 2016 a Director of Education was hired as the first new position in the San Francisco Office, and future key positions to be filled are the head of sales and business development, a sales manager (US), as well as more software developers in Chile.

In addition to the core team, three advisors joined Lab4U. **Nancy Heinen**,<sup>12</sup> who worked at Apple until 2006 as Senior Vice President, General Counsel and Secretary of Apple and originally part of the small executive team hired by Steve Jobs to turn Apple around in the late 1990s. Nancy is currently chair of the Silicon Valley Social Venture Fund. **Hans Nemarich**,<sup>13</sup> former Chief Evangelist of Innovation and the ICT branch of Microsoft in Chile also joined the advisory board with expertise in cloud computing and mobile solutions. Finally to complete the team of experts **Dan Farley**,<sup>14</sup> former president and publisher of Macmillian's Children's Publishing and other leading publishing companies joined the team.

### Lab4Physics 2.5 launched

May 2016 saw the new, improved version of Lab4Physics launched, now available on the different platforms (Android and iOS), with new pre-designed experiments, a more user-friendly interface with step by step instructions and overall improved design. The system began distribution with Aruimed, an educational product distribution platform. By early 2016 Lab4U had its first clients, 15 schools and 2 Universities in Chile, and the focus shifted to marketing and capturing new clients for the new academic year both in Chile and the US.

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<sup>10</sup> <https://cl.linkedin.com/in/victoriacorti>

<sup>11</sup> <https://cl.linkedin.com/in/feranto>

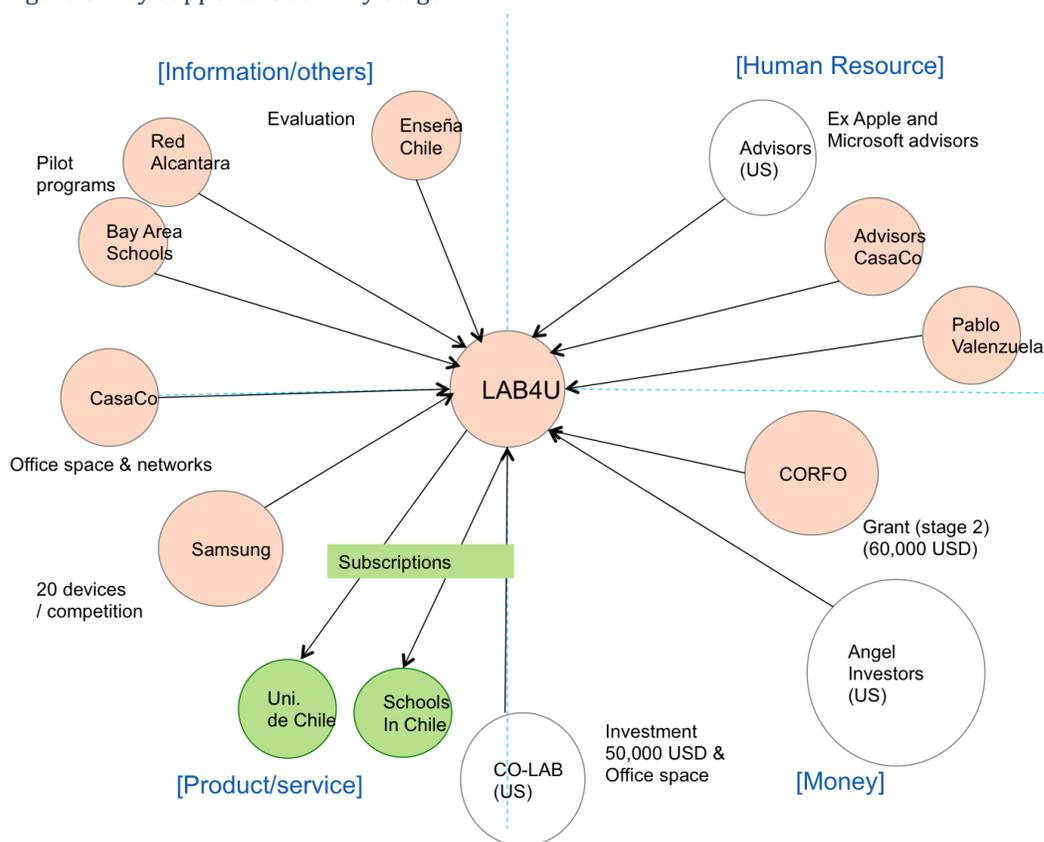
<sup>12</sup> <http://www.sv2.org/page/nancy-heinen-bio>

<sup>13</sup> [www.linkedin.com/pub/hans-nemarich/a/292/19](http://www.linkedin.com/pub/hans-nemarich/a/292/19)

<sup>14</sup> <https://www.linkedin.com/in/dhfarley1>

## 6.2.2 Key supporters

Figure 6. Key supporters at Early Stage



## 7. Scalability and Replicability

Lab4U's potential for scale is enormous given the size of the market in which it is operating. Worldwide, the education industry is estimated at around 1 Trillion USD, positioning itself as the second largest industry after health. Lab4U is focused on the Mobile Learning market which was reported at 5.3 billion USD in 2012 and by 2020 it forecasts a growth that will reach 37.8 USD billion in North America, Latin America, Europe, Asia, Middle East and Africa. Sub-educational markets, such as Edu-Gaming, E-Learning, Social Learning, Crowd-learning, have a projected growth ranging from 20% to 30% by 2017.

### **Mobile Learning**

The Mobile Learning Market in Latin America is also booming with an annual growth rate of 32.5%. It is anticipated that earnings will be four times higher than the US, with 362.3 million USD achieved in 2012, becoming 1.4 billion USD in 2017. Today, Asia has the third highest growth rate in the World after Africa and Latin America, reaching 2.6 billion USD in 2012 and achieving a market size of 6.8 billion USD for 2017. While Asia will become the region, which will generate highest revenues for mobile learning in the World, Lab4U's target is currently Latin America and the US. In addition there is considerable political support for STEM education worldwide, which Lab4U's product contributes to (see Annex 2 "Spending on Laboratory Equipment" for more details).

### **International strategy**

Lab4U's international strategy is to capture clients from the US market, the Middle East and North Africa (MENA) countries and Chile. This is for several reasons; first and foremost whilst the company is committed to developing in their home country the team recognize that the market in Chile is small. In addition the "ChileconValley" culture is to export quickly. One who has crossed the borders and started to export their product or service to another country defines a successful Chilean entrepreneur. For this reason, it is unsurprising that within the 2nd year of operations, Lab4U had already registered a company in the US. At the same time this focus on exports over internal markets from the Chilean entrepreneurial ecosystem represents a challenge for Lab4U. The company has found little support from public institutions to buy their product for Chilean schools rather than sending the company abroad to promote their product. To grow in the US presents a different kind of challenge, the market is far more demanding with much higher expectations from teachers and students, which means that the product has to be impeccable.

As for the MENA region Lab4U carried out a first pilot with a public school for girls, supported by the Abu Dhabi Education Council, which is creating a library of apps to promote science education in the region in collaboration with Trial Planet. Although the country has some of the best laboratories in the world, teachers are still lacking tools to stimulate curiosity and adventure in science and generate critical thinking.

Up until now most of Lab4U's work has been behind the scenes and invisible, involving intense technological development for multiplatform readiness, Android and iOS, technological development and trials to achieve for autonomy from the teacher to be able to run the trial without the need of Lab4U team. Now, two years on, with a team and expert advisors in both Chile and the US, Lab4U is positioned to launch their international strategy to seek clients both in the US, MENA region and Chile. The next 18 months will be key for proving their success and viability of the business.

## 8. Final Reflections

### Key milestones

The following three key events can be highlighted as critical junctures in Lab4U's development since the team began brainstorming their idea in March 2013 at the Start Up weekend in Santiago:

- The approach from **Socialab** in 2013. This occurred just at the time when the team could have given up, they had no funds, were working part time, studying and struggling to develop a viable product. The support came at a critical stage and opened them up to national and international networks, gave them support in business development, a much-needed loan and stimulating environment to work in.
- Grants from **CORFO**: Flexible Assigned Fund (Acronym in Spanish SSAF) grant (80,000 USD) and Technology Grant (150,000 USD).
- The first sign of confidence from a private investor in 2014, **the Science and Life Foundation** was a second major turning point. This put Lab4U on the map, giving them support and recognition from the established scientific community in Chile.
- Winning the **Global Intel Innovation Prize** late 2014 could be described as the third key milestone, which positioned Lab4U within the international ecosystem of science education innovation. This later led to support from Zynga and Co-lab in the US as well as a series of world-class advisors from Apple, Microsoft and the world of m-learning.

### Challenges for growth

The current major challenge for Lab4U is to implement a successful marketing and distribution strategy, ensuring the target audience purchases the product. There are two parts to this challenge, firstly the B2C strategy, how to reach students and teachers directly to download the free App in a highly competitive market of mobile phone applications. The second part of the challenge is the B2B strategy, where Lab4U is a tiny player in a huge market of science education technology with most competitors already well established in the sector. While the competitors products are generally more expensive and not so well attuned to the limited operational budgets of schools, they are years ahead in terms of market presence. Increasing the currently low conversion rate to secure clients is Lab4U's current challenge, which will require strong distribution partners in the sector to ensure their visibility.

### **Contribution to social innovation**

It is at this stage too early to identify how Lab4U is contributing to systemic change in the field of science education, however the potential from a shift away from expensive hardware and software to more accessible mobile phone applications to broaden access to science education has major potential as a game changer in the field. The challenge for Lab4U will be how to manage the potential competition when other players appear in this field, to maintain ahead of the game with new technologies and to lead the sector towards a more interactive and effective science education. Adoption of the solutions provided by Lab4U from the public sector in the US in the context of improving STEM education and in Chile improving quality of education could help to broaden the impact of the company, however as yet the results are limited in this sense, with government support limited to Start Up grants from the Chilean government.

## Annex 1 Lab4Physics Experiments

The table below provides a brief description and the objectives of **Lab4Physics** educational activities based on **Next Generation Science Standards**.<sup>15</sup>

<b>Name of Experiment</b>	<b>Objective</b>	<b>Description</b>
Move it!	Associate movement in one dimension to a position-time graph, using the concepts of Reference System, Position and Time	A student moves through a coordinate axis along two different routes. Students analyze the position-time graph generated by the Lab4Physics Velocity tool.
x-t Graph	Hypothesize the position-time chart of one-dimensional motion.	Students move a toy car along two routes and hypothesize about the shape of the position vs. time graph. They compare it with the graph obtained in the Lab4U Average Velocity Tool.
Are d, $\Delta x$ , the same?	Use the definitions of distance and displacement to solve problems.	Students use the definitions of distance and displacement in position-time graphs to solve problems in the Lab4Physics Average Velocity Tool.
What are average speed and velocity?	Know and understand the meaning of average speed and average velocity.	Students discuss the meaning of average speed and average velocity on the position-time graph obtained using the Lab4Physics Average Velocity Tool.
Slope and Velocity	Determine the meaning of the slope of the position-time graph.	The students discuss the meaning of the slope of the position-time graph representing the motion of the toy car, the graph being generated by the Lab4Physics Average Velocity Tool.
Uniform Rectilinear Motion	Associate the uniform rectilinear motion of a toy car with the position-time graph.	The students plot the position-time graph of a toy car with uniform rectilinear motion (URM) using the Lab4Physics Average Velocity Tool for three starting positions and direction of motion. Finally, they must identify the trajectory of the toy car and replicate it from various position-time graphs.
What is acceleration	Propose and implement a strategy for finding the time of	The students propose and implement a strategy to calculate the time of collision between two trains, using graph paper and the

<sup>15</sup> <http://www.nextgenscience.org/hsp-s-fi-forces-interactions>

	collision between two moving bodies.	Lab4Physics Average Velocity Tool.
Accelerated movement	Determining when a moving body accelerates from the analysis of position-time and velocity-time graphs.	Students measure the time taken by a ball to slide down an inclined table and, using the Lab4Physics Average Velocity Tool, determine the characteristics of the position-time and velocity-time graphs for accelerated movements.
Calculating the acceleration of gravity	Calculate the value of the acceleration of gravity	A pair of students transform their smartphone into a pendulum, in order to measure the period of oscillation by analyzing the acceleration-time graph given by the Lab4Physics accelerator. From this experiment you can determine the value of the acceleration of gravity.
Oscillation	Understand the concept of cycle of oscillation of a pendulum and relate it to an acceleration-time graph.	The students transform their cellphone into a pendulum. Then, discuss the meaning of oscillation or cycle, and relate to the data generated by the Lab4Physics Accelerometer Tool.
Period and frequency	Calculate the frequency and the period of a pendulum.	The students will transform their phone into a pendulum. Then, using the Lab4Physics Accelerometer Tool, they will calculate the frequency and the period of the pendulum.
Tone and frequency	Determine the relationship between the tone of sound and its frequency.	Students play different notes on a musical instrument, and using the Sound Tool, determine the relationship of the tone of sound with frequency.
Energy Conservation	Investigate the behavior of Kinetic Energy, Potential Energy and Mechanical Energy of a ball that descends under the effect of its own weight.	Students record the fall of a tennis ball dropped from a fixed height using the Lab4Physics Camera Tool. Students use the position-time and velocity-time graphs to obtain and analyze the graphs of potential energy, kinetic energy and mechanical energy versus time.
Force, mass, acceleration	Fine the relationship between mass, acceleration and force experienced by a body.	Students use a rope to slide their phone, which at the same time will be pushed by a mass falling from the edge of a2. This is done in order to deduce the relationship between force, mass and acceleration that a body experiences.

Mechanical work	Solve problems related to mechanical work in a system of masses connected by means of a rope that slides over a table.	Students join two bags with different masses by means of a thread. They will slide one mass along the table while the other falls off the edge of the. Then, students will design an experiment to measure the mechanical work of each of the masses within the system.
Centripetal acceleration	Understand the concept of momentum and the conservation of linear momentum.	Students will rotate a phone in their hands and observe the acceleration present in the circumferential movement using the accelerometer tool. Then, they will set up an experiment to determine the factors that influence centripetal acceleration.

## Annex 2 Spending on Laboratory Equipment

The table below shows that annual spending on laboratory equipment from US schools showing an average of 1 USD to 2 USD per student.

TABLE 6-3 Spending on Laboratory Equipment (Median Amount Spent in 2000 by a Typical High School of 1,100 Students)

Demographic Category	Median Amount (\$)	Standard Error
Overall	2,538	(253)
School location		
Urban	2,957	(464)
Rural	994	(292)
Suburban	2,905	(506)
School poverty		
1st quartile (lowest poverty)	3,126	(380)
2nd quartile	1,842	(335)
3rd quartile	2,758	(1,039)
4th quartile	1,928	(445)
Non-Asian minority percentage		
1st quartile (lowest percentage)	2,476	(383)
2nd quartile	2,372	(526)
3rd quartile	2,926	(812)
4th quartile (highest percentage)	1,928	(445)

SOURCE: Banilower, Green, and Smith (2004).

While the table above shows limited budgets for school spending on laboratory equipment in the United States more recently there is considerable support from the US government on STEM education. President Obama strongly believes that schools must equip many more students to excel in science, technology, engineering and mathematics. The 2014 Budget invests 3.1 USD billion in programs across the Federal government on STEM education, an increase of 6.7 percent over 2012 funding levels.

For improving undergraduate STEM education, the National Science Foundation (NSF) is launching a 123 USD million new program to improve retention of undergraduates in STEM fields and improve undergraduate teaching and learning in STEM subjects to meet the President's goal of preparing 1 million more STEM graduates over the next decade. Investing in breakthrough research on STEM teaching and learning, with approximately 65 USD million for the Advanced Research Projects Agency for Education (ARPA-ED), which would allow the Department of Education to support high-risk, high-return research on next-generation learning technologies, including for STEM education. Science education has never been so important and so invested in the US and the world, which brings an evident business opportunity for Lab4U. In the United States only the government spends 3 USD billion each year in STEM programs (US GAO, 2013).