Business Plan, Financial and Risk Analysis from the Start-up Mathrix
Dissertação apresentada à Escola de Economia de Empresas de São Paulo da Fundação Getúlio Vargas, como requisito para obtenção do título de Mestre Profissional em Economia.

Campo do Conhecimento:
International Master in Finance

Orientador Prof. Dr Paulo Soares de Pinho e Prof. PhD Ricardo Rainer Rochman
Cabalzar, Filipi.


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Abstract

Mathrix is an e-learning math website that will be launched in March 2016. This master thesis offered a unique chance to interact with experienced supervisors in venture capitalism and project investment. It could serve as guidelines for entrepreneurs who intend to raise funds.

Starting with the company’s business plan, the thesis focuses on estimating the company’s value with its return on investment using three scenarios and taking into consideration the risks evolved.

Keywords: project investment, company valuation, risk analysis, business plan, start-up
Resumo

Mathrix é um website e-learning de matemática que será lançado em Março, no ano 2016. Esta tese de mestrado permitiu uma oportunidade única de interação com profissionais experientes na área de capital de risco e projetos de investimento. Poderá ser utilizada como guia por empreendedores interessados em angariar fundos.

Começando com o plano de negócio da empresa, a tese foca-se em estimar o valor da empresa, com o seu retorno de investimento, utilizando três cenários e tendo em consideração os respectivos riscos.

**Palavras chave:** projeto de investimento, avaliação de empresa, análise de riscos, plano de negócio, start-up
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</tbody>
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Executive summary

Mathrix is an e learning Math platform for French speakers. It provides a complete solution and coaching to improve Math results for 11 to 21 years old students. Mathrix is innovative in two ways, starting with its teaching video format. Videos have been proven to be the most effective tool for e learning. Mathrix redefined teaching so that it fits an entertaining and colorful video format, using jokes and drawings to retain student’s attention. Moreover, all video courses are backed by written gamified step-by-step exercises, where students receive reward points for each achievement. The second way Mathrix adds value to this 15 Millions students\(^1\) market, is by the complete workspace it provides on the website, in particular the “Math Wiki”. This left panel helps students to access hundreds of summarized chapters at any moment using its research field and can be opened from everywhere on the website. Therefore, the student has access to all information without having to leave his current page thanks to a split “Wiki / Current chapter” view.

Regarding the market, France is the leading country in Europe in the use of private teaching. In fact, every family spends on average 1500€ per year\(^2\). The e learning market is trending upwards as students are always better equipped in terms of technology and are shifting their ways to search for information.

Mathrix targets the Math niche, which represents more than 50%\(^3\) of the private teaching. Moreover, at least 5 Millions of Math related keywords are researched

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\(^1\) (Ministère de l'Education Française)
\(^2\) (Piquemal, Marie « Libération » (Duhigg, 2014))
\(^3\) (Centre Analytique Stratégique)
per month on Google. Finally our two persons team is able to enter the market with very low initial investment due to our respective background in mathematics and IT.

We will use two main channels to reach our clients and users. The first one is Mathrix YouTube channel and its 1000 videos that will optimize the ranking on Google alongside with Ad Words pay per click campaigns. Another way to increase visibility is to publish articles on the blog and develop networking with other non-competitors educational channels that already have an active network on social medias.
The website and its functionalities

The website

Dashboard

Every individual lacks motivation to take action and change bad habits\(^4\). This is the case for sports, diets but also studies. Thanks to our six lessons (appendix), we created a website that would help to overcome students procrastination. Below are the main functionalities from the website.

First the student chooses his class. Once chosen, he has access to all his chapters listed on the left side, who always remain at sight (see Figure 1). The main board has three main functionalities; the first one allows him to see his current progression. The second one is the action button that allows him to resume his last session. Finally the lower part contains a mathematical game to improve his skills in calculus and a graphic showing his accumulated experience points. Other minor statistical features like levels, last activities are also available.

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\(^4\) (Duhigg, 2014)
Program Choice

Once the student starts a chapter he has the choice to choose between two different modes: regular or “turbo” (see switch button on Figure 2). The turbo mode targets students having less time to prepare for their exams. The program focuses more on exercises with short video explanations. The method works in the following way:

1. We gather the most frequent exam exercises
2. We chunk them in easy steps
3. We teach the students how to master these steps.

Once a mode is selected, he gets a study program timeline and can schedule messages or whatsapp "comeback-to-work” recalls.

Workspace

Once a program chosen, the student will navigate through multiple steps and pages to achieve his goal. He will work in two types of workspace: the written exercises and the video pages. Three types of action can be made: study, ask for help, and review summaries.
Study and ask for help

The center area contains either a video or an exercise with its summary that can be downloaded for later review.

- **Videos**: interactive, colorful and entertaining. Those ingredients are paramount for a good YouTube channel and they are integrated in a balanced way to all videos (Figure 3).

![Figure 3 Video lessons](image)

- **Exercises**: step-by-step and also explained in a brief video showing how to solve them (Figure 4). Note that the wiki panel can be seen on the left.

![Figure 4 Exercises and opened Wiki panel on the left](image)
Below every video and exercise page a “discussion” button allows the student to ask questions or report an error. At every step he will also receive achieving points so that he can keep track of his progress.

**Review summaries**

On the left hand side the “Math wiki” panel can be opened. Thanks to the search bar of this panel the student can access hundreds of summaries related to math.

The panel format allows a **split view** so that the user can read the summaries while studying.
Market size and trend

The market

Mathrix enters the e-learning market for 11-21 years old French speaking students. Mathrix can be used, for example in the following countries: France, Switzerland, Belgium, Canada, Morocco, Algeria, Tunisia, Senegal and numerous other countries from Africa. The market size is potentially estimated at 15 Millions students\(^5\). Only in France, every family spends an average of 1500€ per year on private teaching and half of these courses are in math.

Besides the fact that mathematics are the biggest enemy of students, the educational e-learning market is worldwide trending upwards as more small competitors are entering the market.

We conclude that entering the math niche gives us access to most of the e learning market. It is the fastest and most cost-efficient way to maximize exposure for two reasons:

1. We (co-founders) studied math and have experience in teaching and programming. This allows us to create most of the product.

2. The competition for math keywords on Google and YouTube is almost non-existent. This allows us to be very aggressive on math keywords. See more details under competitors.

\(^5\) (Ministère de l'Education Française)
Search engines trends and requests

Using search engine optimization tools\(^6\)\(^7\), the following researches numbers were obtained on Google.fr and YouTube.com/fr:

“Maths” = 190’000, “Mathématiques” = 130’000, “Mathematiques” = 120’500, “Maths en ligne” 60’000 and plenty of other math related keywords with 5’000-10’000 monthly researches. The cumulated number is difficult to assess with all the specific researches but is well over 2 Millions\(^8\) only on Google and YouTube. Figure 5 points out the business cycle with its up and down periods like the holidays (low movements) and the exams (peaks). This pattern\(^9\) will be taken into consideration for the financial previsions of Mathrix.

![Figure 5 Google trend math courses research](image)

Note: an interesting market entry will be on September 2016, when all middle schools will switch to new programs in France. Studies show that all program changes result in grade drops as teachers are not initially used to the new methods. Moreover this major change introduces a “numerical program” and is therefore in alignment with what we provide. Our goal is to enter this trend when students will seek for e-learning solutions.

\(^6\) (Google Analytics)  
\(^7\) (Keyword Tool Pro)  
\(^8\) (Google Correlate)  
\(^9\) (Google Trends)
Several articles from 2013 (Frenchweb, Le Monde) also pointed out that French speaking market still has “a gap to fill” in terms of e learning compared to the English one.
Who is our Target

The client
Parents are the ones paying for the service. Statistics from the French government website show that around 65% of French parents come from modest or poorer backgrounds\(^{10}\) and that they have three times less access to private teaching. Moreover, studies show that one student out of three from modest backgrounds shows severe difficulties in school. This same study reveals that inequalities between those children’s and the better ones increase during middle school. Mathrix provides an alternative formula for these families with lower income (65% of the market). The wealthier families would perceive this assistance as more efficient and would be easier to convert to an eight times cheaper solution.

The user
The ones using Mathrix are 11-21 years old students and parents who try to help their children’s. All students looking for help can be categorized under the three categories below:

- **Studious guy** (estimated at 40%*) - needs additional coaching and better methods to improve grades.

- **Economic guy** (estimated at 40%*) - will consider the service as a cheaper therefore better alternative to a private teacher.

- **Last minute guy** (estimated at 20%*) – is short on time and needs quick solution.

\(^{10}\) (Ecart des inégalités au collège)
* Market research done in December 2015 with a panel of 32 professors in four high schools and two middle schools in Alsace, France.

The hardest client to convert will be the last minute guy as he rarely shows up. Therefore it is important too convince them rapidly how valuable the service is.

**Our competitors**

Below is a quick description of our main direct competitors:

**Mathsbook** is a website created in 2012 providing only video explanations for high school students in math. Mathsbook is owned by Toni Haddad and has a capital of 10'000€\(^\text{11}\). They average 250 researches per month on Google and don’t share their video on YouTube. No mobile application.

**Level of competitiveness:** 1.5/5

**Leprofduweb** was created in 2012 and provides video and written explanations for high school students in math and (sometimes) other courses. Leprofduweb is owned by BAKAMAR Production and has a capital of 30’000€\(^\text{12}\). They average 280 researches per month on Google and share some videos on YouTube. No mobile application.

**Level of competitiveness:** 2/5

**Kiffelesmaths** was created in 2013 and provides video and written explanations for high school students in math. Kiffelesmaths is owned by ISMAIL BOUKILI and has

---

\(^{11}\) (Mathsbook)  
\(^{12}\) (Leprofduweb)
a capital of 10’000€\textsuperscript{13}. They average 600 researches per month on Google and have no activity on YouTube. No mobile application in perspective.

**Level of competitiveness:** 2.5/5

**Maxicours** is a quite formal platform for middle and high school students created in 2000 owned by Edulever that has a capital of 1’104’000€\textsuperscript{14}. They offer a very complete video and exercise service for all courses. They average 22’000 researches on Google per month. Judging from their teaching format, they seem quite 'old school'. Moreover, their videos are not available on YouTube, thus they miss huge exposure. Their Facebook page has very few updates and their mobile application is very criticized by the few users who tried it.

**Level of competitiveness:** 3.5/5

**Kartable** was created mid 2013 and offers five to eight written courses for middle and high school students. Kartable is owned by Julien Solal and has a capital of 1’333€\textsuperscript{15}. They average 130’000 researches on Google and their courses are only written (no videos and no YouTube channel). They gained a lot of exposure participating to a famous journal contest where they became start-up of the year 2014. In September 2015, after raising 1.2 Millions of Euros they started implementing a premium formula. They also monetized their mobile app making it a paying service after 48 hours of use. This resulted on massive complaints from most users. This app currently ranks 1.5/5 on both Google Play\textsuperscript{16} and Apple stores\textsuperscript{17}.

\textsuperscript{13} (Kiffelesmaths)  
\textsuperscript{14} (Maxicours)  
\textsuperscript{15} (Kartable)  
\textsuperscript{16} (Google Play)  
\textsuperscript{17} (Apple Store)
The website drawbacks:

- No video content.
- No interactivity, copy past of schoolbooks with some illustrations.
- According to teacher’s forums there are many errors

**Level of competitiveness: 4.5/5**

**Lesbonsprofs** was created in 2011 and offer six courses for last year middle school and high school French students. Lesbonsprofs is owned by ABA Education and has a capital of 1’350€\(^{18}\). They average 25’000 researches on Google and have the most active educational YouTube channel from the competitors. Their most watched videos are in biology. Regarding mobile application, they have one with few downloads and comments.

**Level of competitiveness: 5/5**

**Detailed comparison**

<table>
<thead>
<tr>
<th>Competitor</th>
<th>Video</th>
<th>Written</th>
<th>Work space</th>
<th>Assistance</th>
<th>Track Progress</th>
<th>Blog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxicours</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Mathsbook</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Kiffelesmaths</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kartable</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lesbonsprofs</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Leprofduweb</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mathrix</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*Table 1 Competitors comparison*

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\(^{18}\) (Lesbonsprofs)
Competitors Table analysis

First thing to notice is that all websites, except Kartable, believe in the video format. Some of them even skip the writing format like Leprofduweb and Kiffelesmaths. Not all websites providing videos post them on YouTube like Mathsbook and Maxicours. Therefore they miss huge and free way to increase their exposure.

⇒ Mathrix will provide both video and written lessons, most of the written will also be downloadable in one click on pdf.

Mobile applications

The Google play store and the App Store have no reliable educational app for middle and high school students.

Lesbonsprofs are on Google play store and launched their app in December 2014. Only 9 reviewers rated them (average of 4.5/5).

Maxicours is on the Apple store (average of 2/5) with 12 reviews and Google play (average of 3.5/5) with 120 reviews. The app has never been updated and seems irrelevant.

Kartable is on the Apple store (1.5/5) with 67 reviews of the new version and Google play (3.7/5) with 1420 reviews of both versions together. They updated the app in September 2015 to a paying one after 48 hours of use. After this major update they received more than 200 (1/5) ratings only on the Google store, with some very harsh comments complaining about the premium version. Early December 2015 Kartable stepped back and updated a free version of their app again.

⇒ Assessing our competitors, the mobile world has plenty of potential.

⇒ A simple recap version of our website will already provide a lot of value on the mobile stores. However our ambition is to use a gaming format to teach
This step-by-step game could reveal to be the ultimate tool for math applications in a mobile format, where users wouldn’t need any paper and pen.

See further analysis of competition in the Appendix.

**Comparison of pricing**

Comparing a yearly-subscription, our competitors offer the following prices on their respective websites

Mathsbook = 120€
LeProfduWeb = 90€
Kiffelesmaths = 150€
Maxicours = 180€
Lesbonsprofs = 400€ (with two corrected exercises per month)
Kartable = 20€ (no video content available).
Mathrix = 115€

![Figure 6 Yearly fees for premium services](image-url)
How to monetize and expand

Two sources of income

Mathrix will have **two sources of income**. The premium package will be the main income followed by the catch-up programs.

The **catch-up sessions** consists in giving a preparation or a catch-up course during several sessions. The subscribers (not necessarily premium) will pay a fixed amount and in exchange receive exercises routines and instructions to follow on the website. Live streaming courses are additionally given to the enrolled students.

**Free subscribed version** - when the user subscribes via email or via Facebook, he can:

- Access up to 40-50% of the content including videos and step-by-step exercises.
- Track his progress
- Download a limited amount of summaries
- Play games for a limited amount of time.

**Premium version**

- Unlock the entire content
- Choose the Turbo program
- Schedule sms or what app recall
- Access methodology videos
- Unlimited download of summaries
- Unlimited play of arithmetic games

The premium packages will cost:

- 19,90€/month for a monthly subscription
- 14,90€/month for a semester subscription
- 9,90€/month for a yearly subscription

**Expansion strategy**

Mathrix can be extended in three main directions, see Figure below.

1) Extend the math program to the university.
2) Extend the math program to all remaining French-speaking countries. The YouTube channel and the ad word campaigns will be a good lead to know what countries should be our first targets. This first cross-country expansion could take less than a month because most of the program is common to all countries.
3) Extend the content to other field of studies like physics, chemistry, biology, French, history or philosophy.
Attracting and converting clients and users

Our communication policy is to attract our clients and users using the YouTube channel, Google Ad Words campaigns and Facebook fishing (explained below).

Below is a list of the most important tools for the marketing strategy.

**YouTube channel**

In all videos, the summarized contents can be downloaded by clicking on an annotation which leads to the website. This is called fishing through YouTube.

The YouTube channel can also gain popularity by affiliation programs with other non-competitors math and science channels. For instance, “Micmaths channel” talks about everyday mathematics and have 120’000\(^{19}\). Regarding everyday physics, “E-penser channel” has more than 598’000 subscribers\(^{20}\). There are other examples of science channels on YouTube with more than 50’000 subscribers that are easy to contact.

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\(^{19}\) (Micmaths)  
\(^{20}\) (E-penser)
Facebook and forum fishing

Many persons are actively helping on Facebook public math groups, pages or other forums. We would contact them and propose to post their answer on our website. Once the student clicks on the link to access his solution, he will have to subscribe to see it. This allows us to get new users on our platform and he earns a certain amount for every subscribed user.

Market data – Core story method\(^{21}\)

The ads can be spread through paying services like Google Ad Words and Facebook. Radio is also a good way to directly reach parents.

We will create several campaigns and test the most efficient keywords following specific titles rules. All ads will be based on market data and not product data.

Example: - The 7 common mistakes made by bad students and the 5 techniques the smartest students use to optimize their results.

Mental arithmetic game

Maths games average more than 150’000 researches\(^{22}\) on Google every month. Adding a game that would allow students to improve their mental arithmetic skills can increase traffic and eyeballs on our website. Moreover, it will be used as an entertainment so that users stay longer on the website.

\(^{21}\) (Holmes, 2008)
\(^{22}\) (Google Analytics)
Get endorsements

From our previous universities: Ecole Polytechnique Fédérale de Lausanne, Nova School of Business and Economics, Fundação Getúlio Vargas, Amsterdam University or from different teachers and celebrities like Cedric Vilani (French fields medal).

For other attracting and converting resources see the Appendix.
Financial analysis

The traffic estimation on Mathrix is crucial to evaluate revenues and potential risks. As explained in the section “Attracting and Converting”, we dispose of free and paying methods to attract people to the website.

Once traffic is generated, the conversion rate’s are the lifeblood of a Freemium website and they need to be as high as possible. More specifically there are two conversion rates, the first one is the probability of a visitor subscribing for free. The second conversion rate is the probability of a free subscriber to pay for a premium subscription. Obviously the second conversion rate will be a lot smaller than the first one.

Note that an increase in our conversion rates will result in a direct increase of our profits.

Traffic estimation

Business Cycle

The overall traffic of the website and YouTube channel will follow a very specific business cycle that is taken into consideration in the traffic estimations. It follows Figure 5 from search engines trends and requests.

| Exam preparation period | Summer Holidays | Begin of the school year | Regular year |

- The exam preparation period will coincide with our three months launching period (April-June). This period is the most active one, we estimated it 50% higher as the average month.
- The summer holiday (July-August) is the calmest period. We considered that it only generates 20% of our average month.
- Begin of school year (September-October) is a calmer period, 80% of the average month.
- Regular year goes from November to March and is considered to be the average month.

**Conversion rates**

The first four green cases on Table 2 below are free resources to attract clients on Mathrix. The three following yellow cases on the table are the paying tools. Next to each source are entered the two different estimated conversion rates.

<table>
<thead>
<tr>
<th>Source</th>
<th>Conversion to Free user</th>
<th>Conversion to Premium user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google Organic</td>
<td>60%*</td>
<td>1.5%**</td>
</tr>
<tr>
<td>Fishing</td>
<td>90%*</td>
<td>1.5%**</td>
</tr>
<tr>
<td>Word of mouth</td>
<td>70%*</td>
<td>1.5%**</td>
</tr>
<tr>
<td>YouTube Channel</td>
<td>80%*</td>
<td>1.5%**</td>
</tr>
<tr>
<td>YouTube Channel</td>
<td>35%*</td>
<td>1.5%**</td>
</tr>
<tr>
<td>Google ad Words</td>
<td>25%*</td>
<td>1.5%**</td>
</tr>
<tr>
<td>Facebook ads</td>
<td>25%*</td>
<td>1.5%**</td>
</tr>
</tbody>
</table>

Table 2 Conversion rates

* estimated on the current math website, YouTube channel and Facebook page

** conservative approach as the French average is equal to 3.2%23

**Marketing budget**

- Three months launching period = 1’000€ per month
- Other months = 500€ per month
- This budget can also be allocated in Search Engine Optimization tools24 (SEO) that help to rank better on Google.

23 (Chaffey)
24 (Ahrefs, 2015)
Other important variables

The four elements on Table 3 help to estimate the trends in organic researches and the overall increase in terms of sharing.

<table>
<thead>
<tr>
<th>Monthly changes</th>
<th>Increase of…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users talking about it**</td>
<td>15%</td>
</tr>
<tr>
<td>Google traffic*</td>
<td>20%</td>
</tr>
<tr>
<td>YouTube traffic*</td>
<td>25%</td>
</tr>
<tr>
<td>Catch-up course**</td>
<td>30%</td>
</tr>
</tbody>
</table>

* The Google and YouTube traffic increases are the ones we observed the first months on our first math website.

** Estimations

Note: pessimistic and optimistic scenarios were evaluated under “MIRR and NPV Scenarios”.

Traffic estimation

The following traffic estimations were made over a period of 18 months. Table 4 below took in consideration all conversion rates of Table 2 and trends of Table 3 to calculate the monthly number of free and premium users on Mathrix. Regarding the paying tool, the budget allocation is described in the Appendix.
<table>
<thead>
<tr>
<th>Month(s)</th>
<th>Cycles</th>
<th>Intensity</th>
<th>Date</th>
<th>Total Free Users affected by Cycle</th>
<th>Number of premium users</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preparation period</td>
<td>110%</td>
<td>Apr-16</td>
<td>6310</td>
<td>95</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>140%</td>
<td>May-16</td>
<td>8230</td>
<td>123</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>200%</td>
<td>Jun-16</td>
<td>12109</td>
<td>182</td>
</tr>
<tr>
<td>4</td>
<td>Summer Holidays</td>
<td>20%</td>
<td>Jul-16</td>
<td>290</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>20%</td>
<td>Aug-16</td>
<td>343</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Begin of the school year</td>
<td>60%</td>
<td>Sep-16</td>
<td>2604</td>
<td>82</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>80%</td>
<td>Oct-16</td>
<td>3800</td>
<td>113</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>100%</td>
<td>Nov-16</td>
<td>5258</td>
<td>134</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>100%</td>
<td>Dec-16</td>
<td>5886</td>
<td>125</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>100%</td>
<td>Jan-17</td>
<td>6664</td>
<td>137</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>100%</td>
<td>Feb-17</td>
<td>7628</td>
<td>151</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>100%</td>
<td>Mar-17</td>
<td>8821</td>
<td>183</td>
</tr>
<tr>
<td>13</td>
<td>Preparation period</td>
<td>110%</td>
<td>Apr-17</td>
<td>11329</td>
<td>230</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>140%</td>
<td>May-17</td>
<td>16984</td>
<td>311</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>200%</td>
<td>Jun-17</td>
<td>28806</td>
<td>494</td>
</tr>
<tr>
<td>16</td>
<td>Summer Holidays</td>
<td>20%</td>
<td>Jul-17</td>
<td>2986</td>
<td>47</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>20%</td>
<td>Aug-17</td>
<td>3684</td>
<td>57</td>
</tr>
<tr>
<td>18</td>
<td>Begin of the school year</td>
<td>60%</td>
<td>Sep-17</td>
<td>15029</td>
<td>293</td>
</tr>
</tbody>
</table>

Table 4 Monthly free and premium users on Mathrix

Revenues estimation

The estimation is based on the two income sources: the **premium packages** and the **catch-up sessions**. The average amount spent for a premium user (main income) is calculated on Table 5.

<table>
<thead>
<tr>
<th>Premium</th>
<th>Monthly Price</th>
<th>Engagement</th>
<th>Pack choice*</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Month</td>
<td>€ 19.90</td>
<td>1</td>
<td>40%</td>
<td>€ 19.90</td>
</tr>
<tr>
<td>3 Months</td>
<td>€ 15.90</td>
<td>3</td>
<td>30%</td>
<td>€ 47.70</td>
</tr>
<tr>
<td>6 Months</td>
<td>€ 12.90</td>
<td>6</td>
<td>10%</td>
<td>€ 77.40</td>
</tr>
<tr>
<td>1 Year</td>
<td>€ 9.90</td>
<td>12</td>
<td>20%</td>
<td>€ 118.80</td>
</tr>
<tr>
<td>Average premium amount spent</td>
<td>€ 16.00</td>
<td>Average months engagement</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

*Estimated

Table 5 Average amount spent per premium user
Note: Based on the “pack choice” probability on Table 5, the average amount spent for a premium user is 16€ and he is engaged for 4 months. In other word, a premium user spends on average 16*4 = 64€.

Our second income, the catch-up session, are charged 35€ per student. On Table 6 (below) is the planning for the first catch-up sessions. The increase of participants between each catch-up session is equal to 30% according to Table 3.

<table>
<thead>
<tr>
<th>Cycles</th>
<th>Months</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation period</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Summer Holidays</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Begin of the school year</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>39</td>
</tr>
<tr>
<td>Regular year</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Preparation period</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>66</td>
</tr>
<tr>
<td>Summer Holidays</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Begin of the school year</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6 Catch-up sessions schedule

The premium package income represents 89% of the total income, the catch-up session is equal to the last 11% (Figure 10).
Profitability of Mathrix

Cash Flows

To measure the profitability of the business two indicators are calculated: the Net Present Value (NPV) and the Modified Internal Rate of Return (MIIR).

Before calculating the NPV and the MIIR, the first step is to compute all cash flows. Figure 11 below shows how the budget is allocated, one can see that “marketing” and “office and salary” represent the two major costs. Marketing (null during the summer holidays months 4-5 and 16-17) is almost the unique expense during the first six months. We plan to rent an office after the 6th month. Finally, the 11th month we would start paying 1’000€ in salaries. Note that the start-up creation costs 1’000€ and is planned on the 9th month; therefore it can be seen that the source “Other” represents a bigger share during this month. Please refer to the Appendix for further details.
Net Present Value

\[ NPV = \sum_{t=1}^{18} \frac{C_t}{(1 + r)^t} \]

In this formula, \( t = 1, 2 \ldots 18 \) are the 18 months, \( C_t \) stands for the cash flow of the \( t \)-month and \( r \) is the discount rate. In the calculations a discount rate of 4% was used.

The goal is to obtain a positive NPV, which means that the projected earning generated by this project exceeds the anticipated costs (both values in present euros).

Modified Internal Rate of Return

The internal Rate of Return (IRR) is a particular case of the discount rate when the value of the NPV is equal to zero.

\[ IRR = \text{value of } r \text{ such as } \sum_{t=1}^{18} \frac{C_t}{(1 + r)^t} = 0. \]

For this project the Modified Internal Rate of Return will be used as the IRR has several issues while computing projects with positive cash flows. In fact when the IRR is used, the money is considered reinvested at the project’s rate of return. This can rarely be the case and may lead to the belief that a project is more profitable than it actually is in reality. The MIRR used in the following estimations adjusts the IRR.
and corrects this issue. Because of MIRR’s correction of the former issue of IRR, a project’s MIRR will often be significantly lower than the same project’s IRR\textsuperscript{25}.

**MIRR and NPV scenarios**

In the traffic estimation section conversion rates and organic research trends were estimated (Table 2, Table 3). Those numbers represent the “Normal Scenario”. On Table 7 are this scenario’s values of the MIRR = 48% and the NPV = 45’039€.

In this part, two extra scenarios are computed, the upside and the downside scenario that can be seen on the Table 7 below. The upside scenario was configured such as all conversion rates and organic trends on Table 2 and Table 3 from the “Normal situation” were 20% higher. The downside situation was configured such that the rates were 20% lower.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Change</th>
<th>Probability</th>
<th>MIRR</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upside</td>
<td>20%</td>
<td>5%</td>
<td>48%</td>
<td>€ 45'039</td>
</tr>
<tr>
<td>Base</td>
<td>0%</td>
<td>20%</td>
<td>20%</td>
<td>€ 14'612</td>
</tr>
<tr>
<td>Down</td>
<td>-20%</td>
<td>75%</td>
<td>4%</td>
<td>-€1'433</td>
</tr>
</tbody>
</table>

Table 7 MIRR and NPV scenarios

According to the Wall-Street journal\textsuperscript{26} 75% of start-up face failure during the first three years; therefore it is supposed that a “downside” situation is 75% likely. An “Upside” situation is only 5% likely and the 20% left would be a “Normal” situation. From those numbers, the expected MIRR and NPV can be computed, see Table 8.

<table>
<thead>
<tr>
<th>Expected MIRR</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected NPV</td>
<td>€ 4'099</td>
</tr>
</tbody>
</table>

Table 8 Expected MIRR and NPV

\textsuperscript{25} (Investopedia)
\textsuperscript{26} (Cage)
Risk Analysis Framework

The goal of the following risk analysis is to ensure that security is cost effective, relevant, timely and responsive to threats. The risk matrix on Figure 12 helps to prioritize risks and shows how to manage the amount of money that should be applied to protect against those risks in a sensible manner. This will be done in four steps\(^\text{27}\).

1) Identify assets and their values

2) Identify threats and vulnerabilities

3) Quantify the probability and business impact of these potential threats

4) Provide an economic balance between the impact of the threat and the cost of the countermeasure

The risk analysis matrix (Figure 12) shows how likely a threat related to our assets can occur and how much it impacts the business.

\(^{27}\) (Harris, 2012)
Measures and solutions

Once the risks assessed, how much are we willing to invest to find an economical balanced viable solution? The following solutions are based on the risk analysis matrix of Figure 12.

[First Row] The most important points to treat are the ones having a high impact on the business such as (a) website hacking, (b) YouTube channel ban, (c) payment problems and (d) the copy of the website. The measures we will take:

(a)+(d) Reinforce website security by storing all our data on servers that use very strong encryption. All access codes need to belong passwords that are stored in secured software. Costs 25€/month

(b) Produce exclusive content, no copying and be very reactive to every YouTube alert regarding online videos.
(c) Use the Hyper Text Transfer Protocol Secure or “https”, it is an additional security layer of SSL or TSL on the http://mathrix.fr for payment pages.

Costs 50€/one payment

[ Middle Row ] **Middle impact** on the business: they are related to maintenance and marketing issues. The technical problems are not likely to happen as one of the co-founder is responsible for the coding and the servers are hosted by 1and1, which is a very reliable and trustworthy service.

If paying marketing fails as we run out of cash due to lower expected income from premium packages and catch-up courses, we need reliable free sources to keep attracting users. The most powerful tool Mathrix has is its YouTube channel that grows 60% per month. In fact with 120 videos posted on March 2015, the channel attracts 500 views per day. The second tool is the website and all social medias that are important factor to improve ranking on Google.

[ Third Row ] **Low impact** on the business: (a) Content mistakes (on the videos or the website), (b) negative appreciations, (c) issues with storing all video. The only way to take care of the first two points is to deliver the best content possible. Regarding storage, as long as all the videos are on YouTube (even private), there will be no server problems.
Human Resources planning

Profile of future partners

According to our growth expansion matrix the next partners need to fulfill the descriptions below.

- Content
  - Adapt to more French speaking countries like Switzerland, Belgium, Canada, Morocco, Algeria, Tunisia and other less developed countries from Africa.
  - Increase to University students
  - Add more courses like Physics, Chemistry, Biology and French

- Marketing
  - Blog articles using affiliate marketing
  - SEO for website and YouTube channel, main SEO sources will be the websites backlinko.com and source-wave.com

Team Description

Filipi Cabalzar, 26 years old with a Bachelor in Mathematics from the Ecole Polytechnique Fédérale de Lausanne (EPFL) and (almost) a double degree Master in International Finances from both Nova School of Business and Economics and Fundação Getúlio Vargas universities.

Filipi is Swiss-Brazilian and speaks Portuguese, German, French and English.

His responsibilities in Mathrix are:

- Design of the user interface
- Video teacher
- Elaboration of the content
- Marketing and Search Engine Optimization (SEO)

**Julien Schneider**, 24 years old with a Bachelor in Mathematics from the Ecole Polytechnique Fédérale de Lausanne (EPFL) and Master in Financial Mathematics from the University of Amsterdam.

His responsibilities in Mathrix are:

- Coder of the website and mobile apps
- Elaboration of the content
- Marketing and Search Engine Optimization (SEO)
Appendix

What helped us to create Mathrix

Statistics from our current YouTube channel, first math website and our combined experience in teaching helped us to create Mathrix in the following way.

The six lessons we learnt

1) Students look for video contents in particular corrected exercises. They first prefer to apply a concept rather than acquire a deep understanding of it. Concrete exercises and historical applications are the most welcomed one.

2) YouTube is the biggest video platform, offers huge exposure and exponential growth.

3) The teacher needs to be dynamic and the videos 6 to 8 minutes long.

4) We retain 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we hear and see, 70% of what we say and 90% of what we do.

5) To see results, students must drill on written exercises. Repetition is the mother of skills.

6) A planning and efficient workspace helps to get started.

Competitors further analysis

How well are the competitors ranked on Google?

Maxicours is well ranked on Google and in some wider researches related to e-learning. Kartable has also a decent ranking in Google (2-3 first pages). However, both companies do not have a YouTube channel and therefore miss a lot of exposure.
Surprisingly, none of the websites cited seem to use Google Ad Words. This can be seen on the very low prices of the costs per click for perfect keywords (less than 0.08€ per click).

**Note on Google Ad Words:** the cost per click (CPC) competition is very low especially for mathematical terms, around 0.08€ per click on Google. The amount is even less on YouTube. In comparison the CPC of a florist in Paris is higher than 4€. Therefore the entry barrier in this market is extremely low.

**Can the service be tested?**

Maxicours and Mathsbook only provide a test module before subscribing. All other platforms are Freemium.

➤ Mathrix will be Freemium. It can be tested on a all chapters. If the student wants to take the next step and access the whole content he can choose one of our premium formulas (see pricing).

**Analyze of the help instruments and workspace.**

Only Maxicours and Kartable provide a complete workspace where a student would have all the resources to fill his needs. However if the student prefers video explanations, Kartable doesn’t provide any.

Maxicours have a huge videos database. They focus seem also to be theory driven.

➤ Mathrix provides in the working space an integrated Wiki panel that can be used as research. All written exercises and videos are step-by-step so that the users can study at their own rhythm.

➤ We also provide two types of programs according to their needs, the normal and the turbo program.
Is the website updated and the community interacting?

Mathsbook and Lesbonsprofs are the only websites being fed by a blog. The other platforms barely post on their Facebook page, YouTube channel or Twitter account.

Further tools to attract and convert

Charity donation

The creation of Mathrix originated with the desire to have a powerful impact. Educating people to succeed is in our sense the most efficient way to start. To keep our commitment and values we decided that 10% of all monthly packages would be donated to a NGO that helps children’s to have access to school.

Affiliation program

On the paying page, the client has the possibility to enter email addresses from friends. Depending on the number of users subscribing within 5 days, they get 20%, 30% or 50% of reduction on the monthly fee. See pricing for detailed explanation.

Mathrix Blog

The blog would be a place to read entertaining content such as inspirational daily quotes and logical problems that require no specific knowledge in math. The blog would also be a way to enrich our Facebook activities and communicate on wider topics to foster interactions and discussions on our page.

Other tools

- Facebook and Google+ page
- Newsletters
- Teacher suggestion or endorsement
- Contact blogs to share our content (easier using a buzz video)
- Voluntary persons willing to distribute flyers and hand posters in their schools.

**Financials**

**Budget allocation for paying marketing**

During the three first months, the amount spent in marketing is equal to 1000€ per month.

<table>
<thead>
<tr>
<th>Paying marketing tools</th>
<th>Budget Allocation</th>
<th>Amount invested</th>
<th>Cost-per-Click</th>
<th>Reach</th>
</tr>
</thead>
<tbody>
<tr>
<td>YouTube Channel</td>
<td>50%</td>
<td>€ 500.00</td>
<td>€ 0.05</td>
<td>10000</td>
</tr>
<tr>
<td>Google ad Words</td>
<td>40%</td>
<td>€ 400.00</td>
<td>€ 0.10</td>
<td>4000</td>
</tr>
<tr>
<td>Facebook ads</td>
<td>10%</td>
<td>€ 100.00</td>
<td>€ 0.30</td>
<td>334</td>
</tr>
</tbody>
</table>

During the other months the amount spent is 500€ per month.

<table>
<thead>
<tr>
<th>Paying marketing tools</th>
<th>Budget Allocation</th>
<th>Amount invested</th>
<th>Cost-per-Click</th>
<th>Reach</th>
</tr>
</thead>
<tbody>
<tr>
<td>YouTube Channel</td>
<td>50%</td>
<td>250</td>
<td>€ 0.05</td>
<td>5000</td>
</tr>
<tr>
<td>Google ad Words</td>
<td>40%</td>
<td>200</td>
<td>€ 0.10</td>
<td>2000</td>
</tr>
<tr>
<td>Facebook ads</td>
<td>10%</td>
<td>50</td>
<td>€ 0.30</td>
<td>167</td>
</tr>
</tbody>
</table>

**Detailed Cash flows**

From the total revenues (see Estimated Revenues) the following expenses will be deducted:

- Marketing expenses
- Website server
- YouTube channel manager
- Office from 7th month (October 2016)
- Stripe payment (3% on the revenues)
- Legal and start up creation 9th month (December 2016)
- Salary from 11th month (February 2017)
- Workspace Setup (also from February 2017)
- Accounting
- Other services

Two scenarios of geometrical growth

There are only three ways to increase the business:
- Increase the number of customers
- Increase the average transaction
- Increase the frequency of transactions

How to reach 44% growth per year

If we assume 1000 users, the following numbers look completely realistic

<table>
<thead>
<tr>
<th>Number of clients</th>
<th>Premium</th>
<th>Catch-up courses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>1 * 19.90€</td>
<td>1 * 35€</td>
<td>54'900€</td>
</tr>
<tr>
<td>1200</td>
<td>1.2 * 19.90€</td>
<td>1.2 * 35€</td>
<td>65’880€</td>
</tr>
<tr>
<td>20% of client increase</td>
<td>20% subscribe for an extra month</td>
<td>20% more attend an extra course</td>
<td>44%</td>
</tr>
</tbody>
</table>

Appendix Table 3

How to reach 200% growth per year

If we assume 1000 users, the following numbers look completely realistic

<table>
<thead>
<tr>
<th>Number of clients</th>
<th>Premium</th>
<th>Catch-up courses</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>1 * 19.90€</td>
<td>1 * 35€</td>
<td>54’900€</td>
</tr>
<tr>
<td>1500</td>
<td>2 * 19.90€</td>
<td>2 * 35€</td>
<td>164’700€</td>
</tr>
<tr>
<td>50% of client increase</td>
<td>All subscribe for an extra month</td>
<td>All make an extra request</td>
<td>200%</td>
</tr>
</tbody>
</table>

Appendix Table 4
**Human resource**

**How to attract excellence**

Europe in general always looks up to the USA and places like Silicon Valley that stands for the ideal start-up environment. Every entrepreneur or young passionate student or worker would love to be immersed in this kind of environment. The tendency nowadays is that most of young persons struggle finding a pleasant job where they feel like contributing to something that makes sense for them.

Our goal is to offer this environment that seems utopic in our belief system.

**How?** Starting in a cheaper and dream place… Lisbon! This European capital has all the arguments to attract young motivated persons like an ideal climate, magnificent beaches and the living costs are almost divided by two compared to France and way more compared to Switzerland.

We believe that a motivated and empowering team will be the determinant factor to grow stronger.

The **next step** after building an empowering work environment with strong company culture would be self-promotion. As a start-up we would be selling a lifestyle and reinforce the process to find individuals with passion and drive to integrate the team.
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